Bachelor of Science in Engineering
Degree Program

Student Guide

Prepared
by the

Department of Engineering Fundamentals
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Bachelors of Science in Engineering
Michigan Technological University

A. EDUCATION PHILOSOPHY OF THE BSE PROGRAM

The Bachelor of Science in Engineering (BSE) degree program is an engineering degree path that has the flexibility to offer programs in niche or emerging areas, or to tailor a program to fit your specific career goals when they do not fit within Michigan Tech's disciplinary engineering programs. Your courses are uniquely combined to provide you with the specialized engineering education you desire or need to meet your goals. The curriculum includes an Engineering Fundamentals Core, a Technical Emphasis, and a set of Directed Electives, along with the required courses in math and basic sciences, Michigan Tech's General Education program, and free electives. Courses for the Technical Emphasis are taken from one or more of the departments within the College, and occasionally from other academic units. These courses, when blended with courses for the Directed Electives, allow students choices and options for a minimum of 35 credits. And, choices for the General Education electives and free electives offer even more flexibility. The BSE undergraduate degree program is accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone: (410) 347-7700.

B. EDUCATIONAL OBJECTIVES OF THE BSE PROGRAM

The educational objectives of the BSE program are broader than those of the other engineering programs offered at Michigan Tech. The post-degree opportunities in employment and education are varied due to the flexible nature of the BSE curriculum. While some paths are defined (Service Systems Engineering, Industrial Engineering, and Geospatial Engineering), the program offers you the ability to tailor your courses (under the supervision of an academic advisor and with required approval of the BSE Governance Committee) to meet specific career or preparatory goals. The objectives for the program are listed in Table 1.

Table 1. The Educational Objectives of the Bachelor of Science in Engineering Degree program.

Bachelor of Science in Engineering graduates are prepared to accomplish the following objectives:

1. Join, or break ground in establishing, a workforce in an emerging or blended discipline of engineering; and
2. Secure employment in a profession or field for which an undergraduate engineering education is an asset; or
3. Gain admission to and successfully complete a graduate program in an engineering discipline or in another field for which an engineering undergraduate degree is recognized as appropriate preparation for graduate work.

C. EDUCATIONAL OUTCOMES OF THE BSE PROGRAM

In order to ensure that you, as a graduate of this program, will be able to attain the objectives in Table 1, the BSE curriculum has program outcomes that all students will, before they graduate, attain. These outcomes are provided in Table 2.

Table 2. Program Outcomes for BSE students.

a	An ability to apply knowledge of mathematics, science, and engineering
b	An ability to design and conduct experiments, as well as to analyze and interpret data
c	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d	An ability to function on multidisciplinary teams
e	An ability to identify, formulate, and solve engineering problems
f	An understanding of professional and ethical responsibility
g	An ability to communicate effectively
h	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i	A recognition of the need for, and an ability to engage in life-long learning
j	A knowledge of contemporary issues
k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

D. CURRICULAR STRUCTURE OF THE BSE PROGRAM

The basic curriculum of the BSE degree program is provided in Table 3. It consists of five structured components: General Education, Basic Mathematics and Sciences, Core Engineering courses, a Technical Emphasis, and an approved set of Directed Electives. In Table 3, the total number of credits (127) reflects the use of the 48-minimum requirement of engineering credits from the combined Engineering Fundamentals Core and Technical Emphasis areas. The five structured curricular components and their credit distributions are discussed in the subsections that follow.

Table 3. The basic curricular structure of the BSE degree program.

General Education credits	28
Mathematics and Basic Sciences credits	32
Engineering Fundamentals Core credits*	25 - 26
Technical Emphasis credits*	22 - 23
Directed Electives credits	13 (minimum)
Free Electives credits	6
	Total = 127** credits

* A minimum of 48 engineering credits is required from the combined Engineering Fundamentals Core and Technical Emphasis.
** Completion of a Certificate Program may require an additional 2 to 6 credits.

The flexibility of the BSE program is provided through choices in Technical Emphasis credits, Directed Electives credits, and Free Electives (41 credits minimum). It is balanced by required courses in the Engineering Fundamentals Core, mathematics, and basic sciences (a combined 57 credit minimum) to ensure that the fundamental essence of an engineering education is provided, and to ensure that you will be able to successfully navigate the upper-level courses that are part of your Technical Emphasis and Directed Electives. Additionally, the General Education requirement contains four core courses (13 credits) and selections from a list of approved humanities, arts, and social sciences (HASS) courses. The HASS classes (15 credits) you select must include EC3400 (Economic Decision Analysis; 3 credits), but the others can be chosen to edify the focus of your curricular path.

