MATERIALS SCIENCE & ENG (MS&E)

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 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 6000 Special Problems (IND 0.0-6.0)
Problems or readings on specific subjects or projects in the department. Consent of instructor required.

MS&E 6001 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 6010 Seminar (RSD 0.0-6.0)
(Variable) Discussion of current topics.

MS&E 6040 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 6050 Continuous Registration (IND 1.0)
Doctoral candidates who have completed all requirements for the degree except the dissertation and are away from the campus must continue to enroll for at least one hour of credit each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.

MS&E 6085 Internship (IND 0.0-15)
(Variable) Students working toward a doctor of engineering degree will select with the advice of their committees, appropriate problems for preparation of a dissertation. The problem selected and internship plan must conform to the purpose of providing a high level engineering experience consistent with the intent of the doctor of engineering degree.

MS&E 6099 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 6110 Bonding, Crystallography, and Structure-Property Relationships (LEC 3.0)
Principles of electronic structure and chemical bonding in solids and their relationships to electrical, mechanical, thermal, and optical properties. An exploration of reciprocal lattices and tensor properties of crystals; consideration of the impact of crystal symmetry on anisotropy. The influence of defects and grain boundary phenomena on material behavior. Prerequisite: Graduate standing, or undergraduate standing with instructor and advisor approval.

MS&E 6120 Thermodynamics and Phase Equilibria (LEC 3.0)
Classical thermodynamic treatment of materials and material processing based on the 1st and 2nd Laws of Thermodynamics and phase equilibria considerations. The course will cover equilibria in gaseous systems, gas-solid reactions including passive and active oxidation, solution thermodynamics, phase equilibria in solution systems, and electrochemistry. Prerequisite: Graduate standing, or undergraduate standing with instructor and advisor approval.

MS&E 6130 Kinetic Theory for Materials (LEC 3.0)
Phenomenological and atomistic theories of diffusion in materials including discussion of short circuit diffusion and ionic diffusion in an electric field. Fundamentals of phase transformation in materials; chemical fluctuation, nucleation and growth theory; kinetic models for evaluating and predicting diffusion controlled transformation kinetics. Prerequisite: Graduate standing, or undergraduate standing with instructor and advisor approval.
**MS&E 6210 Tissue Engineering II** (LEC 3.0)
The course will introduce graduate 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. A related topic term paper and oral presentation are expected. Prerequisite: Graduate standing. (Co-listed with Bio Sci 6240).

**MS&E 6220 Advanced Energy Materials** (LEC 3.0)
The objectives of the graduate level course are to review the recent developments on advanced energy materials and systems in addition to basic understanding how chemical and physical properties of materials can lead to energy alternatives. Prerequisite: Graduate standing.

**MS&E 6230 Nanomaterials** (LEC 3.0)
Introduction of the fundamentals of nanomaterials and recent developments on nanomaterials. Topics include physical and chemical properties, synthesis, processing, and applications of nanomaterials. Example nanomaterials include nanoparticles, nanotubes, and nanowires. Students will need to complete a project related to nanomaterials. Prerequisite: Graduate Standing. (Co-listed with Chem Eng 6310).

**MS&E 6310 Biomaterials II** (LEC 3.0)
This course will introduce graduate 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. A term paper and oral presentation are required. (Co-listed with BIO SCI 6210, CHEM ENG 6300).