

# Metallurgical and Materials Engineering Courses

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## Courses

### **MME 5191. Individual Studies.**

Individual Studies (0-0-1) Individual variable credit research, design, or analysis on advanced phases of metallurgical and materials engineering problems conducted under the direct supervision of a faculty member. A maximum of 3 credit hours may be applied towards the MS degree.

**1 Credit Hour**

**1 Total Contact Hour**

0 Lab Hour

0 Lecture Hour

1 Other Hour

### **MME 5192. Clinical Rotations-Engineers.**

This course facilitates the recognition of the importance of designing medical devices and biologics with the end-user in mind. Each rotation will include background in terms of theory and clinical application provided by a physician, including selected case studies, followed by "hands-on" experience (whenever possible) with technical personnel. Clinical rotations will be at the Foster School of Medicine, the William Beaumont Army Medical Center, and the US- Mexico Border Health Association.

**1 Credit Hour**

**3 Total Contact Hour**

0 Lab Hour

0 Lecture Hour

3 Other Hour

**Prerequisite(s):** (BIOL 6304 w/C or better ) AND (DRSC 5495 w/C or better ) AND (MASE 6321 w/C or better ) OR (EE 6321 w/C or better ) OR (MME 5312 w/C or better ) OR (EE 5321 w/C or better)

### **MME 5193. Graduate Clinical Research.**

The student is matched with a research clinician and will "shadow" the clinician throughout the course. The following activities are conducted: direct observation of procedures (diagnostic and interventional), development of Institutional Review Board protocols, clinical data analysis, and interaction with the company sponsoring a device/drug trial.

**1 Credit Hour**

**3 Total Contact Hour**

3 Lab Hour

0 Lecture Hour

0 Other Hour

**Prerequisite(s):** (BIOL 6305 w/C or better ) AND (DRSC 5495 w/C or better ) AND (MASE 6321 w/C or better)

### **MME 5194. Graduate Research.**

Graduate Research (0-0-1) Individual variable credit research of contemporary topics in metallurgical and materials engineering.

**1 Credit Hour**

**1 Total Contact Hour**

0 Lab Hour

0 Lecture Hour

1 Other Hour

### **MME 5195. Graduate Seminar.**

Graduate Seminar (1-0) Conferences and discussions of various, contemporary topics in metallurgical and materials engineering by faculty, graduate students, and speakers from industry, government, or other academic institutions or departments. The program is organized to encourage the development of communication skills at a professional level for graduate students. Required of all graduate students during each semester of full-time enrollment. Up to 3 credits can be applied to the degree.

**1 Credit Hour**

**1 Total Contact Hour**

0 Lab Hour

1 Lecture Hour

0 Other Hour

**MME 5197. Medical Device Practicum.**

The use of structured techniques for client needs identification will be taught. Student teams will follow a structured process for the concept generation design of a biomedical device. Students will consult experts, perform patent searches, and conduct competitive benchmarking as part of external searches for solutions.

**1 Credit Hour**

**3 Total Contact Hour**

0 Lab Hour

0 Lecture Hour

3 Other Hour

**Prerequisite(s):** (MASE 6192 w/C or better AND MASE 6327 w/C or better)

**MME 5294. Graduate Research.**

Graduate Research (0-0-2) Individual variable-credit research of contemporary topics in metallurgical and materials engineering. .

**2 Credit Hours**

**4 Total Contact Hours**

0 Lab Hours

2 Lecture Hours

2 Other Hours

**MME 5302. Matls Extraction & Synthesis.**

Materials Extraction, Synthesis, and Processing (3-0) Thermodynamic, thermochemical, electrochemical kinetic, and phase equilibrium fundamentals and fundamental structures and properties of materials applied to examples of ferrous and non-ferrous extraction and processing. Examples include copper extraction, refinement, processing, alloying and performance; iron and steel making and iron alloy processing, metal and ceramic powder processing, and contemporary materials synthesis and processing. Offered in alternate years.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**MME 5304. Phase Transformations & Micros.**

