

# Metallurgical and Materials Engineering Courses

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## Courses

### **MME 1205. Computation/Graph in Mater Sci.**

Computation/Graphics in Materials Science: This course is an introduction to software basics and computation in material science. Students will be able to become familiar with the use and application of numerous software currently used in the field to support computation and advanced manufacturing

**Department:** Metallurgical & Materials Eng.

**2 Credit Hours**

**4 Total Contact Hours**

3 Lab Hours

1 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Prerequisite(s):** (MATH 1411 w/C or better)

### **MME 1301. Intro to Metal Mat Engr Design.**

This course will introduce the student to effective procedures for solving simple metallurgical and materials engineering and design problems using mathematics, computers, basic measuring systems and devices, computational tools, and statistical concepts. The course will also introduce the student to the metallurgical and materials engineering profession, including the role and responsibilities of the engineer in today's society. The laboratory portion (MME 1101) will provide some hands-on, practice-oriented experiences. Prerequisites: MATH 1411 and ENGL 1311, each with a grade of "C" or better. Prerequisites may be taken concurrently with MME 1301.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MATH 1411 w/C or better ) AND (RWS 1301 w/C or better ) OR (RWS 1601 w/C or better ) OR (COMM 1611 w/C or better ) OR (ENGL 1611 w/C or better)

### **MME 1405. Intro to Metal and Matls Eng.**

Introduction to Metallurgical and Materials Engineering: This course will introduce the students to effective procedures for solving simple metallurgical and materials engineering and design problems using mathematics, computers, basic measuring systems and devices, computational tools, and statistical concepts. The course will also introduce the student to the metallurgical and materials engineering profession, including the role and responsibilities of the engineer in today's society. The laboratory portion will provide some hands-on, practice-oriented experiences.

**Department:** Metallurgical & Materials Eng.

**4 Credit Hours**

**6 Total Contact Hours**

3 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, LDEL, LDMT, MME

**Prerequisite(s):** (MATH 1411 w/C or better AND RWS 1301 w/C or better)

### **MME 2303. Intro to Materials Sci & Engrg.**

Introduction to the properties of engineering materials and relationships to their structure, behavior, and processing. Materials testing and measurement of properties. Selection of materials for engineering applicants considering interrelationships between structure properties, processing, and performance. Prerequisite: CHEM 1305 with a grade of "C" or better.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (CHEM 1305 w/C or better)

**MME 2305. Material & Energy Balance.**

Introduction to process variables, stoichiometry, materials balance, first law of thermodynamics, and energy balance applied to materials systems.

Prerequisites: CHEM 1305 or 1306, and MATH 2313, with grades of "C" or better. Restricted to sophomores, juniors, and seniors.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (CHEM 1305 w/C or better ) OR (CHEM 1306 w/C or better ) AND (MATH 1411 w/C or better)

**MME 2434. Mechanics of Materials.**

A first course in Newtonian mechanics, using vectors. Equilibrium of particles, and rigid bodies, forces in space, centroids, moments of inertia, study of stress and strain; use of stress-load equations to determine the state of stress in specific structural elements; study of combined stresses. Prerequisite: MATH 1411 with a grade of "C" or better.

**Department:** Metallurgical & Materials Eng.

**4 Credit Hours**

**6 Total Contact Hours**

3 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MATH 2313 w/C or better ) AND (PHYS 2420 w/C or better)

**MME 3195. Junior Professional Orientation.**

Junior Professional Orientation: Introduction to the engineering profession with emphasis on job placement, professional ethics and the engineering field exam.

**Department:** Metallurgical & Materials Eng.

**1 Credit Hour**

**1 Total Contact Hour**

0 Lab Hour

1 Lecture Hour

0 Other Hour

**Major Restrictions:**

Restricted to majors of MME

**Classification Restrictions:**

Restricted to class of JR

**Prerequisite(s):** (MME 2303 w/C or better)

**MME 3306. Rate Processes.**

Rate Process in Materials Systems (3-0) Introduction to reaction kinetics, fluid flow, and heat transfer applied to materials systems. Restricted to major: MME. Restricted to minors: CHEM and GEOL. Prerequisite: ENGR 1401, CHEM 1306, and MATH 2326 or MATH 3326, each with a grade of "C" or better, and senior standing.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (CHEM 1306 w/C or better ) AND (MATH 2326 w/C or better)

**MME 3308. Appl Chemical Thermodynamics.**

Applied Chemical Thermodynamics (3-0) First, second, and third law of thermodynamics applied to materials systems. Topics include thermochemistry, chemical equilibria, phase equilibria, solutions, activity, and electrochemical potentia. Restricted to major: MME. Restricted to minors: CHEM and GEOL.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 2305 w/C or better)