1. General Education as defined by the University

The General Education program is required for all baccalaureate degrees at Michigan Tech and has four components. It begins with core courses (four of them) designed to broaden your appreciation of diverse ways of thinking about problems, cultures, and behaviors, as well as to provide a forum within which communication skills can be enhanced. These core courses are followed by HASS distribution courses (courses in Humanities, Arts, and Social Sciences). From among the HASS courses on the approved selection list, BSE students are required to take EC 3400 (Economic Decision Analysis). The third General Education component is a STEM (Science, Technology, Engineering, and Math) component. All aspects of this component are met within the required math and science courses for the BSE. The fourth component of General Education is a co-curricular activity requirement that is usually satisfied by physical education activities, but it also includes some ROTC activities and some musical performance groups as options. These activities are often taken in half-unit increments to meet the three-unit requirement. The units do not count in the overall degree-credit requirements nor in GPA calculations since they are not "credits." Taking all this into account, the General Education program adds the following courses to the BSE program:

General Education Core Courses:		
UN1001	Perspectives on Inquiry	3
UN1002	World Cultures	4
UN2001	Revisions	3
UN2002	Institutions	3
Humanities, Arts, and Social Sciences (HASS) Courses:		
EC3400	Economic Decision Analysis	3
Other HASS Distribution Courses		12*
Co-Curricular Activities:		
3 units (not counted in credit totals)		
	Subtotal	**28 credits**

* One or more HASS distribution course may be specified within a minor or certificate area.

2. Basic Mathematics and Science Requirements

The BSE program requires a minimum of 25% of the total degree requirements to be categorized as mathematics and basic sciences. The program requires a mathematics core of 15 credits and a science core of 8 credits. The remaining elective mathematics and basic science credits are selected by you in order to satisfy prerequisite requirements for your choice of Technical Emphasis or Directed Electives plan, *with some restrictions*. The elective math credits must

come from math (MA) courses that list a BSE Mathematics Core course as a prerequisite or from courses receiving BSE approval. The elective science credits must come from the following disciplines with the indicated restrictions on course level: Chemistry (CH) with a course number above 1150; Biology (BL) with a course number of 1010, 1020, 1040, or above 2000; or Physics (PH) with a course number of 1200 or above 1250. The use of other courses to satisfy science elective credits requires BSE approval. Please note that courses found on the HASS distribution list will not count for math or for science electives.

Mathematics Core:		
MA1160	Calculus with Technology I	4
MA2160	Calculus with Technology II	4
MA2320	Elementary Linear Algebra	2
MA3520	Elementary Differential Equations	2
MA3710	Engineering Statistics	3
Science Core:		
CH1150	University Chemistry 1	3
CH1151	University Chemistry 1 Laboratory	1
PH1100	Physics by Inquiry I (Laboratory)	1
PH2100	University Physics I - Mechanics	3
*Mathematics and/or Science Electives:**		9
	Subtotal	**32 credits**

* Mathematics and Science electives to be chosen to satisfy prerequisite requirements for the technical emphasis and/or the choice of minor, certificate, or approved Directed Electives plan of study. Restrictions apply.

3. Engineering Fundamentals Core

A core of fundamental engineering courses (25 to 26 credits) is required for the BSE degree. These fundamental engineering topics include problem solving, ethics, computer use and analysis, teaming, statics, strength of materials, materials science and engineering, basic circuits and instrumentation, thermodynamics, and fluid mechanics. In addition, students must complete a minimum of one semester of a senior design project and one of four possible design implementation options. The Design Implementation courses expose students to the many facets of executing typical engineering projects.

