***Twin Cities Campus***

# Materials Science and Engineering B.Mat.S.E.

*Chemical Engineering & Materials Science*

**College of Science and Engineering**

- Program Type: Baccalaureate
- Requirements for this program are current for Fall 2018
- Required credits to graduate with this degree: 121
- Required credits within the major: 100 to 101
- Degree: Bachelor of Materials Science and Engineering

The program in materials science and engineering leads to a bachelor's degree that enables students to immediately enter the profession. The program develops an understanding of the properties and the origin of these properties in a broad range of materials, including metals, ceramics, semiconductors, polymers, and composites. Because the program is broadly based, graduates find employment across a range of industries, including the automotive, chemical, electronics, energy, and medical technology industries. Graduates also find positions in consulting, research, technical management, and teaching.

The materials science and engineering (MSE) program is designed to prepare students to achieve the following career and professional accomplishments after graduation:
Be employed as a materials engineer or a related engineering or science position, using and developing his or her skills based on the demands of the job.
Enter into a graduate or professional program, applying his or her knowledge and experience toward an advanced or professional degree.
Be an effective team member, using and developing communication and teamwork skills.
Be a responsible engineer/scientist or professional, demonstrating ethical and professional responsibility and continuing to learn through formal and informal educational experiences.

## Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

## Admission Requirements

Students must complete 10 courses before admission to the program.

Freshman and transfer students students are usually admitted to pre-major status before admission to this major

Students interested in materials science and engineering are recommended to take MATS/CHEN 1001 to learn more about the field.

For information about University of Minnesota admission requirements, visit the Office of Admissions website.

**Required prerequisites**

**Mathematics**

MATH 1271 - Calculus I [MATH] (4.0 cr)
*or* MATH 1371 - CSE Calculus I [MATH] (4.0 cr)
*or* MATH 1571H - Honors Calculus I [MATH] (4.0 cr)
MATH 1272 - Calculus II (4.0 cr)
*or* MATH 1372 - CSE Calculus II (4.0 cr)
*or* MATH 1572H - Honors Calculus II (4.0 cr)
MATH 2263 - Multivariable Calculus (4.0 cr)
*or* MATH 2374 - CSE Multivariable Calculus and Vector Analysis (4.0 cr)
*or* MATH 2573H - Honors Calculus III (4.0 cr)
*or* MATH 2243 - Linear Algebra and Differential Equations (4.0 cr)
*or* MATH 2373 - CSE Linear Algebra and Differential Equations (4.0 cr)
*or* MATH 2574H - Honors Calculus IV (4.0 cr)

**Physics**

PHYS 1301W - Introductory Physics for Science and Engineering I [PHYS, WI] (4.0 cr)
*or* PHYS 1401V - Honors Physics I [PHYS, WI] (4.0 cr)
PHYS 1302W - Introductory Physics for Science and Engineering II [PHYS, WI] (4.0 cr)
*or* PHYS 1402V - Honors Physics II [PHYS, WI] (4.0 cr)

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**Introduction to Materials Science and Engineering**
MATS 3011 - Introduction to Materials Science and Engineering (3.0 cr)

## General Requirements

All students are required to complete general University and college requirements including writing and liberal education courses. For more information about University-wide requirements, see the liberal education requirements.Required courses for the major or minor in which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

## Program Requirements

All freshmen in the College of Science and Engineering must complete CSE 1001: First-Year Experience.

**Chemistry**
**Principles of Chemistry 1**
CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr)
*or* CHEM 1071H - Honors Chemistry I [PHYS] (3.0 cr)
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
*or* CHEM 1075H - Honors Chemistry I Laboratory [PHYS] (1.0 cr)
CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
*or* CHEM 1072H - Honors Chemistry II [PHYS] (3.0 cr)
CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
*or* CHEM 1076H - Honors Chemistry II Laboratory [PHYS] (1.0 cr)
CHEM 2301 - Organic Chemistry I (3.0 cr)
*or* CHEM 2331H - Honors Elementary Organic Chemistry I (3.0 cr)

**Major Courses**
AEM 4511 - Mechanics of Composite Materials (3.0 cr)
MATS 3001 - Thermodynamics of Materials (3.0 cr)
MATS 3002 - Mass Transport and Kinetics (3.0 cr)
MATS 3012 - Metals and Alloys (3.0 cr)
MATS 3013 - Electrical and Magnetic Properties of Materials (3.0 cr)
MATS 3141 - Numerical Methods for Materials Science (3.0 cr)
MATS 3801 - Structural Characterization Lab (4.0 cr)
MATS 3851W - Materials Properties Lab [WI] (4.0 cr)
MATS 4212 - Ceramics (3.0 cr)
MATS 4221 - Materials Performance (4.0 cr)
MATS 4301W - Materials Processing [WI] (4.0 cr)
MATS 4400 - Senior Design Project (3.0 cr)
CHEM 4502 - Introduction to Quantum Mechanics and Spectroscopy (3.0 cr)
*or* PHYS 2303 - Physics III: Physics of Matter (4.0 cr)
Complete the required mathematics course not used for admission to the program.
MATH 2243 - Linear Algebra and Differential Equations (4.0 cr)
*or* MATH 2373 - CSE Linear Algebra and Differential Equations (4.0 cr)
*or* MATH 2574H - Honors Calculus IV (4.0 cr)
*or* MATH 2263 - Multivariable Calculus (4.0 cr)
*or* MATH 2374 - CSE Multivariable Calculus and Vector Analysis (4.0 cr)
*or* MATH 2573H - Honors Calculus III (4.0 cr)
MATS 4214 - Polymers (3.0 cr)
*or* CHEM 4214 - Polymers (3.0 cr)
*or* CHEN 4214 - Polymers (3.0 cr)
**Statics/Dynamics**
Students majoring in Materials Science and Engineering are required to take AEM 2031. Students may take AEM 2011/AEM 3031 with prior departmental approval.
AEM 2031 - Mechanics for Materials Engineers (3.0 cr)
*or* AEM 2011 - Statics (3.0 cr)
AEM 3031 - Deformable Body Mechanics (3.0 cr)

