

MATERIALS SCIENCE AND ENGINEERING (MSE)

MSE 120 Introduction to Engineering (2 crs)

Prerequisite: MATH 109 or concurrent enrollment.

A comprehensive study of the engineering design process. Discussion of engineering disciplines with comparisons. The laboratory portion of the course includes design projects from various engineering disciplines.

Attributes: LE-S3 Creativity
Lecture/Discussion Hours: 1
Lab/Studio Hours: 2

MSE 221 Living in a Materials World (3 crs)

Prerequisite: MATH 114 or concurrent enrollment. No credit if taken after MSC1 100.

The interplay of the structure, properties, and processing of technological materials and their impact on performance. Societal benefits of sustainable, biomimetic, or responsible materials selection.

Lecture/Discussion Hours: 3
Lab/Studio Hours: 0

MSE 256 Introduction to Computer Aided Design (1 cr)

Prerequisite: MATH 109 or concurrent enrollment.

The course provides an introduction to 3-dimensional computer aided design and modeling.

Lecture/Discussion Hours: 0
Lab/Studio Hours: 3

MSE 286 Engineering Sophomore Seminar (1 cr)

• *This course requires access to a laptop computer which can be brought to class when required. Please see the Materials Science and Biomedical Engineering Department laptop requirement: <https://www.uwec.edu/academics/college-arts-sciences/departments-programs/materials-science-biomedical-engineering/academic-offerings/materials-science-biomedical-engineering-laptop-requirements/>*

Career preparation for materials science, materials science and engineering, and biomedical engineering majors. Will include seminars with external speakers and class discussions of relevant issues.

MSE 289 Research Experience - MSE (1-3 crs)

Consent: Instructor Consent Required

This course provides research opportunities in Materials Science & Engineering for students in their first or second year of their major studies.

Repeat: Course may be repeated

MSE 307 Engineering Statistics (4 crs)

Prerequisite: MATH 114.

• *Enrollment before or concurrent with MSE 368 recommended. This course requires access to a laptop computer which can be brought to class when required. Please see the Materials Science and Biomedical Engineering Department laptop requirement: <https://www.uwec.edu/academics/college-arts-sciences/departments-programs/materials-science-biomedical-engineering/academic-offerings/materials-science-biomedical-engineering-laptop-requirements/>*

Principles of engineering experimentation and data collection, elementary probability distributions, use of confidence intervals and significance tests in engineering design and decision-making, use of statistical software, design of experiments, statistical process control

Lecture/Discussion Hours: 3
Lab/Studio Hours: 2

MSE 315 Materials Characterization (4 crs)

Prerequisite: CHEM 103 or CHEM 115 and PHYS 211 or PHYS 231 or concurrent enrollment.

A survey of commonly used materials characterization methods (XPS, SEM, AFM, XRD, XRF), including their theory of operation and hands-on experience. Includes a discussion of the measurement process and instrumental analysis of samples.

Attributes: LE-S3 Creativity
Lecture/Discussion Hours: 2
Lab/Studio Hours: 4

MSE 334 Soft Materials (4 crs)

Prerequisite: CHEM 325 and MSE 221

Includes in-depth soft materials topics such as synthesis and processing, structure-property relationships, and applications of soft materials.

Lecture/Discussion Hours: 4
Lab/Studio Hours: 0

MSE 350 Thermodynamics of Materials (4 crs)

Prerequisite: MSC1 100 or MSE 221 or GEOL 312; CHEM 104 or CHEM 109 or CHEM 115; C or above in MATH 215; PHYS 232 or concurrent enrollment.

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Survey of the laws of thermodynamics and their application in Materials Science including phase equilibria. Mathematical skills relevant to engineering applications are discussed in the lab section.

Grading Basis: No S/U Grade Option
Lecture/Discussion Hours: 3
Lab/Studio Hours: 2

MSE 357 Phase Transformation & Kinetics (3 crs)

Prerequisite: MSE 221; MATH 215; CHEM 104 or CHEM 109 or CHEM 115

Phase transformations are explored with emphasis on microstructure development, the impact of diffusion, and nucleation/growth mechanisms.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

MSE 362 Microelectronic Materials Processing (2 crs)

Prerequisite: MSE 350; MSE 357 or concurrent enrollment. No credit if taken after MSCI 362

- Formerly MSCI 362.

The fabrication of microelectronic devices is discussed, and the thermodynamics and kinetics that impact process design. Methods and practices are reviewed.

Grading Basis: A-F Grades Only

Lecture/Discussion Hours: 2

Lab/Studio Hours: 0

MSE 363 Microelectronic Materials Processing Lab (2 crs)

Prerequisite: MSE 350 or CHEM 433 or PHYS 332. No credit if taken after MSCI 363

- Formerly MSCI 363.

