

## **Materials Science & Engrg**

### **MY 5000 - Materials Science and Engineering**

Concepts of crystallography and crystal structure. Designed for students without a degree in materials science and engineering. Covers microstructural development as related to phase diagrams, kinetics of phase transformations, diffusion and materials processing. Relationship of properties to microstructure and processing. No degree credit given to students with materials undergraduate degrees.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** On Demand

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

### **MY 5100 - Thermodynamics and Kinetics I**

Solution thermodynamics and application to phase equilibria. Driving force for phase transformations. Chemical thermodynamics applied to materials processing. Corrosion and oxidation of metals. Applications to engineering situations.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Fall

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

### **MY 5110 - Thermodynamics and Kinetics II**

The kinetics of liquid-to-solid and solid-to-solid phase transformations. Diffusion-controlled phase transformations, including nucleation, growth, coarsening, spinodal decomposition, eutectic and eutectoid transformations, cellular transformations, and massive transformations. Martensitic transformations.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Spring

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**Pre-Requisite(s):** MY 5100

### **MY 5200 - Advanced Scanning Electron Microscopy**

Basic design and operating principles of scanning electron microscope (SEM) with discussions on interactions of electrons with solids and resulting signal production, for analysis of heterogeneous materials using X-ray microanalysis, and applications to surface science. Includes practical training on advanced operation of SEM and FE-SEM (FE=field emission)\* instruments with an emphasis on the production of high resolution images and quantitative X-ray analysis of specimen composition based on real and virtual standards. (\*if available)

**Credits:** 3.0

**Lec-Rec-Lab:** (2-0-3)

**Semesters Offered:** Summer

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 5250 - Transmission Electron Microscopy**

Practical aspects of materials characterization by transmission electron microscopy.

**Credits:** 3.0

**Lec-Rec-Lab:** (2-0-3)

**Semesters Offered:** On Demand

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 5260 - Crystallography & Diffraction**

Crystallographic concepts and diffraction analyses in materials science.

**Credits:** 3.0

**Lec-Rec-Lab:** (2-0-3)

**Semesters Offered:** On Demand

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 5400 - Mechanical Behavior of Materials**

Elasticity and plasticity in solids. Dislocation interactions and strengthening mechanisms. High temperature deformation. Low and high temperature material forming operations. Fracture processes in materials.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Fall, Spring

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 5430 - Electronic Materials**

A study of the physical principles, operational characteristics, models, and basic applications of selected solid-state devices.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Spring

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 5460 - Solid State Devices**

A study of the physical principles, operational characteristics and models and basic applications of solid state devices such as p-n junctions, metal-semiconductor junctions and transistors.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Fall

**MY 5470 - Semiconductor Fabrication**

Graduate level introduction to the science and engineering of semiconductor device fabrication.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Fall

**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**MY 5480 - Advanced MEMS**

This course will cover advanced topics dealing with MEIXIS technologies, transduction mechanisms, and microfabricated sensors and actuators and is continuation of EE4240/MY4240.

**Credits:** 4.0

**Lec-Rec-Lab:** (3-1-0)

**Semesters Offered:** Spring

**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**Pre-Requisite(s):** EE 4240 or MY 4240

**MY 5480D - Advanced MEMS**

This course will cover advanced topics dealing with MEMS technologies, transduction mechanisms, and microfabricated sensors and actuators and is continuation of EE4240/MY4240.

**Credits:** 4.0

**Lec-Rec-Lab:** (3-1-0)

**Semesters Offered:** Spring

**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**Pre-Requisite(s):** MY 4240D or EE 4240D

**MY 5550 - Solid Surfaces**

The performance, durability, and stability of composites, coatings, films, advanced ceramics, implants, and nano-technological products rely on the understanding, control and manipulation of surfaces and interfaces. This course provides both a fundamental and practical introduction to the concepts and theories of solid surfaces and solid-liquid interfaces. The capillary effects, electrical aspects of interfaces, and adsorption at materials surfaces, with their practical applications and consequences, are emphasized.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Spring

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 5580 - Introduction to Scanning Probe Microscopy**

Students will learn basics of design and fundamental physics behind the scanning probe microscopy techniques. The lectures will also discuss analysis of the solid surfaces regarding roughness, topography, composition, heterogeneity, and adhesion properties using atomic force microscopy (AFM). Artifacts associated with inappropriate conditions in atomic AFM imaging will be discussed as well. Training in the operation of the AFM instrument and exploration of its capability during the laboratory sessions will complement the lectures.

