Materials Science and Engineering

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, IBIO 150, MMG 141, MSE 201, PLB 105, PSL 250  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: (41)
      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  3
      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
   b. Select four of the following courses: (12)
      MSE 425  Biomaterial & Biocompatibility  3
      MSE 460  Electronic Struct, Bonding in Materials & Devices  3
      MSE 465  Design & Application of Engr Materials  3
      MSE 474  Ceramic and Refractory Materials  3
      MSE 476  Phys Metallurgy of Ferrous & Alumn Alloys  3
      MSE 477  Manufacturing Processes  3
   c. 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.

   *To enroll MSE 426 & MSE 477, enroll in ME 426 & ME 477
   *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 for Pre Health Prof  3
      CEM 351  Organic Chemistry I  3
      ME 495  Tissue Mechanics  3
      MSE 425  Biomaterials and Biocompatibility  3
      IBIO 341  Fundamental Genetics  4

   2. Complete two of the following courses: (6)
      MSE 460  Electronic Struct, Bonding in Materials & Devices  3
      MSE 465  Design and Application of Egr. Materials  3
      MSE 474  Ceramics and Refractory 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 474  Ceramic and Refractory Materials  3
      MSE 476  Phys Metallurgy of Ferrous and Alumn Alloys  3
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 465 Design and Application of Egr. Materials 3
   - MSE 476 Phys Metallurgy of Ferrous and Alum Alloys 3
   - MSE 481 Spectroscopic and Diffraction Analysis of Materials 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 Prncpls in Polymrs & Mats Sys 3
   - MSE 426 Introduction to Composite Materials 3
   - MSE 460 Electronic Structure & Bonding in Materials & Devices 3

Complete the following: (3)
At least 3 credits in courses 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, 2015. 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, 3508 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 May 2016
Materials Science and Engineering
Sample Program

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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 graduates of the MSE Program will:

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

Last Revised June 2016