**MME 3309. Circuits, Elect Mat & Devices.**

Circuits, Electronic Materials and Devices: Theory of the electrical, semiconductor, magnetic, and optical properties of materials. The application of quantum mechanics to predict nano-structured material behavior. Applications of nano-structured materials in electronic devices.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**5 Total Contact Hours**

3 Lab Hours

2 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Prerequisite(s):** (PHYS 2420 w/C or better AND PHYS 2421 w/C or better ) AND (MATH 2326 w/C or better)

**MME 3314. Composite Materials.**

Composite Materials (3-0) Introduction to fiber-reinforced materials. Manufacturing technology for strong fibers and whiskers. Mechanical performance, design, and manufacturing of composite products. Adhesion, interfacial shear, and critical fiber length. Anisotropic plane-stress elasticity; multiaxial strength of anisotropic materials. Classical theory of laminates. Delamination and other performance problems. Restricted to major: MME.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 2434 w/C or better ) AND (MME 2303 w/C or better)

**MME 3406. Nanofuctnl Physical Metallurgy.**

The underlying principles of physical metallurgy dealing with the structure property relationships will be covered. Topics will include crystal structures; nano, micro, and macro defects; solid solutions; precipitation hardening; diffusion; and phase equilibriums including nanophases, deformation and annealing, nucleation and growth, solidification and nanophases affecting properties. Restricted to major: MME. Prerequisites: junior standing.

**Department:** Metallurgical & Materials Eng.

**4 Credit Hours**

**4 Total Contact Hours**

0 Lab Hours

4 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 2303 w/C or better)

**MME 3407. Mechanical Behavior of Matls.**

Mechanical Behavior of Materials (3-3) The microstructure-property relationships will be emphasized in this course. The deformation o\processes for metals, ceramics, polymers and composite materials will be analyzed in terms of current theories and models. The topics include twinning, martensite, fracture, dislocation mechanisms and mechanical testing. theory, plastic deformation, creep, fatigue, strengthening Prerequisites: Junior standing Restricted to major: MME. . . . .

**Department:** Metallurgical & Materials Eng.

**4 Credit Hours**

**6 Total Contact Hours**

3 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 2303 w/C or better ) AND (MME 3406 w/D or better)

**MME 3413. Materials Characterization.**

Materials Characterization: The application of modern instrumentation and techniques to structural characterization problems. Both theory and operation will be stressed. X-Ray analysis, electron microscopy (TEM-SEM), and electron probe analysis will be included.

**Department:** Metallurgical & Materials Eng.

**4 Credit Hours**

**6 Total Contact Hours**

3 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Prerequisite(s):** (MME 2303 w/C or better AND PHYS 2421 w/C or better)

**MME 4171. Engineering Problems.**

Engineering Problems (0-0-1) Original investigation of special problems in the student's field, the problem to be selected by the student with the approval of the head of the department. May be repeated for credit. Restricted to major: MME. Prerequisites: Senior standing.

**Department:** Metallurgical & Materials Eng.

**1 Credit Hour**

**1 Total Contact Hour**

0 Lab Hour

0 Lecture Hour

1 Other Hour

**MME 4175. Undergrad Research-Metallurgy.**

Undergraduate Research In Metallurgy (0-0-1) Supervised individual research. May be repeated for credit as topic varies. Can only be substituted for metallurgy electives or technical electives. Restricted to major: MME. Prerequisites: Senior standing and a 3.0 grade point average.

**Department:** Metallurgical & Materials Eng.

**1 Credit Hour**

**1 Total Contact Hour**

0 Lab Hour

0 Lecture Hour

1 Other Hour

**MME 4181. Practice-Oriented Experiences.**

Work experience in business, industrial, governmental, professional, service, or other sectors to provide on-the-job training, internships, practice-oriented experiences, and professional preparation in the student's area of interest. A report covering the practice-oriented experience must be submitted by the student to the departmental coordinator or the chair at the end of each internship's practice period. A student may use 3 hours in his or her degree plan in place of a technical elective or as a free elective or additional credit in the degree program. Prerequisite: Selection by the coordinator, department chairperson, and employer.

**Department:** Metallurgical & Materials Eng.

**1 Credit Hour**

**1 Total Contact Hour**

0 Lab Hour

0 Lecture Hour

1 Other Hour

**MME 4182. Practice-Oriented Experiences.**

Work experience in business, industrial, governmental, professional, service, or other sectors to provide on-the-job training, internships, practice-oriented experiences, and professional preparation in the student's area of interest. A report covering the practice-oriented experience must be submitted by the student to the departmental coordinator or the chair at the end of each internship's practice period. A student may use 3 hours in his or her degree plan in place of a technical elective or as a free elective or additional credit in the degree program. Prerequisite: Selection by the coordinator, department chairperson, and employer.

