

# Materials Science and Engineering

Accredited by the Engineering Accreditation Commission of ABET, [www.abet.org](http://www.abet.org)

## 1. University Requirements: (23-24)

Writing, Rhetoric and American Cultures (WRA)	4
Integrative Studies in Humanities (IAH)	8
Integrative Studies in Social Sciences (ISS)	8
Bioscience (one of the following):	
BS 161, BS 162, ENT 205, MMG 201,	
MMG 301, PLB 105, PSL 250, ZOL 141	3-4

## 2. College Requirements: (30)

CEM 151	General and Descriptive Chemistry	4
EGR 100	Introduction to Engineering Design	2
EGR 102	Introduction to Engineering Modeling	2
MTH 132	Calculus I	3
MTH 133	Calculus II	4
MTH 234	Multivariable Calculus	4
MTH 235	Differential Equations	3
PHY 183	Physics for Scientists & Engineers I	4
PHY 184	Physics for Scientists & Engineers II	4

## 3. Major Requirements: (62)

### A. Complete all of the following: (44)

CE 221	Statics	3
CEM 152	Principles of Chemistry	3
CEM 161	Chemistry Laboratory I	1
*ECE 345	Electronic Instrumentation and Systems	3
ME 222	Mechanics of Deformable Solids	4
MSE 250	Materials Science and Engineering	3
MSE 310	Phase Equilibria in Materials	3
MSE 320	Mechanical Properties of Materials	3
MSE 331	Materials Characterization Methods I	1
MSE 350	Electronic Structure & Properties of Matls	3
MSE 360	Fundamentals of Microstructural Design	3
MSE 370	Physical Processing of Materials	3
MSE 381	Materials Characterization Methods II	2
MSE 466	Design and Failure Analysis (W)	3
MSE 477	Manufacturing Processes	3
STT 351	Probability and Statistics for Engineering	3

### B. Select two of the following courses: (6)

MSE 454	Ceramic and Refractory Materials	3
MSE 465	Desn & Application of Engr Materials (W)	3
MSE 476	Phys Metallurgy of Ferrous & Alum Alloys	3

### C. Complete at least 5 credits from 400-level courses within the College of Engineering: (5)

### D. Technical Electives: (7)

Complete at least 7 credits in courses selected from a list of approved technical electives available from the Department of Chemical Engineering and Materials Science.

\*ECE 302 and ECE 303 may be substituted for ECE 345.

## Concentrations

Students may elect to complete a more focused set of courses to enhance their ability to function at the interface with another scientific, engineering, or business discipline. Concentrations are available to, but not required of, any student enrolled in the Bachelor of Science degree in Materials Science and Engineering. Completing the Bachelor of Science degree in Materials Science and Engineering with a concentration may require more than 128 credits. The concentration will be noted on the student's transcript.

### Biomedical Materials Engineering Concentration: (25)

To gain interdisciplinary skills in human biology and earn a Bachelor of Science degree in Materials Science and Engineering with a biomedical materials engineering concentration, students must complete requirement 3. a. above and the following:

#### 1. Complete all of the following: (16)

ANTR 350	Human Gross Anatomy & Structural Biol	3
CEM 351	Organic Chemistry I	3
ME 495	Tissue Mechanics	3
MSE 425	Biomaterials and Biocompatibility	3
ZOL 341	Fundamental Genetics	4

#### 2. Complete one of the following courses: (3)

MSE 454	Ceramics and Refractory Materials	3
MSE 465	Design and Application of Egr. Materials	3
MSE 476	Phys Metallurgy of Ferrous & Alum Alloys	3

#### 3. Technical Electives: (6)

An approved list of Technical Electives is available from the adviser.

### Manufacturing Engineering Concentration (18):

To gain interdisciplinary skills with business and design engineers for manufacturing projects and earn a Bachelor of Science degree in Materials Science and Engineering with a manufacturing engineering concentration, students must complete requirement 3. a. above and the following:

#### 1. Complete all of the following: (9)

ECE 415	Computer Aided Manufacturing	3
ME 478	Product Development	3
MSE 465	Design and Application of Egr. Materials	3

#### 2. Complete three of the following courses (9):

GBL 323	Introduction to Business Law	3
MSE 426	Introduction to Composite Materials	3
MSE 454	Ceramic and Refractory Materials	3
MSE 476	Phys Metallurgy of Ferrous and Alum Alloys	3

Completion of this concentration fulfills requirement 2 of the admission requirements for the Master of Science degree in Manufacturing and Engineering Management offered by The Eli Broad College of Business.