Engineering Fundamentals Core:

	ENG1101	Engineering Analysis & Prob. Solving	3
	ENG1102	Engineering Modeling & Design	3
	ENG2120*	Statics & Strength of Materials	4
	MY2100**	Intro to Materials Science & Engineering	2
OR	CE3101	Civil Engineering Materials	3
OR	CS1121	Intro to Computer Science 1	3
	EE3010	Circuits and Instrumentation	3
	ENG3200*	Thermodynamics & Fluid Mechanics	4
	ENG4905***	Multidisciplinary Senior Design Project I	3
	XXYYYY	Design Implementation (see options below)	3-4
		Subtotal	**25-26 credits**

* Due to prerequisite requirements, students pursuing the Industrial Engineering BSE pathway must take MEEM2110 and MEEM2150 in place of ENG2120, and MEEM2200 and MEEM3210 in place of ENG3200.

** MY2100 is a three-credit course that has 2 credits of engineering content (as noted above) and 1 credit of science content, which can be applied to the math and science electives.

*** Department-specific senior design projects may be used to satisfy this requirement but must be taken in their entirety (i.e., both semesters must be taken if the selected department project comprises two semesters of effort). Enterprise engineering efforts (ENT4950/4960) may also be used to fulfill this requirement.

Four choices of Design Implementation are available for BSE students, and your choice of Technical Emphasis and senior design will determine which option is most appropriate in providing the necessary background. Completion of one of the following options will satisfy the Design Implementation requirement.

Design Implementation Options:

	MEEM2500	Integrated Design and Manufacturing	4 (lab)
OR	CE3332	Fundamentals of Construction Engineering	3
OR	SSE 2300	Service System Design and Dynamics	3
OR	*Choice of 3 courses from the following list:*		
	ENT3957	Product and Process Development I	1
	ENT3966	Design for Manufacturing	1
	ENT3967	Fundamentals of Product/Process Development	1
	ENT3972	Practical Electronic Circuit Design and Fabrication	1
	ENT3975	Introduction to Vehicle Design and System Modeling	1

4. Technical Emphasis:

The Technical Emphasis area consists of **22 to 23 credits** usually taken within one or more of the engineering departments. The purpose of a Technical Emphasis is to define a sequence of related engineering courses that establish a coherent program of study. The specific courses within the Technical Emphasis should also serve as adequate preparation for graduate coursework, thereby enabling you to meet one of the BSE program's educational objectives. The Technical Emphasis courses must include at least one engineering laboratory experience. In addition, between the Technical Emphasis and the Engineering Fundamental Core courses, each approved BSE path must include 48 credits of engineering content.

5. Directed Electives:

Within the BSE program, **13 credits** are reserved for Directed Electives. This provides additional flexibility for you to pursue your interests. The courses (usually four) must create a direction of study that compliments the Technical Emphasis area. This can be accomplished by taking courses toward a university recognized Minor or Certificate, or by taking an individualized set of courses. Again, to individualize your set of directed electives, you would work with your advisors and then submit them for approval by the BSE Governance Committee (see Section I-F). Though not required, there are advantages to *completing* a Minor or Certificate program: 1) the added credentials will be properly designated on your degree transcript and, for the Minor, on your diploma; and 2) the Directed Electives are pre-approved (i.e., do not need prior approval from the BSE Governance Committee). Individualized Directed Electives will not be so designated. Lists of available Minors and Certificates are provided in Appendix B and C, respectively, but the most current information is found in the on-line undergraduate course catalog at http://www.admin.mtu.edu/catalog/.

E. BSE PATHWAYS

The basic curricular template for the BSE degree program is provided in Appendix D. Currently there are four pathways in the BSE program: an individualized path and three pre-approved paths leading to defined specializations. The pre-approved paths are Industrial Engineering, Service Systems Engineering, and Geospatial Engineering. Complete lists of the Technical Emphasis and Directed Electives combinations for these pre-approved pathways are provided in Appendix A. Note that the Technical Emphasis and Directed Electives of each path are pre-approved as a

combined set but not as individual curricular components (i.e., the Technical Emphasis or the Directed Electives set taken alone is not *pre-approved*).

1. Individualized Pathways

There are many possible individualized paths through the BSE degree program that you can choose. The philosophy behind the degree is to have a base of courses that are fundamental to engineering (math, basic sciences, and core topics such as statics, strength of materials, thermodynamics, and fluid mechanics) and couple it with a sequence of additional courses in a technical emphasis and with directed electives. These additional courses will provide a unique specialization for either employment or for graduate studies – unique in the sense that the specialization could not be attained in a discipline degree program at Michigan Tech. Thus the BSE program can provide you with a great deal of flexibility in creating your own educational program. Approval by the BSE Governance Committee ensures that you have a coherent program that meets all accreditation requirements.