**Department:** Metallurgical & Materials Eng.

**1 Credit Hour**

**1 Total Contact Hour**

0 Lab Hour

0 Lecture Hour

1 Other Hour

**MME 4183. Practice-Oriented Experiences.**

Work experience in business, industrial, governmental, professional, service, or other sectors to provide on-the-job training, internships, practice-oriented experiences, and professional preparation in the student's area of interest. A report covering the practice-oriented experience must be submitted by the student to the departmental coordinator or the chair at the end of each internship's practice period. A student may use 3 hours in his or her degree plan in place of a technical elective or as a free elective or additional credit in the degree program. Prerequisite: Selection by the coordinator, department chairperson, and employer.

**Department:** Metallurgical & Materials Eng.

**1 Credit Hour**

**1 Total Contact Hour**

0 Lab Hour

0 Lecture Hour

1 Other Hour

**MME 4190. Special Topics in MME Lab.**

Special Topics in MME Lab: Lab for MME 4190. May be repeated for credit when topic varies.

**Department:** Metallurgical & Materials Eng.

**1 Credit Hour**

**3 Total Contact Hour**

3 Lab Hour

0 Lecture Hour

0 Other Hour

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 2303 w/C or better)

**MME 4195. Senior Professional Orient..**

Senior Professional Orientation (1-0) Introduction to the engineering profession with emphasis on job placement, professional ethics and an engineering field examination. Required of all students prior to graduation. Restricted to major: MME. Prerequisite: Senior standing.

**Department:** Metallurgical & Materials Eng.

**1 Credit Hour**

**1 Total Contact Hour**

0 Lab Hour

1 Lecture Hour

0 Other Hour

**MME 4219. Senior Design Project 1.**

Senior Design Project 1: Students will develop a group design project for a client and present a critical design review before the end of the semester. The project will integrate the understanding of the scientific and engineering principles underlying the four major elements of the field: structure, properties, processing, and performance related to material systems appropriate to the field. Students will apply experimental, computational and statistical methods to solve materials problems including selection and design with realistic constraints.

**Department:** Metallurgical & Materials Eng.

**2 Credit Hours**

**4 Total Contact Hours**

3 Lab Hours

1 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of MME

**Classification Restrictions:**

Restricted to class of SR

**Prerequisite(s):** (MME 3407 w/C or better AND MME 3413 w/C or better)

**MME 4220. Senior Design Project 2.**

Senior Design Project 2: The project will integrate the understanding of the scientific and engineering principles underlying the four major elements of the field: structure, properties, processing, and performance related to material systems appropriate to the field. Students will apply experimental, computational and statistical methods to solve materials problems including selection and design with realistic constraints. Teams provide status reports to the course instructor or client on a biweekly basis. This course will culminate in a formal presentation to peer groups, faculty members and industry stakeholders.

**Department:** Metallurgical & Materials Eng.

**2 Credit Hours**

**4 Total Contact Hours**

3 Lab Hours

1 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of MME

**Classification Restrictions:**

Restricted to class of SR

**Prerequisite(s):** (MME 4219 w/C or better AND MME 4316 w/C or better)

**MME 4271. Engineering Problems.**

Engineering Problems (0-0-2) Original investigation of special problems in the student's field, the problem to be selected by the student with the approval of the head of the department. May be repeated for credit. Prerequisites: Senior standing.

**Department:** Metallurgical & Materials Eng.

**2 Credit Hours**

**2 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

2 Other Hours

**MME 4275. Undergrad Resrch-Metallurgy.**

Undergraduate Research In Metallurgy (0-0-2) Supervised individual research. May be repeated for credit as topic varies. Can only be substituted for metallurgy electives or technical electives. Restricted to major: MME. Prerequisites: Senior standing and a 3.0 grade point average.

**Department:** Metallurgical & Materials Eng.

**2 Credit Hours**

**2 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

2 Other Hours

**MME 4290. Special Topics in MME.**

Special Topics in MME: Selected topics in Metallurgical and Materials Engineering. May be repeated for credit when topic varies.