Phase Transforming and Microstructures (3-0) The theory of the nucleation and growth kinetics of solid materials, solid-solid transformations and mechanisms. Rate processes, decomposition and ordering reactions and microstructures. Diffusionless transformations, eutectoid, and martensitic transformations are covered along with associated microstructural morphologies and property/ performance control by microstructure control in materials.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 3406 w/C or better AND MME 3407 w/C or better ) AND (MME 5401 w/C or better)

**MME 5308. Mechanical Behavior of Matrls.**

Mechanical Behavior of Materials (3-0) The underlying principles of elastic and plastic deformation of metals, ceramics, polymers, and composite materials will be developed. Topics include dislocation theory, slip, twinning, microstructures, high and low temperature deformation behavior (tensile properties, creep and fatigue) of crystal line and amorphous materials. Offered in alternate years.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 2303 w/C or better ) OR (MET 3203 w/C or better)

**MME 5312. BME for Global Health.**

Graduate level course that provides an overview of the role of engineering technological advances to improve human health. The following points will be emphasized throughout the semester: What are the challenges in healthcare delivery in remote locations; How are we paying for healthcare delivery? What is the role of engineering to solve healthcare problems; and how do new healthcare technologies move from the lab to the bedside.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**MME 5313. Advanced Matrls & Composites.**

Advanced Materials and Composites (3-0) Properties and structures of composite materials and design of composite systems to yield desired combinations of properties. Metal, ceramic, and polymer composite systems as well as high-performance alloy system or microcomposites. Applications of materials and composite fundamentals to manufacturing and processing. Offered in alternate years.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 5401 w/C or better AND MME 5403 w/C or better)

**MME 5325. Telemedicine & Imaging Informa.**

This course focuses on applications of point-of-care diagnostics for chronic disease management. It also introduces basic concepts in telemedicine. Students will gain the knowledge, understanding and practical preparation needed to implement a program to diagnose and treat patients in remote areas.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**MME 5326. BME Dev Design & Regulation.**

This course introduces the regulatory requirements for the design, testing and clinical implementation of medical devices and biologics. The first part covers the FDA regulatory process. The second part covers key legal and policy issues involved in a clinical organization: Health Insurance Portability and Accountability Act and Joint Commission on the Accreditation of Health Care Organizations rules on risk management, standards, regulations, compliance and ethics.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MASE 6325 w/C or better ) OR (EE 6325 w/C or better ) OR (EE 5325 w/C or better ) OR (MME 5325 w/C or better)

**MME 5331. Biomaterials.**

This course discusses various aspects pertaining to the selection, processing, testing (in vitro and in vivo) and performance of hard and soft biomaterials, orthopedic devices, and cardiovascular, ophthalmologic and dental applications. The biocompatibility and surgical applicability of metallic, polymeric and ceramic implants and prosthetic devices are discussed. The physicochemical interactions between the implant material and the physiological environment will be described. Biomaterials in maxillofacial, orthopedic dental, ophthalmic and neuromuscular applications will be emphasized.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**MME 5333. Biofabrication.**

This course focuses on using cells, proteins, biomaterials and/or other bioactive elements as building blocks to fabricate advanced biological models, medical therapeutic products and non-medical biological systems.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**MME 5390. Special Topics.**

Special Topics (3-0) Advanced topics of contemporary interest in metallurgical and materials engineering. May be repeated for credit when topic varies.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

3 Lecture Hours

0 Other Hours

**MME 5391. Individual Studies.**

Individual Studies (0-0-3) Individual variable credit research, design, or analysis on advanced phases of metallurgical and materials engineering problems conducted under the direct supervision of a faculty member. A maximum of 3 credit hours may be applied towards the M.S. degree.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

3 Other Hours

**MME 5394. Graduate Research.**

Graduate Research (0-0-3) Individual variable-credit research of contemporary topics in metallurgical and materials engineering.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

3 Other Hours

**MME 5396. Graduate Projects.**

Graduate Projects (0-0-3) Individual research design, or analysis on advanced phases of engineering problems conducted under the direct supervision of a faculty member. The courses, including a written report, are requested of all students in the non-thesis option.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

3 Other Hours

**MME 5397. Graduate Projects.**

Graduate Projects (0-0-3) Individual research, design, or analysis on advanced phases of engineering problems conducted under the direct supervision of a faculty member. The courses, including a written report, are required of all students in the non-thesis option.

