

All MSE offerings

(Undergraduate level)

MSE 3300	Introduction to Materials Science and Engineering
MSE 3321	Mechanical Behavior of Materials
MSE 4310	Polymer Material Science
MSE 4315	Introduction to Composites
MSE 4320	Nanoscale Materials
MSE 4336	Advanced Mechanical Behavior of Materials
MSE 4337	Fatigue of Engineering Materials
MSE 4338	Failure Analysis
MSE 4339	Fracture Mechanics
MSE 4390	Special Topics in Materials Science

(Graduate level)

MSE5141- TRANSMISSION ELECTRON MICROSCOPY LAB

Specimen preparation. Operation of the transmission electron microscope. Beam alignment and rotation calibration. Bright field and dark field imaging. Weak beam imaging. Examination of defects.

MSE5190- SPECIAL TOPICS IN MATERIALS SCIENCE AND ENGINEERING

May be repeated for credit when topic changes.

MSE5191- ADVANCED STUDIES IN MATERIALS SCIENCE AND ENGINEERING

Topics selected from various areas of materials science and engineering. Work performed as a thesis substitute normally will be accomplished under the course number 5391, with prior approval of the Committee on Graduate Studies.

MSE5192- MASTER'S COMPREHENSIVE EXAMINATION

Directed study, consultation, and comprehensive examination over coursework leading to the Master of Engineering degree in Materials Science and Engineering. Required of all Master of Engineering students in the semester they plan to graduate.

MSE5193- SEMINAR IN MATERIALS SCIENCE AND ENGINEERING

Selected topics in materials science and engineering presented by faculty, students, and invited lecturers.

MSE5290- SPECIAL TOPICS IN MATERIALS SCIENCE AND ENGINEERING

May be repeated for credit when topic changes.

MSE5291- ADVANCED STUDIES IN MATERIALS SCIENCE AND ENGINEERING

Topics selected from various areas of materials science and engineering. Work performed

as a thesis substitute normally will be accomplished under the course number 5391, with prior approval of the Committee on Graduate Studies.

MSE5300- INTRODUCTION TO MATERIALS SCIENCE AND ENGINEERING

Physical, mechanical, electrical and chemical properties of metals, semiconductors, ceramics, polymers and composites, with an emphasis on understanding fundamental issues. Relationships between the processing, micro and macro structure of materials with their properties, such as strength ductility, toughness, fatigue and fracture and creep properties with special emphasis on mechanical properties of metals, polymers, ceramics and composites.

MSE5304- ANALYSIS OF MATERIALS

Theoretical understandings and practical applications of various characterization techniques to materials analysis, ranging from x-rays and electron diffraction, x-ray spectroscopy, and surface topography, are discussed. Practice of these techniques in lab class typically includes SEM spectroscopy, powder diffraction, Laue diffraction, and the double crystal x-ray diffraction.

MSE5310- DISLOCATION THEORY

Theory of dislocations and their reactions and interactions in crystalline materials developed and extended into a basic understanding of mechanical properties of crystalline materials.

MSE5312- MECHANICAL BEHAVIOR OF MATERIALS

Concepts of stress and strain, theory of plasticity. Elementary dislocation theory. Deformation of single crystals. Strengthening mechanisms like solid solution strengthening, precipitation hardening, etc. Elementary concepts in fracture mechanics. Microscopic aspects of fracture, fatigue, and creep of materials.

MSE5314- FRACTURE MECHANICS

Theory and applications of linear elastic fracture mechanics. Topics include stress analysis of cracks, crack-tip plasticity, fatigue and stress corrosion. Applicability to materials selection, failure analysis and structural reliability reviewed.

MSE5315- FATIGUE OF ENGINEERING MATERIALS

Cyclic deformation, fatigue crack initiation and growth in ductile solids. Application of fracture mechanics to fatigue. Mechanisms of crack closure. Variable and multiaxial fatigue and corrosion fatigue. Fatigue of brittle solids.

MSE5321- PHASE TRANSFORMATIONS OF MATERIALS

The theory of homogeneous and heterogeneous transformations, nucleation and growth, martensitic transformations, heat treatment and control of microstructure.

MSE5330- CORROSION

Quantitative application of electrochemical principles to corrosion reactions. Effects of

metallurgical factors and environmental conditions on oxidation, erosion, and cracking discussed along with materials selection.

MSE5331- FERROELECTRIC DEVICES

Crystallography and its relation to ferroelectrics, effects of crystal symmetry on crystal properties, isotropic and anisotropic properties, matrix and tensor representation of physical properties, transformation of axes, principal axes of tensor, crystal properties in matrix notation, matrix method, electrostatics, thermodynamics of electrification, origin of spontaneous polarization, ferroelectric materials, fabrication of ceramics and in depth discussion of representative ferroelectric, electrostrictive, dielectric and piezoelectric devices. Fabrication and characterization of piezoelectric actuator. Prerequisite: permission of instructor.

MSE5333- MAGNETIC PROPERTIES OF MATERIALS

Classical and quantum mechanical understandings of magnetic properties of materials. Specific applications of these properties to various devices are discussed. Prerequisite: MSE 5305 or permission of instructor.