2. Industrial Engineering

The approved path for Industrial Engineering maps courses that emphasize topics in manufacturing and its optimization, including human factors. These courses are from Mechanical Engineering, Business, Math, Humanities, and Social Sciences. See Appendix A for the list of pre-approved courses.

3. Service Systems Engineering (SSE)

In response to the need for engineering within the service sector industries, several SSE courses were developed that emphasize analysis, design, optimization, and the planning and management of service sector operations, including the human influence on service systems. Additional courses in the approved path are from Business, Mechanical Engineering, and Social Sciences. See Appendix A for the list of pre-approved courses.

4. Geospatial Engineering

At the request of the Surveying Program, a pathway was defined to study geospatial concepts that include measurements, modeling, data collection and acquisition techniques, maps and mapping technologies, data and metadata formats, and visualization. The approved plan reflects state-of-the-art geospatial research and technologies, and it includes courses from Surveying Engineering (in the School of Technology), Computer Science, Physics, and Business. See Appendix A for the list of pre-approved courses.

F. BSE GOVERNANCE COMMITTEE

The BSE Governance Committee oversees the BSE program and approves individualized paths, ensuring that students earn a high quality degree and that the degree meets all accreditation requirements.

1. Members of the BSE Governance Committee

   The membership of the Governance Committee will include the following people:

   a. Chair of the Department of Engineering Fundamentals (will also serve as chair of the committee) – Dr. Jean Kampe
   b. Associate Dean for Academic Affairs, College of Engineering – Dr. Leonard Bohmann
   c. Academic Advisor of the Department of Engineering Fundamentals – Ms. Amy Monte

G. STUDENT ADVISING FOR THE BSE PROGRAM

Student advising is a key element to the success of any degree program. Although the BSE program is simple in its overall structure, there are complexities that are best conveyed through discussion with your advisor to avoid complications as you progress through the program. Academic and career advising takes place at several fronts to ensure that you are well informed about your course options and various career opportunities.

1. Academic Advising

Your academic advisor is in the Department of Engineering Fundamentals (EF). The EF academic advising staff provides information about the overall BSE program, how it is structured, and all of your available opportunities and options. You will have, at a minimum, one general and one individual meeting each academic year. The scope of these meetings encompasses discussion of the program, notification of pending or implemented program changes, and clarification of degree requirements. The EF advisors also ensure that all paperwork pertaining to graduation, the declaration of minors or certificates, any petitions to alter degree requirements, and any petitions for exceptions are processed in accordance with established University policies and guidelines.

The academic advisors will assist you with the planning and implementation of your BSE curriculum pathway. All paths require approval from the BSE Governance Committee, but there

are three pre-approved pathways: Service Systems Engineering, Industrial Engineering, and Geospatial Engineering. Any variations from these pre-approved paths and all individualized pathways will be submitted to the BSE Governance Committee for review and approval. The EF academic advisor who advises BSE students (Ms. Amy Monte) is seated on the BSE Governance Committee. If you want to propose your own plan of study, you will meet with her several times to clarify your career goals. You will work with her to establish an appropriate blending of study areas that provides the knowledge base for your career goals, and to populate a graduation plan with courses that will meet both BSE and University requirements.

2. Career Advising

Career advising resides in the college as a whole and, in fact, in all academic units of the university, as it depends on your career goals and the areas of study that you are blending to prepare for those goals. Your first advising contact is through the academic advising staff in EF. These advisors will direct you to the appropriate faculty within the College/University who can assist in career decisions and questions. If your target job blends two or more areas of study, you will be directed to the career advisors for each of them. The BSE academic advisors will facilitate communication with and among the career advisors, assist you in synthesizing the advice, and guide you in acting on it. For the pre-approved BSE paths (Service Systems Engineering, Industrial Engineering, and Geospatial Engineering), there are faculty identified in each area to provide career advice.