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

3 Other Hours

**Prerequisite(s):** (MME 5396 w/P or better)

**MME 5398. Thesis.**

Thesis (0-0-3).

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

3 Other Hours

**MME 5399. Thesis.**

Thesis (0-0-3).

**3 Credit Hours**

**3 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

3 Other Hours

**Prerequisite(s):** (MME 5398 w/P or better)

**MME 5401. Microstruc & Microchem Charac.**

Microstructural and Microchemical Characterization of Materials (3-3) An interdisciplinary approach to the theory and applications of techniques for characterizing chemical (microchemical) and microstructural features of solid materials. Techniques that will be stressed include X-ray diffraction, optical metallography, scanning and transmission electron microscopy (emphasizing analytical transmission electron microscopy), electron probe microanalysis, and surface and near surface surface microanalysis (Auger electron spectroscopy, ESCA, SIMS, etc.). Sample preparation techniques will be covered and students will be encouraged to examine materials which may have some application to their research problems. Offered in alternate years.

**4 Credit Hours**

**6 Total Contact Hours**

3 Lab Hours

3 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 4413 w/C or better ) OR (MET 4413 w/C or better)

**MME 5403. Adv Concepts in Matls Sci Engr.**

Advanced Concepts in Materials Science and Engineering (4-0) A blend of contemporary solid state physics and chemistry emphasizing structure and properties and including processing (synthesis) and performance, illustrated by various classes of materials: structural, electronic, magnetic, photonic, and superconducting. Fundamental issues and applications will include: crystal structure and crystal chemistry; disorder/order imperfections; phase equilibria, phase diagrams, phase transformation; reaction rates, kinetics, thermodynamics; microstructures in processing and performance; materials design/materials by design.

**4 Credit Hours**

**4 Total Contact Hours**

0 Lab Hours

4 Lecture Hours

0 Other Hours

**Prerequisite(s):** (MME 3206 w/C or better AND MME 3208 w/C or better AND MME 3406 w/C or better)

**MME 5494. Graduate Research.**

Graduate Research (0-0-4) Individual variable-credit research of contemporary topics in metallurgical and materials engineering.

**4 Credit Hours**

**4 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

4 Other Hours

**MME 5594. Graduate Research.**

Graduate Research (0-0-5) Individual variable-credit research of contemporary topics in metallurgical and materials engineering.

**5 Credit Hours**

**5 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

5 Other Hours

**MME 5694. Graduate Research.**

Graduate Research (0-0-6) Individual variable-credit research of contemporary topics in metallurgical and materials engineering.

**6 Credit Hours**

**6 Total Contact Hours**

0 Lab Hours

0 Lecture Hours

6 Other Hours

**MME 6192. Clinical Rotations-Engineers.**

This course facilitates the recognition of the importance of designing medical devices and biologics with the end-user in mind. Each rotation will include background in terms of theory and clinical application provided by a physician, including selected case studies, followed by "hands-on" experience (whenever possible) with technical personnel. Clinical rotations will be at the Foster School of Medicine, the William Beaumont Army Medical Center, and the US-Mexico Border Health Association.

**1 Credit Hour**

**3 Total Contact Hour**

0 Lab Hour

0 Lecture Hour

3 Other Hour

**Prerequisite(s):** (BIOL 6304 w/C or better ) AND (DRSC 5495 w/C or better ) AND (MASE 6321 w/C or better ) OR (EE 6321 w/C or better ) OR (MME 5312 w/C or better ) OR (EE 5321 w/C or better)