MSE5334- OPTICAL PROPERTIES IN SOLID MATERIALS

Basic understanding of optical response of materials based on classical and quantum models. Particular focus on all phenomena involving light in semiconductors and their optoelectronic applications. Optical properties of solid materials with reduced dimensionality such as thin films and quantum wells and dots. Prerequisite: MSE 5305 or permission of instructor.

MSE5336- ELECTRICAL PROPERTIES OF MATERIALS

Advanced discussion of electronic structure, transport mechanisms in metals, semiconductors and superconductors, with applications to materials used in various electronic devices.

MSE5341- TRANSMISSION ELECTRON MICROSCOPY IN MATERIALS SCIENCE

Crystallography, stereographic projections, and reciprocal lattice. Specimen preparation in transmission electron microscopy. Dynamical and kinematical theories of electron diffraction. Interpretation of diffraction patterns and transmission electron micrographs. Use of the transmission electron microscope.

MSE5345- CERAMIC MATERIALS

Crystal structure of ceramic materials. Phase equilibria in ceramic materials. The processing of ceramics and ceramic matrix composites. Strengthening mechanisms and mechanical properties of ceramics and ceramic matrix composites including flexure, tensile, fracture toughness, fatigue, and creep.

MSE5346- ADVANCED POLYMER CHEMISTRY

Polymer synthesis and reactions including condensation, free-radical, ionic, and coordination polymerizations; principles of polymerization including thermodynamics

and kinetic considerations; physical characterizations including determinations of absolute molecular weights, relative molecular weights, morphology, glass transitions, and polymer crystallinity; relationships between macromolecular structure, properties, and uses of polymeric materials. Also offered as MSE 5346. Prerequisite: CHEM 2321 and 2322 or permission of instructor.

MSE5347- POLYMER MATERIALS SCIENCE

Intermolecular forces of attraction in high polymers, polymer synthesis, morphology and order in crystalline polymers, mechanics of amorphous polymers, time-dependent mechanical behavior, transitional phenomena, mechanical behavior of semicrystalline polymers.

MSE5348- FUNDAMENTALS OF COMPOSITES

Fundamental relationships between the mechanical behavior and the composition of multiphase media; failure criteria discussed. Also offered as MSE 5348 and AE 5315. Credit will be granted only once.

MSE5349- ADVANCED COMPOSITES

Review of current state-of-the-art applications of composites: composite structural analysis; structural properties, damage characterization and failure mechanisms; stiffness loss due to damage, notched sensitivity; delamination; impact; fatigue characteristics; composite material testing; material allowables; characteristics of composite joints. Also offered as ME 5349 and MSE 5349. Credit will be granted only once. Prerequisite: ME 5348 or MSE 5348 or AE 5315 or consent of the instructor.

MSE5351- Current Topics in Nanotechnology

Review and discussion of the latest advances in the field of nanoscale science and technology. Topics include molecular electronics, chemical and biological sensors, synthesis of nanoscale materials, carbon nanotubes, nanowires, nanoparticles, atom-wires, self-assembled monolayers, nanoscale composite materials and techniques for observing and manipulating atoms and molecules. Prerequisite: permission of instructor.

MSE5390- SPECIAL TOPICS IN MATERIALS SCIENCE AND ENGINEERING

May be repeated for credit when topic changes.

MSE5391- ADVANCED STUDIES IN MATERIALS SCIENCE AND ENGINEERING

Topics selected from various areas of materials science and engineering. Work performed as a thesis substitute normally will be accomplished under the course number 5391, with prior approval of the Committee on Graduate Studies.

MSE5398- THESIS

MSE5405- PHYS THERMO MAT

MSE5698- THESIS

MSE5998- THESIS

MSE6196- MSE INTERNSHIP

For students participating in internship programs. May be repeated for credit.

MSE6197- ADVANCED STUDIES IN MATERIALS SCIENCE AND ENGINEERING

May be repeated for credit.

MSE6198- RESEARCH IN MATERIALS SCIENCE AND ENGINEERING

Individually approved research projects in materials science and engineering. May be repeated for credit.

MSE6298- RESEARCH IN MATERIALS SCIENCE AND ENGINEERING

Individually approved research projects in materials science and engineering. May be repeated for credit.

MSE6396- MSE INTERNSHIP

For students participating in internship programs. May be repeated for credit.

MSE6397- ADVANCED STUDIES IN MATERIALS SCIENCE AND ENGINEERING

May be repeated for credit.

MSE6398- RESEARCH IN MATERIALS SCIENCE AND ENGINEERING

Individually approved research projects in materials science and engineering. May be repeated for credit.

MSE6399- DISSERTATION

MSE6696- MSE INTERNSHIP

For students participating in internship programs. May be repeated for credit.

MSE6698- RESEARCH IN MATERIALS SCIENCE AND ENGINEERING

Individually approved research projects in materials science and engineering. May be repeated for credit.

MSE6699- DISSERTATION

MSE6996- MSE INTERNSHIP

For students participating in internship programs. May be repeated for credit.

MSE6998- RESEARCH IN MATERIALS SCIENCE AND ENGINEERING

Individually approved research projects in materials science and engineering. May be repeated for credit.

MSE6999- DISSERTATION