

MATERIALS ENGINEERING (MATL)

MATL 260 Elements of Materials Science

Prerequisites: CHEM 109A and 109L; PHYS 212; MECH 223 or parallel.

Description: Relation of atomic, molecular, and crystal structure to the physical, mechanical, and chemical properties of metals, alloys, polymers, and ceramics.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: MATL 262

MATL 262 Materials Laboratory I

Prerequisites: MATL 260 or parallel.

Description: Engineering behavior of materials with emphasis on macroscopic properties; relationship between these properties, processing history, composition and microstructure. Introduction to the use of metallographic tools used in interpretation.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded

MATL 360 Elements of Materials Science

Prerequisites: CHEM 109A and 109L; PHYS 212; MECH 223 or parallel.

Description: Relation of atomic, molecular and crystal structure to the physical, mechanical and chemical properties of metals, alloys, polymers and ceramics. Experience in investigation of properties of engineering materials.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded

Prerequisite for: MECH 343; MECH 370

Course and Laboratory Fee: \$30

MATL 460 Mechanical Aspects of Materials

Crosslisted with: MATL 860

Prerequisites: MECH 325 and MATL 360, or equivalent.

Description: Emphasizes those principles at the atomistic or molecular level that relate mechanical properties and behavior of different classes of materials to their structure and environment.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: MATL 875; MATL 960; MATL 962

MATL 461 Materials Laboratory II

Crosslisted with: MATL 861

Prerequisites: MATL 360.

Description: Application of scientific principles in the laboratory to the analysis of materials problems and selection of engineering materials.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Course and Laboratory Fee: \$20

MATL 462 X-ray Diffraction

Crosslisted with: MATL 862

Prerequisites: PHYS 212.

Description: Principles of crystallography. Production and properties of X-rays. Interaction of X-rays with atoms and the nature of diffraction (direction and the intensities of diffracted beams). Diffraction patterns and intensity measurements.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 463 Introduction to Materials for Nuclear Energy Systems

Crosslisted with: MATL 863

Prerequisites: MATL 260 or MATL 360 or equivalent

Description: Introduction to materials in nuclear engineering with a focus on power generation, including concepts related to components of nuclear power stations, generation-IV fission reactors, materials for nuclear reactors, degradation of mechanical properties in irradiation environments, and fusion reactors.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 465 Applied Physical Metallurgy and Design

Crosslisted with: MATL 865

Prerequisites: MATL 360 or equivalent.

Description: Principles of alloying; alloy selection; modification of the physical properties of structural alloys by thermal, mechanical, and chemical treatment; solidification and joining phenomena.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 466 Materials Selection for Mechanical Design

Crosslisted with: MATL 866

Prerequisites: MATL 360 and MECH 325.

Description: Rational selection procedure for the most suitable materials for each particular mechanical design. Introduction of materials selection charts and the concept of materials performance indices. Case studies in mechanical design, taking materials selections, shape and process into account. Projects on materials selection at the design concept and the design embodiment stages.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 467 Principles of Powder Metallurgy

Crosslisted with: MATL 867

Prerequisites: MECH 200; MECH 325; MATL 360 or equivalent.

Description: Basic principles of powder metallurgy, with emphasis on methods of producing metal powders, determination of their characteristics; the mechanics of powder compaction; sintering methods and effects; and engineering applications.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 468 Failure Analysis: Prevention and Control**Crosslisted with:** MATL 868**Prerequisites:** MECH 325; MATL 360 or equivalent.

Description: Metallurgical tools for analysis of failures; types and modes of failures; sources of design and manufacturing defects. Case histories utilized to illustrate modes of failures and principles and practices for analysis. Design concepts and remedial design emphasized with these case studies. Several projects involving case analyses and design by students included.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MATL 469 Physical Materials Systems****Crosslisted with:** MATL 869**Prerequisites:** PHYS 212 and MATL 360.

Description: Development of the principles controlling the formation of the structure of engineering materials. Phase diagrams, diffusion, interfaces and microstructures, solidification and diffusional transformation and diffusionless transformations.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MATL 470 Thermodynamics of Alloys****Crosslisted with:** MATL 870

Prerequisites: MATL 360 and MECH 200, or equivalent; MATH 208 or parallel.

Description: Materials thermodynamics of closed systems, introduction to liquid and solid solution alloys, relationship to gas phase, application to binary systems.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** MATL 875; MATL 960; MATL 970; MATL 972**MATL 471 Electron Microscopy of Materials****Crosslisted with:** MATL 871**Prerequisites:** PHYS 212.

Description: Introduction to electron beam instruments. Electron interactions with materials. Basic aspects of electron diffraction, image formation and spectrum generation by materials. Acquisition and analysis of images, diffraction patterns and spectral data. Resolution and sensitivity limits of electron probe methods. Practical experience in the use of electron microscopes for characterization of materials.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MATL 472 Kinetics of Alloys****Crosslisted with:** MATL 872**Prerequisites:** MATL 360 or equivalent; MATH 221/MATH 821.

Description: Kinetics of gas-liquid-solid reactions in alloy systems; analysis of diffusion models applicable to such systems.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MATL 473 Corrosion****Crosslisted with:** MATL 873**Prerequisites:** CHEM 109A and CHEM 109L or equivalent.

Description: Fundamentals of corrosion engineering, underlying principles, corrosion control, and materials selection and environmental control.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MATL 474 Extractive Metallurgy****Crosslisted with:** MATL 874**Prerequisites:** MATL 360 and MECH 200 or equivalent.

Description: Unit operations and processes utilized in production of ferrous, nonferrous, and refractory metals. Examples of production techniques for metal bearing ores, scrap metals, and domestic waste. Control of impurity and alloy content and their relationship to physical properties.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MATL 477 Organic and Inorganic Electronic Materials and Devices****Crosslisted with:** MATL 877**Prerequisites:** Permission

Description: The course introduces the optical and electronic processes in inorganic and organic molecules and polymers that govern the behavior of practical organic electronic and optoelectronic devices.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MATL 492 Special Topics****Crosslisted with:** MATL 892**Description:** Special topics in materials engineering and related areas.**Credit Hours:** 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 24**Grading Option:** Graded