

COURSES FOR METALLURGICAL AND MATERIALS ENGINEERING

Metallurgical and Materials Engineering Courses

MTE121 Introduction to Materials

Hours 1

An introduction to the materials science and engineering profession and history. The course includes selected topics useful in the study of metallurgical and materials engineering.

MTE252 Metallurgical Process Calculations

Hours 3

Mathematical quantitative relations of chemical reactions and physicochemical processes; principles of overall mass and energy balances and the application of these principles to metallurgical systems.

Prerequisite(s): CH 102 and (ENGR 103 or ENGR 123 or ENGR 104) and (MATH 125 or MATH 145)

MTE271 Engr Matls: Struc Prop

Hours 3

Basic structure of ceramics, alloys, composites, metals, and polymers. Relationships between the structure of materials and their mechanical, electrical, magnetic, thermal, and chemical properties.

Prerequisite(s): CH 101 or CH 117; MATH 125 or MATH 145

MTE275 Engineering Materials Lab

Hours 3

Alloy preparation and processing of materials. Materials testing and evaluation, laboratory procedures and techniques, metallography, heat treatment, phase diagrams, hardenability, and mechanical testing. Introduction to technical report writing and application to written laboratory reports.

Prerequisite(s): EN 101

Prerequisite(s) with concurrency: MTE 271

MTE316 Fundamentals of Metal Casting

C

Hours 4

Metal castings principles including pattern design, molding materials, conventional and digital molding methods, sand testing, solidification, risering and gating of castings, casting and mold design, microstructure and casting defects and their influence on mechanical properties. Computer proficiency is required for a passing grade in this course.

Prerequisite(s): MTE 275 and MTE 362

Computer Science

MTE353 Transport Phenomena in Metallurgy

Hours 3

Definition of viscosity, elements of laminar and turbulent flow, and overall mechanical energy balance. Thermal conductivity, steady and transient conduction problems, forced and natural convection, heat transfer, and radiative heat transfer. Definition of binary diffusivity, convection mass transfer, and mass transfer coefficient. The application of the principles covered in the design of specific metallurgical systems.

Prerequisite(s): MATH 238 and MTE 252 or permission of instructor

Prerequisite(s) with concurrency: MATH 238

MTE362 Thermodynamics Of Materials

C

Hours 4

The fundamentals of thermodynamics applied to typical metallurgical processes and reactions, heterogeneous equilibrium, behavior of solutions, standard states, phase diagrams. Emphasis is placed on the use of basic thermodynamic data, graphical representations of thermodynamic data and equilibrium, and the application of using computational tools to solve problems. Computing proficiency is required for a passing grade in this course.

Prerequisite(s): MTE 252 or CHE 254

Computer Science

MTE373 Physical Metallurgy

W

Hours 4

Introduction to the principles of physical metallurgy. Topics include crystal structure, deformation, dislocations, point defects, diffusion, phase diagrams, interfaces, nucleation theory, transformations, and growth. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course.

Prerequisite(s): MTE 271 and MTE 362 or permission of instructor

Writing

MTE380 Synthesis, Proc & Mfg Matls.

Hours 3

Materials Processing fundamentals as they affect dimensions and microstructure of materials and their application in engineering practice. Survey of classical and modern manufacturing processes for engineering materials.

Prerequisite(s): MTE 271 or permission of instructor

MTE402 Fundamentals of Materials and Process Selection and Design

Hours 3

The course covers principles relevant to materials selection and process selection for manufacturing and design. Advanced topics including composites and hybrid materials are also discussed in the course. Not open to students with credit for MFE 342.

Prerequisite(s): AEM 250 and AEM 251 and MTE 271

MTE403 Introduction to Integrated Computational Materials Engineering (ICME)

EXP

Hours 3

This course introduces undergraduate students to Integrated Computational Materials Engineering, covering basic theories of multi-scale modeling and the usage of relevant software tools to solve specifically designed engineering problems. Key topics include Density Functional Theory, Thermodynamics and Kinetics (CALPHAD), Finite Element Analysis, Statistical Analysis and Machine Learning in Materials Science.

Prerequisite(s): MTE 271 and MTE 362 and MTE 373

Experiential Learning

MTE410 Engineering in a Social and Global Context

W

Hours 3

This course exposes students to cultural and societal issues and perspectives and lays the foundation for responsible participation in a diverse society by preparing students to make informed decisions in the complex cultural contexts of both the U.S. and global communities. The course also develops communication skills essential for writing technical reports and manuscripts. Writing proficiency is required for a passing grade.

