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.

**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 110, BS 111, ENT 205, MMG 201
  - MMG 301, PLB 105, PSL 250, ZOL 141 3-4

**College Requirements (29)**
- CEM 151 General and Descriptive Chemistry 4
- CSE 131 Technical Computing and Problem Solving 3
- 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

**A. Major Requirements (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 and Properties of Materials 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 credits):**
- MSE 454 Ceramic and Refractory Materials 3
- MSE 465 Design and Application of Engineering Materials (W) 3
- MSE 476 Physical Metallurgy of Ferrous and Aluminum Alloys 3

**C. Complete at least 5 credits from 400-level courses within the College of Engineering.**

**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.

**E. Options (18-27)**
- **Biomedical Materials Engineering Option (27)**
  - ANTR 350 Human Gross Anatomy & Structural Biology 3
  - BME 401 Quantitative Human Biology 3
  - CEM 351 Organic Chemistry I 3
  - ME 495 Tissue Mechanics 3
  - MSE 425 Biomaterials and Biocompatibility 3
  - 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 Physical Metallurgy of Ferrous and Aluminum Alloys 3

- **Technical Electives (9)**
  An approved list of Technical Electives is available from the advisors.

- **Complete three of the following courses (9)**
  - GBL 323 Introduction to Business Law 3
  - MSE 426 Introduction to Composite Materials 3
  - MSE 454 Ceramics and Refractory Materials 3
  - MSE 476 Physical Metallurgy of Ferrous and Aluminum Alloys 3
  - STT 471 Statistics for Quality and Productivity 3

Completion of this option 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 Option (18)**

ME 423 Intermediate Mechanics of Deformable Solids 3
ME 475 Computer Aided Design of Structures 3
MSE 465 Design and Application of Egr. Materials 3
MSE 476 Physical Metallurgy of Ferrous and Aluminum Alloys 3

**Complete one of the following courses (3)**

MSE 426 Introduction to Composite Materials 3
STT 471 Statistics for Quality and Productivity 3

**Complete one of the following courses (3)**

ME 425 Experimental Mechanics 3
MSE 451 Microscopic and Diffraction Analysis of Materials 3

**Polymeric Engineering Option (18)**

CEM 351 Organic Chemistry I 3
CHE 311 Fluid Flow and Heat Transfer 3
CHE 472 Composite Materials Processing 3
CHE 473 Chemical Engineering Principles in Polymers and Materials Systems 3
MSE 426 Introduction to Composite Materials 3
STT 471 Statistics for Quality and Productivity 3

Upon completion of the required courses for one of these options, the student should contact the Department of Chemical Engineering and Materials Science and request certification for the completion of the option. After the certification is approved by the chairperson of the department and the Dean of the College of Engineering, the Office of the Registrar will enter on the student's academic record the name of the option and the date that it was completed. This certification will appear on the student's transcript.

**Other Electives (Variable)**

**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 Spring, 2006. 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 advisor 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.

Some courses may have prerequisites, which are no otherwise required in the program. Students should check course descriptions to ensure they are aware of prerequisites.

Last revised November, 2005
Materials Science and Engineering Sample Program

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Materials Science and Engineering Program Educational Objectives

The undergraduate program in Materials Science and Engineering (MSE) prepares students to apply their understanding of materials and materials processing in ways that are essential to the realization of designs created by all kinds of engineers. Since the degree bridges between science and engineering, MSE majors develop the ability to communicate between many different disciplines, and work effectively on multidisciplinary teams. MSE students learn the scientific and engineering foundations needed to design metallic, ceramic, polymeric, and composite materials, and the processes used to manufacture components from them. The variety of technical electives and options available in the program allows students develop special expertise in biomaterials, electronic materials, manufacturing, metals, ceramics, or polymeric materials. The MSE faculty is committed to provide a rigorous academic environment that helps students master the analytical and technical skills needed to compete successfully in the workplace or in post-graduate study.

Upon graduation, students should be able to*

I. Use their knowledge of processing-structure-properties-cost relationships, for metallic, ceramic, polymeric, electronic, and composite materials, in support of design, analysis, manufacturing, and quality engineering.

II. Use physically-based, statistical, and empirical relationships to quantitatively describe or predict characteristics of materials at nano-, micro- and macro-length scales, to solve practical design/analysis problems and experimentally validate the solutions.

Within five years after graduation, alumni should be+

III. Contributing to the economic and technical development of Michigan, the U.S., and the global community, especially for businesses and industries that develop, produce, or manufacture, metallic, ceramic, polymeric, electronic, and biomedical materials.

IV. Making effective use of the materials literature and experimental data to introduce or improve products, technical processes or business procedures in the rapidly changing work environments of the future.

V. Developing leadership skills in activities such as directing groups, managing teams, overseeing budgets, and enhancing interdisciplinary collaboration.

VI. Enjoying successful careers that utilize their education, or completing post-graduate degree programs in ranked institutions.

*Program objectives I and II summarize the body of knowledge MSE graduates learn while at MSU (it satisfies program criteria for Materials oriented programs found at www.abet.org); they describe program outcomes, which are assessed using feedback loops within the CHEMS department and the College of Engineering.

+Program objectives III-VI are evaluated using an alumni questionnaire that solicits responses based on these statements.