

# MATERIALS SCIENCE AND ENGINEERING

## Biomedical Engineering Minor

Minimum number of credit hours: 15 hours, consisting of 1 required course, Cer Eng 3110: Introduction to Biomedical Engineering, plus at least 4 courses from an approved list. At least 2 of the elective courses will be at or above the 4000 level. Core courses used toward a student's major degree requirements cannot be used for the minor degree program in BME. Elective courses used toward a student's major degree requirements or another minor degree program cannot be used unless they are approved by the biomedical engineering program committee.

### Elective courses:

BIO SCI 2213	Cell Biology	3
BIO SCI 2219	Cell Biology Laboratory	1
BIO SCI 2223	General Genetics	3
BIO SCI 3313	Microbiology	3
BIO SCI 3319	Microbiology Lab	2
BIO SCI 3333	Human Anatomy and Physiology I	3
BIO SCI 3339	Human Anatomy Physiology I Lab	1
BIO SCI 3343	Human Anatomy and Physiology II	3
BIO SCI 3349	Human Anatomy and Physiology II Laboratory	1
BIO SCI 3483	Biomedical Problems	3
CHEM ENG 4210	Biochemical Reactors	3
BIO SCI 4323	Molecular Genetics	3
BIO SCI 4353	Cancer Cell Biology	3
BIO SCI 4383	Toxicology	3
CHEM 4610	General Biochemistry	3
CHEM 4620	Metabolism	3
BIO SCI 5001	Special Topics	0-6
BIO SCI 5240/ MS&E 5210	Tissue Engineering I	3
MS&E 5310/ BIO SCI 5210/ CHEM ENG 5200	Biomaterials I	3
CHEM ENG 5320	Introduction to Nanomaterials	3
BIO SCI 5323	Bioinformatics	3
STAT 5425	Introduction to Biostatistics	4
ENG MGT 5511	Technical Entrepreneurship	3
MET ENG 4099	Undergraduate Research <sup>1</sup>	0-6

<sup>1</sup> Undergraduate Research may be taken in any science or engineering discipline.

**Mohsen Asle Zaeem**, Assistant Professor  
PHD Washington State University

**Laura Bartlett**, Associate Professor  
PHD Missouri University of Science and Technology

**Richard K Brow**, Curators Professor  
PHD Pennsylvania State University

**Fatih Dogan**, Professor  
PHD Technical University of Berlin

**William G Fahrenholtz**, Curators Professor  
PHD University of New Mexico

**Gregory E Hilmas**, Curators Professor  
PHD University of Michigan-Ann Arbor

**Wayne Huebner**, Professor  
PHD University of Missouri-Rolla

**Aditya Kumar**, Assistant Professor  
PHD Ecole Polytechnique Federale de Lausanne (EPFL)

**Simon Lekakh**, Research Professor  
PHD Belorussian Polytechnic Institute

**David Lipke**, Assistant Professor  
PHD Georgia Institute of Technology

**F Scott Miller**, Teaching Professor  
PHD University of Missouri-Rolla

**Michael Scott Moats**, Associate Professor  
PHD University of Arizona

**Joseph W Newkirk**, Associate Professor  
PHD University of Virginia

**Ronald J O'Malley**, Professor  
PHD Massachusetts Institute of Technology

**Mark E Schlesinger**, Professor  
PHD University of Arizona

**Robert Schwartz**, Professor  
PHD University of Illinois

**Jeffrey D Smith**, Associate Professor  
PHD University of Missouri-Rolla

**David C Van Aken**, Curators Teaching Professor  
PHD University of Illinois Urbana

**Jeremy Lee Watts**, Research Assistant Professor  
PHD Missouri S&T

**Haiming Wen**, Assistant Professor  
PHD University of California-Davis

**Mingzhi Xu**, Assistant Research Professor  
PHD Missouri University of Science and Technology

**Caizhi Zhou**, Assistant Professor  
PHD Iowa State University

**MS&E 4001 Special Topics** (LAB 0.0 and LEC 0.0)  
This course is designed to give the department an opportunity to test a new course. Variable title.

**MS&E 4810 Chemistry And Inherent Properties Of Polymers** (LEC 3.0)  
A basic study of the organic chemistry of natural and synthetic high polymers, their inherent properties and their uses in plastic, fiber, rubber, resin, food, paper and soap industries. Prerequisite: Chem 1320 or Met Eng 1210. (Co-listed with Chem 4810).