The fabrication of microelectronic devices is explored. Methods and practices for photolithography, etching, and deposition are studied in a lab setting.

Grading Basis: A-F Grades Only

Lecture/Discussion Hours: 0

Lab/Studio Hours: 4

MSE 367 Macroprocessing of Materials (3 crs)

Prerequisite: MSE 357

Processing approaches for major categories of bulk materials. Topics range from raw materials to forming and finishing of final products.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

MSE 368 Macroprocessing Materials Lab (2 crs)

Prerequisite: MSE 367 or concurrent enrollment.

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Practical and analytical aspects of processing techniques and investigation of structure-property-processing relationships using hands-on experiences.

Lecture/Discussion Hours: 0

Lab/Studio Hours: 6

MSE 372 Transport Phenomena (3 crs)

Prerequisite: MATH 312

Principles of momentum, heat, and mass transport. Applications of appropriate differential equations and boundary conditions to solve problems in materials processing.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

MSE 374 Electrical, Optical and Magnetic Properties of Materials (4 crs)

Prerequisite: PHYS 332 or MSE 350

- Credit may not be earned in both MSE 374 and PHYS 374.

A description of the behaviors of crystalline solids. Topics include crystallography, diffraction, and the electrical, optical and magnetic properties of materials. Semiconducting materials and devices will also be discussed.

Lecture/Discussion Hours: 4

Lab/Studio Hours: 0

MSE 386 Engineering Junior Seminar (1 cr)Prerequisite: MSE 286 and limited to declared Materials Science and Engineering majors or declared Biomedical Engineering majors
Career preparation for materials science and engineering and biomedical engineering majors, including ethics and other discussions relevant to the major. Will include seminars with external speakers and class discussions of topical issues.

Lab/Studio Hours: 0

Seminar Hours: 1

MSE 387 MS&E Junior Seminar II (0.5 crs)

Prerequisite: MSE 386; Limited to Materials Science and Engineering majors

The second course in the junior seminar course sequence. Will include seminars with external speakers and class discussions of relevant issues.

Lab/Studio Hours: 0

Seminar Hours: .5

MSE 395 Directed Studies (1-3 crs)

Prerequisite: Minimum 2.0 GPA in Materials Science or Materials Science and Engineering or Biomedical Engineering majors

Consent: Department Consent Required

This course is designed to allow a single student or a group of students to pursue their educational goals and interests under the direction of a faculty member.

Repeat: Course may be repeated for a maximum of 6 credits

MSE 406 Failure Analysis and Prevention (3 crs)

Prerequisite: MSE 350 or MSE 357

Analysis of mechanical failure in materials systems, and strategies for mitigating failure risks.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

MSE 451 Computational Materials Science (3 crs)

Prerequisite: MSE 350 or PHYS 333 or CHEM 434.

Theory and application of computational methods to model, understand and predict the behavior of materials. Labs provide hands-on experience in solving real materials problems using computational approaches.

Lecture/Discussion Hours: 2

Lab/Studio Hours: 3

MSE 475 Nanomaterials (3 crs)

Prerequisite: CHEM 104 or 109 or 115, and one of the following: MSE 350, or PHYS 333, or CHEM 434.

Quantum behavior and statistical mechanics of nanomaterials, plus modern synthesis methods, electronic and optical applications, biomaterials.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

MSE 486 MS&E Capstone I (2 crs)

Prerequisite: MSE 256 or concurrent enrollment; MSE 307 or instructor consent; MSE 350; MSE 386 or departmental consent

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First of a two-course capstone sequence. Hands-on, project-based experiences including engineering design, problem solving and Computer Aided Design (CAD).

Lab/Studio Hours: 0

Seminar Hours: 4

MSE 487 MS&E Capstone II (2 crs)

Prerequisite: MSE 486

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Second of a two-course capstone sequence. Conclusion of student-designed projects accompanied by preparation of multiple technical documents.

Attributes: LE-I1 Integration

Lab/Studio Hours: 0

Seminar Hours: 4

MSE 493 Collaborative Internship (1-3 crs)

Prerequisite: 2.50 total GPA; minimum junior standing

Consent: Instructor Consent Required

This course provides students an opportunity to participate in collaborative projects that are performed on campus under the supervision of a faculty member.

Attributes: Internship

Grading Basis: A-F Grades Only

MSE 494 Off-campus Materials Science Internship (1-3 crs)

Prerequisite: 2.50 total GPA; minimum junior standing

Consent: Instructor Consent Required

Off-campus internship with a regional company or other partner, including professional development training and reflection.

Attributes: Internship

Grading Basis: A-F Grades Only