**Credits:** 2.0

**Lec-Rec-Lab:** (1-0-3)

**Semesters Offered:** Fall

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 5600 - Powder Processing**

Processing of metal and ceramic powders into bulk products. Powder manufacture and characterization, compaction, sintering, pressure-assisted consolidation to full density. Emphasis on principles underlying consolidation practices.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Spring - Offered alternate years beginning with the 2005-2006 academic year

**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**Pre-Requisite(s):** MY 2100

**MY 5610 - Materials Recycling: Processing and Utilization**

Methods for materials recycling is the emphasis. Topics include the recycling of materials for steel, aluminum, automobile, foundry, glass, plastics, energy, construction, and other industries. Background of the industry, characteristics of materials, materials flow, and the processing and utilization methods to recycle the materials are presented.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Spring

**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**MY 5620 - Soft Materials**

An introduction to basic concepts, interactions, structures, and properties in soft materials. Topics include polymers, liquid crystals, colloids, surfactants and lipids, polymeric nano composites, and bio materials.

**Credits:** 2.0

**Lec-Rec-Lab:** (2-0-0)

**Semesters Offered:** Fall, Spring - Offered alternate years beginning with the 2004-2005 academic year

**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**Pre-Requisite(s):** MY 2100

**MY 5750 - Bioapplications of Nanotechnologies**

The prospect of bioapplications of nanotechnologies, selected topics including nanodevices for biosensor and drug delivery, biocompatibility and toxicity of nanomaterials, nanostructured polymers for tissue engineering, design and operation of medical nanorobots, ethics and societal impacts of nanobiotechnology, etc.

**Credits:** 2.0

**Lec-Rec-Lab:** (2-0-0)

**Semesters Offered:** Fall - Offered alternate years beginning with the 2005-2006 academic year

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 5900 - Graduate Seminar**

Graduate student presentations at departmental seminars.

**Credits:** 1.0; May be repeated

**Lec-Rec-Lab:** (0-1-0)

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 5970 - Special Topics - Graduate Materials Science and Engineering**

Special Topics in Materials Science and Engineering at the Graduate level.

**Credits:** variable to 4.0; Repeatable to a Max of 8

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Permission of instructor required; Must be enrolled in one of the following Level(s): Graduate

**MY 5990 - MS Thesis Research**

Fundamental and applied research in metallurgical and materials engineering. Taken by graduate students in partial fulfillment of the MS thesis requirements.

**Credits:** variable to 12.0; May be repeated; Graded Pass/Fail Only

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 6100 - Computational Materials Science and Engineering**

Computational and analytical techniques applied to materials science and engineering problems. Develops student facility with modern computational techniques.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** On Demand

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 6110 - Advanced Topics in Materials Processing**

Advanced treatment of various unit operations of materials processing. Operations may include deformation processing, powder and particulate technology, solidification processing, thermomechanical processing, optimum process selection, etc.

**Credits:** variable to 4.0; May be repeated

**Semesters Offered:** On Demand

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 6200 - Advanced Topics in Materials Characterization**

Advanced concepts in materials characterization. Specific course content is tailored to meet the interests of the students and faculty.

**Credits:** variable to 4.0; May be repeated

**Semesters Offered:** On Demand

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 6400 - Advanced Topics in Mechanical Behavior of Materials**

Advanced concepts in mechanical behavior of materials. Specific course content is tailored to meet the interests of the students and faculty.

**Credits:** variable to 4.0; May be repeated

**Semesters Offered:** On Demand

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 6460 - CMOS Devices**

An in-depth treatment of field-effect devices.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Spring

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**Pre-Requisite(s):** MY 5460

**MY 6480 - Thin Films**

Material Science of thin films.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Fall

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**MY 6990 - PhD Thesis Research**

Fundamental and applied research in metallurgical and materials engineering. Taken by graduate students in partial fulfillment of the PhD thesis requirements.

**Credits:** variable to 12.0; May be repeated; Graded Pass/Fail Only

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**Graduate Course Descriptions Effective Fall 2007**

[https://www.banweb.mtu.edu/pls/owa/stu\\_ctg\\_utils.p\\_online\\_all\\_courses\\_gr](https://www.banweb.mtu.edu/pls/owa/stu_ctg_utils.p_online_all_courses_gr)

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