**Technical Electives**
Students must take 13 credits of technical electives.

The list below is not exhaustive; please see your advisor to discuss additional options. Up to 4 credits of MATS 4594 may count toward the 13 required technical elective credits.
Take 13 or more credit(s) from the following:

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Information current as of March 28, 2024

•BIOC 3021 - Biochemistry (3.0 cr)
•BMEN 5001 - Advanced Biomaterials (3.0 cr)
•CEGE 3402 - Civil Engineering Materials (3.0 cr)
•CEGE 3501 - Introduction to Environmental Engineering [ENV] (3.0 cr)
•CEGE 3502 - Fluid Mechanics (4.0 cr)
•CEGE 4121 - Computer Applications II (3.0 cr)
•CEGE 4502 - Water and Wastewater Treatment (3.0 cr)
•CHEM 4201 - Materials Chemistry (3.0 cr)
•CHEM 4701 - Inorganic Chemistry (3.0 cr)
•CHEM 5755 - X-Ray Crystallography (4.0 cr)
•CHEN 2001 - Material and Energy Balances (4.0 cr)
•CHEN 5771 - Colloids and Dispersions (3.0 cr)
•EE 3005 - Fundamentals of Electrical Engineering (4.0 cr)
•EE 3006 - Fundamentals of Electrical Engineering Laboratory (1.0 cr)
•EE 3161 - Semiconductor Devices (3.0 cr)
•EE 5171 - Microelectronic Fabrication (3.0 cr)
•EE 5173 - Basic Microelectronics Laboratory (1.0 cr)
•EE 5657 - Physical Principles of Thin Film Technology (4.0 cr)
•IE 3521 - Statistics, Quality, and Reliability (4.0 cr)
•IE 5441 - Financial Decision Making (4.0 cr)
•IE 5541 - Project Management (4.0 cr)
•MATH 4242 - Applied Linear Algebra (4.0 cr)
•MATH 4428 - Mathematical Modeling (4.0 cr)
•MATH 4512 - Differential Equations with Applications (3.0 cr)
•MATH 4567 - Applied Fourier Analysis (4.0 cr)
•MATH 5485 - Introduction to Numerical Methods I (4.0 cr)
•MATS 4223W - Polymer Laboratory [WI] (2.0 cr)
•MATS 4594 - Directed Research in Materials Science (1.0 - 3.0 cr)
•MATS 5517 - Microscopy of Materials (3.0 cr)
•PDES 3706 - Designing for Manufacture (4.0 cr)
•PDES 5701 - User-Centered Design Studio (4.0 cr)
•PHYS 4001 - Analytical Mechanics (4.0 cr)
•PHYS 4002 - Electricity and Magnetism (4.0 cr)
•PHYS 4911 - Introduction to Biopolymer Physics (3.0 cr)
•PHYS 5701 - Solid-State Physics for Engineers and Scientists (4.0 cr)
•STAT 3022 - Data Analysis (4.0 cr)
•STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)
*or* STAT 3021 - Introduction to Probability and Statistics (3.0 cr)
•MATS 5531 *{Inactive}*(3.0 cr)
*or* CHEN 5531 *{Inactive}*(3.0 cr)
•CHEM 2302 - Organic Chemistry II (3.0 cr)
*or* CHEM 2332H - Honors Elementary Organic Chemistry II (3.0 cr)
•CHEM 2311 - Organic Lab (4.0 cr)
*or* CHEM 2312H - Honors Organic Lab (5.0 cr)
•PDES 3704 - Computer-Aided Design 1: Solid Modeling and Rendering (3.0 cr)
*or* PDES 5704 - Computer-Aided Design Methods (3.0 cr)

**Upper Division Writing Intensive within the major**

Students are required to take one upper division writing intensive course within the major. If that requirement has not been satisfied within the core major requirements, students must choose one course from the following list. Some of these courses may also fulfill other major requirements.

Take 0 - 1 course(s) from the following:

•MATS 3851W - Materials Properties Lab [WI] (4.0 cr)
•MATS 4301W - Materials Processing [WI] (4.0 cr)

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