Metallurgical and Materials Engineering Courses

Courses

MME 1101. Intro to MME Design Lab.
The course combination of MME 1301/1101 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.

1 Credit Hour
3 Total Contact Hour
3 Lab Hour
0 Lecture Hour
0 Other Hour

Prerequisite(s): (MATH 1411 w/C or better ) AND (ENGL 1311 w/C or better ) OR (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 1205. Computation/Graph in Mater Sci.
The course provides an overview of important and novel processing methods used for the manufacture of advanced structural and functional semi-finished components, including the metals, polymers, ceramics, and their composites.

2 Credit Hours
4 Total Contact Hours
3 Lab Hours
1 Lecture Hours
0 Other Hours

Major Restrictions:
Restricted to majors of CE,CHEM,CS,EE,EL,IE,LDCE,LDCS,LDEE,LDME,LDMT,ME,MT,PHYS,PREE

Prerequisite(s): (CHEM 1305 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.

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 (ENGL 1311 w/C or better ) OR (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 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.

3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

Major Restrictions:
Restricted to majors of EL,IE,LDEL,LDIE,LDME,LDMT,MT

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.
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 2313 w/C or better)

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.
4 Credit Hours
6 Total Contact Hours
3 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 1411 w/C or better)

Polymer chemistry and other organic materials, such as rotaxane. Physical and chemical properties and synthetic methods of polymers; properties and applications of rotaxane and other organic materials in nano-technology will be introduced.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (CHEM 1306 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.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (ENGR 1401 w/C or better ) AND (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 potential.
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. Electronic Mat Sci & Tech.
Electronic Materials Science & Technology (3-0) 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.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (PHYS 2421 w/C or better)
MME 3312. Biomat, Biomat Prntng & Dev.
This course provides an overview of digital and non-impact printing for biomedical applications. Their use in non traditional disciplines such as MEMS or bioengineering will be explained. 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 structure.
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 3314. Composite Materials.
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 3321. Engineering Alloys.
Engineering Alloys (3-0) The study of the selection and specification of engineering alloys for the use in industrial applications. Topics related to ferrous and non-ferrous metals in the cast, wrought, powder and particle state will be covered.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MME 3407 w/C or better)

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.
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.
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/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.

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.

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.

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.

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.

1 Credit Hour
1 Total Contact Hour
0 Lab Hour
0 Lecture Hour
1 Other Hour

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.

1 Credit Hour
1 Total Contact Hour
0 Lab Hour
1 Lecture Hour
0 Other Hour
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.
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.
2 Credit Hours
2 Total Contact Hours
0 Lab Hours
0 Lecture Hours
2 Other Hours

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.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

Prerequisite(s):
(MME 2305 w/C or better AND 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.
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 PHYS 2421 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.
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 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.

3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

Prerequisite(s): (MME 3407 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.

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 4322. Nanomaterials & Nanostructures.
Topics will include zero-dimensional nanostructures (including nanoparticles), one and two-dimensional nanostructures (nanowires, nanorods, nano-thin films), nanotubes (especially carbon nanotubes), nanomaterials fabrication and applications, and nanostructure characterization.

3 Credit Hours
0 Total Contact Hours
0 Lab Hours
0 Lecture Hours
0 Other Hours

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

MME 4330. Solidification Processes.
Solidification Processes (3-0) Fundamentals of solidification in processes commonly found in manufacturing. The course will cover the principles involved in metal casting, welding, brazing, soldering and plastic injection molding.

3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

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

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.

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.

3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
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.
4 Credit Hours
6 Total Contact Hours
3 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MME 4303 w/C or better)

MME 4407. 3D Additive Manufacturing.
Additive, subtractive, and joining processes and their use in the formation three-dimensional (3D) parts. Additive manufacturing (AM) technologies fabricate 3D parts using layer-based manufacturing processes directly from computer- aided-design (CAD) models. Direct digital manufacturing (DDM) or rapid manufacturing (RM) is the use of AM technologies in DDM of end-use parts. In this course, students learn about a variety of AM and other manufacturing technologies, their advantages and disadvantages for producing both prototypes and functional production quality parts, and some of the important research challenges associated with using these technologies.
4 Credit Hours
6 Total Contact Hours
3 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (PHYS 2421 w/C or better)

MME 4413. Structural Characterization.
Structural Characterization (3-3) 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.
4 Credit Hours
6 Total Contact Hours
3 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MME 3407 w/C or better)

Introduction to creative industrial problem-solving and the design process in materials engineering. Topics include material and process selection, project planning and resource management, economic decision making in terms of cost evaluation and profitability, and optimization methods. Weekly discussions explore issues of professionalism including engineering ethics, public safety and environmental concerns in design, codes, and standards, etc. Student design teams define and investigate problems in metallurgical processing, materials selection and evaluation, quality control, etc. Design project teams make written and oral progress reports, as well as a final written report and presentation. Laboratory time is devoted to design projects.
4 Credit Hours
6 Total Contact Hours
3 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MME 4303 w/D or better ) AND (MME 3407 w/C or better ) AND (CE 2326 w/C or better)