# Materials Science and Engineering

Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21204-4012 - telephone (410) 347-7700.

## 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, ENT 205, MMG 201,  
  - 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: (63)
- Complete all of the following: (42)
  - 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 260 Electronic, Magnetic, Thermal & optical Properties of Materials 3
  - MSE 310 Phase Equilibria in Materials 3
  - MSE 320 Mechanical Properties of Materials 3
  - MSE 331 Materials Characterization Methods I 2
  - MSE 360 Fundamentals of Microstructural Design 3
  - MSE 370 Synthesis & Processing of Materials 3
  - MSE 381 Materials Characterization Methods II 2
  - MSE 466 Design and Failure Analysis (W) 3
  - STT 351 Probability and Statistics for Engineering 3
- Select four of the following courses: (12)
  - MSE 454 Ceramic and Refractory Materials 3
  - MSE 460 Electronic Struct, Bonding in Materials & Devices 3
  - MSE 465 Desn & Application of Engr Materials (W) 3
  - MSE 476 Phys Metallurgy of Ferrous & Alumn Alloys 3
  - ME 477 Manufacturing Processes 3
- Complete at least 6 credits from 400-level courses within the College of Engineering: (6)

## D. Technical Electives: (3)
Complete at least 3 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: (28)
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 two of the following courses: (6)
   - MSE 454 Ceramics and Refractory Materials 3
   - MSE 460 Electronic Struct, Bonding in Materials & Devices 3
   - MSE 465 Design and Application of Egr. Materials 3
   - MSE 476 Phys Metallurgy of Ferrous & Alumn Alloys 3
   - ME 477 Manufacturing Processes 3

3. Technical Electives: (6)
An approved list of Technical Electives is available from the adviser.

### Manufacturing Engineering Concentration (21):
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: (12)
   - ECE 415 Computer Aided Manufacturing 3
   - ME 477 Manufacturing Processes 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.
Materials Science and Engineering

Metallurgical Engineering Concentration: (21)
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: (18)
   ME 423  Intermed Mechanics of Deformable Solids  3
   ME 475  Computer Aided Design of Structures  3
   ME 477  Manufacturing Processes  3
   MSE 451  Microscopic, Diffraction Analysis of 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 426  Introduction to Composite Materials  3

Polymeric Engineering Concentration (21):
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: (18)
   CEM 351  Organic Chemistry I  3
   CHE 311  Fluid Flow and Heat Transfer  3
   CHE 472  Composite Materials Processing  3
   CHE 473  Chem Engr Prncips in Polymrs & Matls Sys  3
   MSE 426  Introduction to Composite Materials  3
   MSE 460  Electronic Struct & Bonding in Materials & Devices

Complete at least 3 credits in courses selected from a list of approved technical electives available from the Department of Chemical Engineering and Materials Science.

Total Credits Required for Degree  128

The requirements listed above apply to students admitted to 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 Chemical Engineering and Materials Science Department Advising Office, 1428 Engineering Building, phone (517) 432-1352. 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.

Last Revised Aug. 2013
# Materials Science and Engineering

## Sample Program

### Freshman Year

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<th>Fall Credits</th>
<th>Spring Credits</th>
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<td>CEM 152</td>
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<td>CEM 161</td>
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<td>EGR 102</td>
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<tr>
<td>EGR 100</td>
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<td>Elective</td>
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<td>ISS 2XX</td>
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<td>MTH 133</td>
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<td>MTH 132</td>
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<td>WRA 1XX</td>
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### Sophomore Year

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<td>ISS 3XX</td>
<td>4</td>
<td>ME 222</td>
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<td>MSE 250</td>
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<td>IAH 201-210</td>
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<td>MSE 310</td>
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<td>IAH 211 or higher</td>
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<td>MSE 320</td>
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<td>MSE 331</td>
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<td>MSE 370</td>
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<td>STT 351</td>
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<td>MSE 381</td>
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### Senior Year

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<td>MSE 454/456/476</td>
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<tr>
<td>MSE 477</td>
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<td>Engr 400-lvl</td>
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<tr>
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<td>MSE 466</td>
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<td><strong>Total 15</strong></td>
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# Materials Science and Engineering Program Educational Objectives

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.

Last revised, July 2013