APPENDIX A

Pre-Approved BSE Pathways

The BSE pathways that are defined in this appendix by the Technical Emphasis, Directed Electives, and BSE Core modifications listed below are pre-approved when taken with the following BSE curricular components: Engineering Fundamentals Core credits (as per listed modifications), the Mathematics and Basic Sciences credits, General Education credits (which must include EC3400), and Free Electives. Please note that each full pathway is a pre-approved entity, but the individual curricular components (i.e., any Technical Emphasis or set of Directed Electives) alone are NOT pre-approved. Any variation from a given pathway as it is herein defined requires approval from the BSE Governance Committee. Note that pre-approved math and science electives may be listed for these pathways, and that such courses may be pre-requisites to pathway-required courses.

A. Industrial Engineering

Technical Emphasis (21 credits):

MEEM2700	Dynamics	3
MEEM3501	Product Realization I	3
MEEM4180	Engineering Biomechanics	3
MEEM4650	Quality Engineering	3
MEEM4655	Production Planning	3
BA3610	Operations Management	3*
Senior-level (4000-level) technical electives		3
	Total	21

* Does not contain engineering science.

Engineering Fundamentals Core Modifications:

1. MEEM2110 (Statics) and MEEM2150 (Mechanics of Materials) must be taken instead of ENG2120 (Statics and Strength of Materials)
2. MEEM2200 (Thermodynamics) and MEEM3210 (Fluid Mechanics) must be taken instead of ENG3200 (Thermodynamics and Fluid Mechanics)
3. MY2100 (Introduction to Materials Science and Engineering) is required
4. MEEM2500 (Integrated Design and Manufacturing) is required as the Design Implementation

Directed Electives (15 credits minimum):

Economics:

EC2001	Principles of Economics	3

Complete at least one course from each of the following lists:

Applied Statistics:

MA4710	Regression Analysis	3
MA4720	Design & Analysis of Experiments	3
MEEM4660	Data Based Modeling & Control	3
PSY4400	Tests and Measurements	3

Management Science:

MEEM5653	Life-Cycle Engineering	3
MEEM5680	Optimization I	3
FW4150	Forest Resource Management	3

Human Factors:

BA3700	Organizational Behavior	3
BA4770	Human Resource Management	3
BL3070	Biology & Occupational Hygiene	3
HU4625	Risk Communication	3
PSY3060	Physiological Psychology	3

Processing & Service Operations:

BA2300	Principles of Accounting I	3
BA3800	Principles of Marketing	3
BA4620	Supply Chain Management	3
MEEM4610	Advanced Machining Processes	4
MEEM4640	Micromanufacturing Processes	3
MY4130	Principles of Metal Casting	3
	Total	15

Pre-Approved Math and Science Electives (that may be needed as prerequisites):

MA3160	Multivariable Calculus with Technology	4
PH1200	Physics by Inquiry II	1
PH2200	University Physics II – Elec. and Magnetism	3

B. Service Systems Engineering (SSE)

Technical Emphasis (24 credits):

SSE2100	Intro to Service Systems Engineering	3
SSE3200	Analysis & Design of Web-based Services	3
SSE3400	Human Interactions in Service Systems	3
SSE3500	Service System Operations	3
SSE3600	Optimization & Adaptive Decision Making	3
SSE4300	Project Planning & Management for Engineers	3
SSE4600	Managing Risk	3
MEEM4650	Quality Engineering	3
	Total	24

Engineering Fundamentals Core Modifications:

1. CS1121 (Introduction to Programming I) is required in place of MY2100
2. SSE2300 (Service Systems Dynamics and Design) is required as the Design Implementation

Directed Electives (21 credits):

Take all of the following:

BA2300	Accounting Principles I	3
BA3200	IS/IT Management	3
BA3400	Principles of Finance	3
BA3610	Operations Management	3
MET4400	Simulation Methods	3
PSY2000	Introduction to Psychology	3

Take one course of the following:

BA3800	Principles of Marketing	3
BA4620	Supply Chain Management	3
BA4630	Operations Strategy	3
BA3210	Business Database Management	3
BA3580	Legal Environment of Business	3
BA4860	Buyer Behavior and E-Commerce	3
BL3970	Current Health Isuues	3
CE4010	Introduction to Consulting Engineering	3
PSY3070	Cross-Cultural Psychology	3
PSY3700	Industrial Organizational Psychology	3
	Total	21

Pre-Approved Math and Science Electives (that may be needed as prerequisites):