Prerequisite(s): ME 305 or MFE 332 or MTE 373 (C- or better)

Writing

MTE412 Polymer Materials Engineering

Hours 3

Introduction to the manufacture, processing and applications of organic polymeric materials. The chemistry of polymer manufacture, the molecular structure of polymers, and the structure-property relationships for thermoplastic and thermosetting polymers are covered.

Prerequisite(s): CH 102

MTE439 Metallurgy Of Welding

Hours 3

Thermal, chemical, and mechanical aspects of welding using fusion welding processes. The metallurgical aspects of welding, including microstructure and properties of the weld, are also included.

Prerequisite(s): MTE 380 or permission of instructor

MTE441 Chemical Metallurgy

Hours 4

Application of thermodynamics, fluid flow, and heat and mass transfer to the design and operation of chemical metallurgical processes; roasting, agglomerating, oxidation and reduction reactions, smelting, converting, and refining.

Prerequisite(s): MTE 353 and MTE 362

Prerequisite(s) with concurrency: MTE 443

MTE443 Materials Engineering Design I

EXP

Hours 3

Principles of engineering design. Problem formulation, concept design, configuration design, parametric design, detail design, materials selection, manufacturing process selection, prototyping, project planning and cost analysis, application of computer-based design tools, concepts of shared responsibility, teamwork and communication. Analysis of problems, design and development solutions. Oral presentations and written reports. A project will be assigned. Final project presentations will be evaluated by the MTE faculty.

Prerequisite(s): MTE 362, MTE 373, MTE 380

Prerequisite(s) with concurrency: MTE 481

Experiential Learning

MTE445 Materials Engineering Design II (W)

EXP

Hours 3

Capstone design course. Students work in teams on design projects which involve evaluation of industrial based metallurgical or materials problems and emphasize societal impact. Implementation of design principles and the research plan developed in MTE 443. Interim and final design reviews with oral presentations and written reports. Final project presentation will be evaluated by the MTE faculty. Writing proficiency is required for a passing grade in this course.

Prerequisite(s): MTE 316, MTE 441, MTE 443, MTE 455, and MTE 481

Experiential Learning

MTE449 Powder Metallurgy

Hours 3

The course will cover the topic of powder metallurgy, describing the various types of powder processing and how these affect properties of the components made. Current issues in the subject area, from high production to nanomaterials will be discussed.

Prerequisite(s): MTE 373 and MTE 380

MTE450 Plasma Proc of Thin Films

Hours 3

This course will cover fundamental technology involved in thin film processing. Plasma deposition and etch technology will be discussed. The basics of plasma processing equipment will be detailed, with special emphasis on sputtering tools. A range of thin film applications will be explored, with examples of magnetics, semiconductor, optical, and medical applications. The fundamentals of process optimization using a Design of Experiments will be taught with a test case of process optimization for the final exam.

Prerequisite(s): PH 106 or PH 126, and CH 102, or permission of instructor.

MTE455 Mech Behavior Of Mtls

Hours 4

Flow and fracture of solids; uniaxial stress-strain as a reference behavior; theories of terminal stability under impact; monotonic, sustained (creep), and repeated (fatigue) loadings of solids under various states of stress.

Prerequisite(s): AEM 250 or permission of instructor.

MTE467 Strengthening Mechanisms in Materials

Hours 3

Mechanisms and micromechanics of strengthening in engineering materials. This course covers the physical phenomena that contribute towards high mechanical strength in engineering materials. Principles for designing high strength materials will be addressed.

Prerequisite(s): MTE 455 or equivalent: or permission from instructor

MTE476 Physical Ceramics

Hours 3

Topics include ceramic raw materials, refractories, thermal properties, mechanical properties, processing, advanced ceramics, etc.

Prerequisite(s): MTE 353 and MTE 362 and MTE 373

MTE481 Analy Methods For Matls

W

Hours 4

Crystallography, physics of X-rays, diffraction by crystalline materials, applications of X-ray, electron and neutron diffraction, and spectrometric analysis of materials. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course.

Prerequisite(s): MTE 271 and MTE 373 or permission of instructor.

Writing

MTE487 Corrosion Science and Engineering

Hours 3

The course is aimed at investigating the underlying fundamental causes of corrosion problems and failures. Emphasis is placed on the electrochemical reactions occurring and the tools and knowledge necessary for predicting corrosion, measuring corrosion rates, and combining these with prevention and materials selection.

Prerequisite(s): MTE 271; CH 102 or permission of instructor

MTE491 Special Problems

SP

Hours 1-3

An assigned problem is explored individually. Credit is based on the amount of work undertaken.

Prerequisite(s): Permission of instructor

Special Topics Course

MTE492 Special Problems

SP

Hours 1-3

An assigned problem is explored individually. Credit is based on the amount of work undertaken.

Prerequisite(s): Permission of instructor

Special Topics Course