**MS&E 4819 Polymer Science Laboratory** (LAB 1.0)

Lectures and laboratory experiments dealing with polymerization reactions, solution properties and bulk or solid properties will be presented. Each student will prepare polymers and carry out characterization experiments on actual samples. Prerequisite: Chem 4810 or MS&E 4810 and preceded or accompanied by Chem 1100. (Co-listed with Chem 4819).

**MS&E 4850 Fundamentals Of Protective Coating I** (LEC 3.0)

Study of the basic principles of protective coatings with particular reference to the paint and varnish industry. Classifications, manufacture, properties and uses of protective coatings. Prerequisite: Chem 1320. (Co-listed with Chem 4850).

**MS&E 5000 Special Problems** (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

**MS&E 5001 Special Topics** (LEC 0.0-6.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

**MS&E 5010 Seminar** (RSD 0.0-6.0)

(Variable) Discussion of current topics.

**MS&E 5040 Oral Examination** (IND 0.0)

(Variable) After completion of all other program requirements, oral examinations for on-campus M.S./Ph.D students may be processed during intersession. Off-campus M.S. students must be enrolled in an oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

**MS&E 5060 Chemistry of Construction Materials** (LEC 3.0)

The objective of the course is to utilize fundamental concepts of materials science and chemistry to understand, analyze, and describe the chemistry of construction materials. Special focus is given to describe composition-reactivity-microstructure-property relations in various cementitious materials. Prerequisites: At least Senior standing.

**MS&E 5099 Research** (IND 0.0-15)

(Variable) Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required.

**MS&E 5210 Tissue Engineering I** (LEC 3.0)

The course will introduce senior undergraduate students to the principles and clinical applications of tissue engineering including the use of biomaterials scaffolds, living cells and signaling factors to develop implantable parts for the restoration, maintenance, or replacement of biological tissues and organs. Prerequisite: Senior standing. (Co-listed with Bio Sci 5240).

**MS&E 5220 Advanced Phase Equilibria** (LEC 3.0)

Advanced aspects of unary, binary and ternary organic, phase equilibria. Includes practical examples of the applications of phase diagrams to solve engineering problems. Prerequisite: Graduate standing.

**MS&E 5230 Energy Materials** (LEC 3.0)

The objectives of the course are to understand how the rational design and improvement of chemical and physical properties of materials can lead to energy alternatives that can compete with existing technologies. Discussions on the present and future energy needs from a view point of multidisciplinary scientific and technological approaches. Prerequisite: Senior standing.

**MS&E 5310 Biomaterials I** (LEC 3.0)

This course will introduce senior undergraduate students to a broad array of topics in biomaterials, including ceramic, metallic, and polymeric biomaterials for in vivo use, basic concepts related to cells and tissues, host reactions to biomaterials, biomaterials-tissue compatibility, and degradation of biomaterials. Prerequisites: Senior undergraduate standing. (Co-listed with BIO SCI 5210, CHEM ENG 5200).

**MS&E 5517 Materials Selection in Mechanical Design** (LEC 3.0)

This course will introduce the basics of materials selection in mechanical design. It will also introduce the benefits of computational materials and process selection. The students will also learn to use a commercially available materials selection software. This course will be offered as Distance Ed. Prerequisite: Met Eng 2110.

**MS&E 5810 Introduction to Polymeric Materials** (LEC 3.0)

A basic study of the organic chemistry of natural and synthetic high polymers, their inherent properties and their uses in plastic, fiber, rubber, resin, food, paper and soap industries. Credit may not be given for both Chem 5810 and Chem 4810. Prerequisite: Chem 1320 or Met Eng 1210. (Co-listed with Chem 5810).

**MS&E 5819 Polymer Synthesis and Characterization Lab** (LAB 1.0)

Laboratory experiments dealing with polymerization syntheses and solution, bulk and solid properties will be presented. Each student will prepare polymers and carry out all characterization experiments on actual samples. Credit may not be given for both Chem 5819 and Chem 4819. Prerequisite: Chem 4810 or MS&E 4810 or Chem 5810 or MS&E 5810 or Chem Eng 5310, preceded or accompanied by Chem 1100 or Chem 5100 or an equivalent training program approved by S&T. (Co-listed with Chem 5819).

**MS&E 5850 Introduction to Coating Chemistry** (LEC 3.0)

Study of the basic principles of protective coatings with particular reference to the paint and varnish industry. Classifications, manufacture, properties and uses of protective coatings. Credit may not be given for both Chem 5850 and Chem 4850. Prerequisite: Chem 1320 or Met Eng 1210. (Co-listed with Chem 5850).