BL1010	General Biology I	4
BL1040	Principles of Biology	4
BL2010	Anatomy & Physiology I	3
BL2011	Anatomy & Physiology I Lab	1
PH1200	Physics by Inquiry II	1
PH2200	University Physics II – Elec. and Magnetism	3
CH1160	University Chemistry II	3
CH1161	University Chemistry Laboratory II	1
MA4710	Regression Analysis	3
CS3911	Intro to Numerical Methods with FORTRAN	3

C. Geospatial Engineering

Technical Emphasis (25 credits):

SU1500	Data Collection Systems	1
SU2150	Fundamentals of Surveying	4
SU2260	Survey Computations	3
SU3250	Geodetic Adjustments Theory	3
SU3540	Geo. Info Tech w/Elements of Field Cartography	4
SU4003	Geo. Info Systems (GIS) Tech. Fundamentals	1
SU4010	Geospatial Concepts, Technologies, and Data	3
SU4060	Geodesy	3
SU4140	Photogrammetry	3
	Total	25

Engineering Fundamentals Core Modifications:

1. CS1121 (Introduction to Programming I) is required in place of MY2100
2. CE3332 (Fundamentals of Construction Engineering) is required as the Design Implementation

Directed Electives (13 credits):

Take 13 credits from among the following:

BA2300	Accounting Principles I	3
BA2500	Business Law I	3
CS1122	Introduction to Programming II	3
CS2321	Data Structures	3
EET4368	Optics Fundamentals for Technologists	3
FW4540	Remote Sensing of the Environment	3
GE3250	Computational Geosciences	3
PH1600	Introductory Astronomy	2
PH1610	Introductory Astronomy Lab	1
PH1200	Physics by Inquiry II	1
PH2200	University Physics II – Elec. and Magnetism	3
SU2220	Route and Construction Surveying	3
SU3110	Surveying Field Practice	4
SU3180	Boundary Surveying Principles	3
SU3560	Geospatial Imaging Interpretation	3
SU4100	Geodetic Positioning	3
SU4999	Professional Practice Review	1
UN3002	Undergraduate Co-op Education Laboratory	1-2
UN4000	Remote Sensing Seminar	1
	Total	13

Pre-Approved Math and Science Electives (that may be needed as prerequisites):

MA3160	Multivariable Calculus with Technology	4

APPENDIX B

MTU Undergraduate Catalog Descriptions of

University Approved Minors

from

http://www.admin.mtu.edu/catalog/

Accessed July 23, 2010

School of Business and Economics (PDF)

- Economics Minor (BECM)

College of Engineering (PDF)

- Applied Geophysics Minor (EAGM)
- Earth Sciences Minor (EGLM)
- Electrical Engineering Minor (EEEM)
- Electronic Materials Minor (MSEM)
- Geological Engineering Minor (EGEM)
- Manufacturing Minor (EMMF)
- Minerals Processing Minor (CMMP)
- Mining Minor (EMGM)
- Municipal Engineering Minor (ECEM)
- Polymer Science and Engineering Minor (ECMM)
- Product Design Minor (EMPD)
- Structural Materials Minor (MSSM)

Interdisciplinary Minors (PDF)

- Bioprocess Engineering Minor (IMBE)
- Ecology Minor (IMEC)
- Enterprise Minor (ENTM)
- Hydrogen Technology (IMHT)
- Nanoscale Science & Engineering Minor (IMNT)
- Plant Biotechnology Minor (IMPB)
- Plant Sciences Minor (IMPS)
- Remote Sensing Minor (IMRS)

College of Sciences and Arts (PDF)

- Aerospace Studies Minor (AFAS)
- American Studies Minor (SSAS)
- Art Minor (FAAR)
- Astrophysics Minor (SPHA)
- Biochemistry Minor (BLBC)
- Biological Sciences Minor (SBLM)
- Chemistry Minor (SCHM)
- Coaching Fundamentals Minor (PECF)
- Communication Studies Minor (HUCS)
- Computer Science Minor (SCSM)
- Diversity Studies Minor (HUDS)
- Environmental Studies Minor (SSES)
- Ethics and Philosophy Minor (HUEP)
- French Minor (HUF)
- German Minor (HUG)
- Historical Studies Minor (SSHS)
- International French Minor (HUIF)
- International German Minor (HUIG)
- International Spanish Minor (HUIS)
- International Studies Minor (SSIS)
- Journalism Minor (HUJN)
- Law and Society (SSLS)
- Mathematical Sciences Minor (SMAM)