**Department:** Metallurgical & Materials Eng.

**2 Credit Hours**

**4 Total Contact Hours**

3 Lab Hours

1 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 2303 w/C or better)

**MME 4303. Metals Processing.**

Metals Processing (3-0) Analysis of the unit operations involved in metals and mineral production using the principles of material and energy balance, fluid flow, heat transfer, reaction kinetics, and thermodynamics. Survey of processing operations for specific metals such as copper, iron, aluminum, magnesium, titanium, and uranium.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 3306 w/C or better AND MME 3308 w/C or better)

**MME 4304. Printable Materials.**

This course deals with various aspects of nano size particles in conjunction with printing processes to form layered materials for flexible electronics, sensors, RFIDs, and medical devices. Major issues that arise in direct writing processes: ink-jet, micro dispensing deposition write; R2R systems, printable components and processes, emphasizing the fundamental physical chemistry, colloidal stability; general modeling and mathematical concepts, and analysis and simulation tools required for existing or future printable applications. Prerequisites: CHEM 1306 and PHYS 2421 with a grade of C or better; department approval also required. Restricted to majors of MME and Senior standing.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (CHEM 1306 w/C or better ) AND (MME 2303 w/C or better)

**MME 4309. Corrosion.**

Corrosion (3-0) Application of electrochemistry and engineering principles to the corrosion, passivity and protection of metals and alloys. Restricted to majors: MME, MECH, and CE.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 2303 w/C or better AND MME 3308 w/C or better)

**MME 4310. Polymer Engineering.**

Polymer Engineering (3-0) The course provides a basic introduction to the field of polymer science. Basic concepts of organic chemistry address typical polymerization and copolymerization reactions. The characterization of polymer molecules include discussions of thermodynamic solutions, solubility parameters, colligative properties and scanning electron microscopy. Concepts on the structure and properties of bulk polymers emphasize its relationship to molecular characteristics and manufacturing processes. Restricted to major: MME. Prerequisite: MME 3407 with a grade of "C" or better and junior standing.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 2303 w/C or better)

**MME 4312. Biomaterials Science and Eng.**

Biomaterial Science and Engineering: This course provides an overview of digital and non-impact printing for biomedical applications in non-traditional disciplines such as MEMS or bioengineering. By exploiting non-impact printing approaches and new materials, it has become possible to pattern and two- and three-dimensional structures that are biologically active. This course is intended to provide an introduction to this area. It covers established and new digital fabrication methods, new materials and processes that enable fabrication, and manufacture a broad range of biologically active devices, systems and structures.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of CE, CEM, CS, EE, EL, IASE, LDCE, LDCM, LDCS, LDEE, LDEL, LDIE, LDME, LDMT, ME, MT

**Prerequisite(s):** (MME 2303 w/C or better)

**MME 4314. Composite Materials.**

Composite Materials: Introduction to fiber-reinforced materials. Manufacturing technology for strong fibers and whiskers. Mechanical performance, design, and manufacturing of composite products. Adhesion, interfacial shear, and critical fiber length. Anisotropic plane-stress elasticity; multiaxial strength of anisotropic material. Classical theory of laminates. Delamination and other performance problems.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 2303 w/C or better AND MME 2434 w/C or better)

**MME 4315. Metallography and Micro Inter.**

Metallography and Microstructure Interpretation: Metallographic sample preparation and microstructural characterization for various metals, alloys and/or material systems. Use of the tools necessary for analysis including sectioning, mounting, polishing and etching using standard metallographic procedures. Metallographic samples prepared in class will be evaluated using stereomicroscopy, optical and scanning electron microscopy to aid with proper microstructural interpretation. Introduction to chemical analysis using optical emission spectroscopy and X-ray fluorescence for positive material identification.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**5 Total Contact Hours**

3 Lab Hours

2 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 3406 w/C or better)



**MME 4316. Failure Analysis.**

Failure Analysis (3-0) The mechanisms of materials failure, failure analysis techniques and non-destructive testing methods and discussed with emphasis on analysis and interpretation of case studies. Restricted to major: CE and MME

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 2434 w/C or better ) AND (MME 2303 w/C or better)

**MME 4317. Advanced Failure Analysis.**

Advanced Failure Analysis: An advanced study of structural failure processes to include topics in failure analysis, fracture mechanics, nondestructive evaluation (NDE), fatigue, and environmental assisted cracking. Analysis of failures using metallographic, electron microscopy, and microanalytic techniques will be covered. Fracture of specific materials: steels, nonferrous alloys, composites, and nonmetallic will be included. A moderate knowledge of mechanical behavior of materials will be assumed.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 4316 w/C or better)

**MME 4321. Engineering Alloys.**

Engineering Alloys: The study of the selection and specification of engineering alloys for use in industrial applications. Topics related to ferrous and nonferrous metals in the cast, wrought, powder and particulate state will be covered. Mill test reports (MTR) and how to interpret them as well as interpreting compliance with various specification entities to include ASTM, API, ABS, etc. are inherent to the course.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 3406 w/C or better)

**MME 4331. Non-Destructive Examination.**

Non-Destructive Examination: Introduction and theory of ultrasonic testing, such as phased array and shear wave techniques, dye penetrate inspection, interpretation of radiographs, wet/dry magnetic particle inspection, chemical analysis using X-Ray fluorescence and in-situ metallography techniques (replication).

