MATERIALS ENGINEERING (MATL)

MATL 860 Mechanical Aspects of Materials
Crosslisted with: MATL 460
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 861 Materials Laboratory II
Crosslisted with: MATL 461
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 862 X-ray Diffraction
Crosslisted with: MATL 462
Prerequisites: PHYS 212.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MATL 864 Thin Films and Surface Engineering
Prerequisites: Graduate standing in engineering, physics, chemistry, or permission
Description: Thin films play an important role in a myriad of applications ranging from magnetic recording media, architectural glass panels, and microelectronics to coatings for reduction of wear and corrosion in components on board the space shuttle. Includes: vacuum science and technology; pumping systems and instrumentation; thin film deposition techniques; surface modification techniques; characterization of thin film properties; microstructural, physical and mechanical properties; and comparisons of surface enhancement techniques in terms of suitability, performance, and cost.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MATL 865 Applied Physical Metallurgy and Design
Crosslisted with: MATL 465
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 866 Materials Selection for Mechanical Design
Crosslisted with: MATL 466
Prerequisites: MATL 360 and MECH 325; or permission.
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 867 Principles of Powder Metallurgy
Crosslisted with: MATL 467
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 868 Failure Analysis: Prevention and Control
Crosslisted with: MATL 468
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 869 Physical Materials Systems
Crosslisted with: MATL 469
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 870 Thermodynamics of Alloys
Crosslisted with: MATL 470
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 871 Electron Microscopy of Materials
Crosslisted with: MATL 471
Prerequisites: PHYS 212.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MATL 872 Kinetics of Alloys
Crosslisted with: MATL 472
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 873 Corrosion
Crosslisted with: MATL 473
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 874 Extractive Metallurgy
Crosslisted with: MATL 474
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 875 Glass and Ceramic Materials
Prerequisites: MATL 860 and 870, or permission
Description: Principles underlying the processing and microstructure evolution in nonmetallic materials, particularly glasses and ceramics. Structure-property relations in ceramics for engineering applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MATL 877 Organic and Inorganic Electronic Materials and Devices
Crosslisted with: MATL 477
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 892 Special Topics
Crosslisted with: MATL 492
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

MATL 960 Materials Aspects of Fracture
Prerequisites: MATL 860; MATL 870
Description: Utilization of certain aspects of applied elasticity, plasticity, and materials physics to explain the relationship between materials structures and mechanical properties. Includes review of various types of material failure and mechanical tests employed to predict behavior of materials with emphasis on metals.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MATL 962 Imperfections in Crystals
Prerequisites: CHEM 882; MATL 860
Description: Fundamental properties of defects in solids. Energy considerations for point, line, and plane defects. Equilibrium and nonequilibrium concentrations of defects and annealing theory. Mutual interactions of defects and formation of secondary defects. Interaction of defects with other perturbations of the crystal lattices.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MATL 970 Advanced Thermodynamics of Materials
Prerequisites: MATL 870, MATH 821 or equivalent
Description: Applications of thermodynamic concepts to phase equilibria in materials systems. Systematics of solution theories and lattice modeling. Experimental methods; computer modeling in materials thermodynamics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
MATL 972 Transformation in Materials
Prerequisites: CHEM 882; MATL 870
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MATL 997 Research Other Than Thesis
Prerequisites: Advanced graduate standing and permission
Description: Supervised non-thesis research and independent study.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 24
Grading Option: Graded

MATL 998 Advanced Materials Topics
Prerequisites: Permission
Description: Course offered as the need arises to teach advanced topics in materials characterization, processing, synthesis or properties not covered in other 900-level courses.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 9
Grading Option: Graded