- Microbiology Minor (BLMB)
- Military Arts and Science Minor (AMAS)
- Music Minor (FAMU)
- Pharmaceutical Chemistry (CHPM)
- Physics Minor (SPHM)
- Psychology Minor (PSYM)
- Social and Behavioral Studies Minor (SSBH)
- Spanish Minor (HUS)
- Technical Theater Minor (FATT)
- Theater Arts Minor (FATA)

APPENDIX C

MTU Undergraduate Catalog Descriptions of

University Approved Certifications

from

http://www.admin.mtu.edu/catalog/

Accessed July 23, 2010

School of Business & Economics (PDF)

- Certificate in International Business (CIB)

School of Forest Resources & Environmental Science (PDF)

- Certificate in Geographic Information Systems (CGIS)
- Certificate in Industrial Forestry (CIF)

College of Engineering (PDF)

- Certificate in Design Engineering—Distance (CDE)
- Certificate in Electric Power Engineering (CEPE)
- 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)

Interdisciplinary Certificates (PDF)

- Certificate in Global Technological Leadership (CGTL)

APPENDIX D

Basic Curriculum of the BSE Degree Program

Table D1. Basic Curriculum for the Bachelor of Science in Engineering

Year; Semester	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Sciences	Engineering Topics *Check if Contains Significant Design(X)*	General Education	Other
Year 1 Fall	MA1160 Calculus with Technology I	4			
	CH1150 University Chemistry 1	3			
	CH1151 University Chemistry 1 Laboratory	1			
	PH1100 Physics by Inquiry I	1			
	ENG1101Engineering Analysis & Problem Solving		3 (X)		
	UN1001 Perspectives on Inquiry[1]			3	
Year 1 Spring	MA2160 Calculus with Technology II	4			
	PH2100 University Physics I - Mechanics	3			
	ENG1102 Engineering Modeling & Design		3 (X)		
	UN1002 World Cultures			4	
	Math/Science Elective	1			
Year 2 Fall	MA2320/1[3] Elementary Linear Algebra	2			
	MA3520/1[3] Elementary Differential Equations	2			
	ENG2120 Statics and Strength of Materials		4		
	UN2001 Revisions			3	
	HASS[2] Distribution Course			3	
	Math/Science Elective	3			
Year 2 Spring	MA3710 Engineering Statistics	3			
	MY2100 Introduction to Materials Science & Engineering	1	2		
	UN2002 Institutions			3	
	Technical Emphasis		4		
	HASS Distribution Course			3	
Year 3 Fall	EE3010 Circuits & Instrumentation		3		
	Technical Emphasis		3		
	Directed Elective (Minor/Certificate)				4
	HASS Distribution Course			3	
	Design Implementation		3-4 (X)		
Year3 Spring	ENG3200 Thermodynamics & Fluid Mechanics		4		
	Technical Emphasis		6		
	Directed Elective (Minor/Certificate)				6

Year 4 Fall	ENG4905 Senior Design		3(X)		
	HASS Distribution Course			3	
	Senior-level (4000) Technical Electives		6-7		
	EC3400 Economic Decision Analysis[4]			3	
Year 4 Spring	Math/Science Elective	4			
	Directed Elective (Minor/Certificate)				3
	Senior-level (4000) Technical Elective		3		
	Free Electives				6
TOTALS – ABET BASIC-LEVEL REQUIREMENTS		32	48	28	19
OVERALL TOTAL FOR DEGREE	127 credit hours				
PERCENT OF TOTAL		25.2%	37.8%	22.0%	15.0%
Totals must satisfy one set	Minimum semester credit hours	32 hrs	48 hrs		
	Minimum percentage	25%	37.5%		

[1]UN courses in this table are the four core courses required in General Education.

[2]HASS Distribution Courses are selected from an approved list of courses in the Humanities, Arts, and Social Sciences. Additional requirements on selections made from this list are provided on the HASS list.

[3]MA2321 and MA3521 are accelerated versions of MA2320 and 3520; the accelerated versions may be taken in the same semester with MA2321 in the first half and MA3521 in the second as Linear Algebra is prerequisite of Differential Equations. If MA2320 and MA3520 (regular pace) are taken, MA2320 must precede MA3520.

[4]EC3400 is a HASS course that is BSE-required.