### Metallurgical Engineering Concentration: (18)

The requirements listed above apply to students admitted to

To enhance the student's ability to characterize, process, and design with metals in association with mechanical engineers and earn a Bachelor of Science degree in Materials Science and Engineering with a metallurgical engineering concentration, students must complete requirement 3.a. above and the following:

**1. Complete all of the following: (15)**

ME 423	Intermed Mechanics of Deformable Solids	3
ME 475	Computer Aided Design of Structures	3
MSE 426	Introduction to Composite Materials	3
MSE 465	Design and Application of Egr. Materials	3
MSE 476	Phys Metallurgy of Ferrous and Alum Alloys	3

**2. Complete one of the following courses (3):**

ME 425	Experimental Mechanics	3
MSE 451	Microscopic & Diffraction Anlyns of Matls	3

**Polymeric Engineering Concentration (15):**

To gain interdisciplinary skills to facilitate interactions with chemical engineers and earn a Bachelor of Science degree in Materials Science and Engineering with a polymeric engineering concentration, students must complete requirement 3. a. above and the following:

**Complete all of the following: (15)**

CEM 351	Organic Chemistry I	3
CHE 311	Fluid Flow and Heat Transfer	3
CHE 472	Composite Materials Processing	3
CHE 473	Chem Engr Prncpls in Polymrs & Matls Sys	3
MSE 426	Introduction to Composite Materials	3

**Other Electives (Variable)**

**Total Credits Required for Degree** **128**

the major of Materials Science and Engineering in the Department of Chemical Engineering and Materials Science (CHEMS) beginning Fall, 2008. The Department of Chemical Engineering and Materials Science constantly reviews program requirements and reserves the right to make changes as necessary. Consequently, each student is strongly encouraged to consult with his/her adviser to obtain assistance in planning an appropriate schedule of courses. Students who have questions about Materials Science and Engineering should contact the Engineering Undergraduate Studies Advising Office, 1415 Engineering Building, phone (517) 355-6616, extension 1. For scheduling academic appointments visit: <https://www.egr.msu.edu/adcalendar/>

Some courses may have prerequisites, which are not otherwise required in the program. Students should check course descriptions to ensure they are aware of prerequisites.

## Materials Science and Engineering Sample Program

Freshman Year				Sophomore Year			
Fall	Credits	Spring	Credits	Fall	Credits	Spring	Credits
CEM 151	4	CEM 152	3	CE 221	3	Bioscience	3/4
CEM 161	1	EGR 102	2	ISS 3XX	4	ME 222	4
EGR 100	2	Elective	1/2	MSE 250	3	MSE 350	3
ISS 2XX	4	MTH 133	4	MTH 234	4	MTH 235	3
MTH 132	3	WRA 1XX	4	PHY 183	4	PHY 184	4
<b>Total</b>	<b>14</b>	<b>Total</b>	<b>14/15</b>	<b>Total</b>	<b>18</b>	<b>Total</b>	<b>17/18</b>

  

Junior Year				Senior Year			
Fall	Credits	Spring	Credits	Fall	Credits	Spring	Credits
Elective	3	ECE 345	3	MSE 454/465/476	3	Elective	3
IAH 201-210	4	Elective	3	MSE 454/465/476	3	Elective	3
MSE 310	3	IAH 211 or higher	4	MSE 477	3	Engr 400-IV	3
MSE 320	3	MSE 360	3	Technical Elective	3	MSE 466	3
MSE 331	1	MSE 370	3	Technical Elective	3	Technical Elective	3
STT 351	3	MSE 381	2				
<b>Total</b>	<b>17</b>	<b>Total</b>	<b>18</b>	<b>Total</b>	<b>15</b>	<b>Total</b>	<b>15</b>

### Materials Science and Engineering Program Educational Objectives

Approved to replace the document adopted on 5/11/05

The MSE program prepares students to apply their understanding of the processing, application, and sustainable use of engineering materials essential to the realization of new ideas coming from engineers, scientists, enterprises, and society. Our overarching objectives are to equip graduates with the confidence that comes from professionalism, and provide them with the tools needed to contribute meaningfully within any of the diverse professional career paths they may choose. Since the discipline creates bridges between science and engineering, MSE majors must communicate effectively with people in many different specialties, and work effectively in multi-disciplinary teams. MSE graduates must be aware of the economic, social, and environmental implications entailed in the processing and use of materials, and must have a solid grounding in professional engineering ethics.

The faculty provide a rigorous academic environment so that graduates will have mastered the analytical and technical skills needed to successfully compete as professionals, entrepreneurs, or as postgraduate scholars.

#### ***The MSE Program prepares our graduates to:***

- I. Achieve success in Materials Science & Engineering or another chosen career;
- II. Advance to leadership roles within their profession and community;
- III. Contribute effectively to their disciplines, economies and society;
- IV. Compete with confidence for opportunities for postgraduate education;
- V. Enjoy the benefits of a lifetime of learning and professional development.