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**5 Total Contact Hours**

3 Lab Hours

2 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 2303 w/C or better)

**MME 4332. Root Cause Analysis.**

Root Cause Analysis: Using analytical techniques to determine underlying causes and causal factors related to materials, component and systemic problems. Analytical tools and techniques will be used to identify problems and track data used to determine the root and proximate cause and to implement corrective actions.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 1205 w/C or better AND MME 2303 w/C or better)

**MME 4333. Fracture Mechanics.**

Fracture Mechanics: Mechanisms of fracture for brittle and ductile materials using linear elastic and elastic-plastic fracture mechanics. ASTM standard fracture testing, numerical methods, and creep, fatigue, and dynamic fractures of metallic and non-metallic materials.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 2303 w/C or better AND MME 2434 w/C or better ) AND (MATH 2326 w/C or better)

**MME 4334. Biomed Product Performance.**

Biomedical Product Performance Analysis: Students will learn through case-based studies of product development for biomedical devices with emphasis on factors that contribute to the success or failure of new biomedical products. Additionally, students will learn about the special challenges presented by emerging biomedical technologies.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 2303 w/C or better AND MME 4312 w/C or better)

**MME 4335. Functional Failure Analysis.**

Functional Failure Analysis: A structural approach to identifying potential failures that may exist with a design or process. Failure modes are the means by which a process or product can fail. Failures in this context are the ways failures can lead to waste, defects and harmful outcomes which may lead to litigation and manufacturing liability claims. The intent is to use this information to make improvements to the process and/or the product design.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 2303 w/C or better AND MME 2434 w/C or better)

**MME 4340. Mineral Processing.**

Mineral Processing: The study of mineral concentrate production from ores.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 4303 w/C or better)

**MME 4341. Recycling Processes.**

Recycling Processes: The study of the metal recycling from industrial wastes.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 4303 w/C or better)

**MME 4342. Hydrometallurgy.**

Hydrometallurgy: The study of metal extraction process in aqueous solutions from ore or concentrates.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 4303 w/C or better)

**MME 4350. Material Joining Technologies.**

Material Joining Technologies: Fundamentals of materials joining theory and application. A variety of technologies will be covered, to include: welding, brazing, soldering, adhesives, etc. for metals, ceramics, polymers, composites and electronic materials. Emphasis will be on both the theoretical principles of each process and practical aspects of the technique and or equipment.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 3406 w/C or better)

**MME 4371. Engineering Problems.**

Engineering Problems (0-0-3) Original investigation of special problems in the student's field, the problem to be selected by the student with the approval of the head of the department. May be repeated for credit. Restricted to major: MME. Prerequisites: Senior standing.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

3 Other Hours

**MME 4375. Undergrad Rsrch in Metallurgy.**

Undergraduate Research in Metallurgy (0-0-3) Supervised individual research. May be repeated for credit as topic varies. Can only be substituted for metallurgy electives or technical electives. Restricted to major: MME. Prerequisite: Senior standing and a 3.0 grade point average. .

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

3 Other Hours

**MME 4390. Special Topics in MME.**

Special Topics in MME: Selected topics in Metallurgical and Materials Engineering. May be repeated for credit when topic varies.

**Department:** Metallurgical & Materials Eng.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Major Restrictions:**

Restricted to majors of EL, MME

**Classification Restrictions:**

Restricted to class of JR,SR

**Prerequisite(s):** (MME 2303 w/C or better)

**MME 4404. Mat. Synthesis & Manufacturing.**

Materials Synthesis & Manufacturing (3-3) Materials and processing in deposition of multilayered structures with emphasis in the synthesis of nanostructured materials immersed in matrix typically in colloidal solution and their stability conditions such as reducing agent, ph, concentration, etc. Comparison in the analysis of nano particles and bulk material with fluid flow, heat transfer, electrical conductivity, and thermodynamics. Manufacturing devices and techniques used to deposit, or imprint, nano- materials and their applications. Restricted to major: MME. .

**Department:** Metallurgical & Materials Eng.

**4 Credit Hours**

**6 Total Contact Hours**

3 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 3306 w/C or better AND MME 3308 w/C or better)