MATERIALS ENGINEERING (MATL)

MATL 2600 ELEMENTS OF MATERIAL SCIENCE (3 credits)
Relation of atomic, molecular, and crystal structure to the physical, mechanical, and chemical properties of metals, alloys, polymers, and ceramics.
Prerequisite(s)/Corequisite(s): CHEM 1180 and PHYS 2120; and MENG 3250 or EMEC 3250 coreq. Not open to non-degree graduate students.

MATL 2620 MATERIALS LABORATORY I (1 credit)
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.
Prerequisite(s)/Corequisite(s): MATL 2600 coreq. Not open to non-degree graduate students.

MATL 3600 ELEMENTS OF MATERIAL SCIENCE (4 credits)
Relation of atomic, molecular and crystal structure to the physics, mechanical and chemical properties of metals, alloys, polymers and ceramics. Experience in investigation of properties of engineering materials.
Prerequisite(s)/Corequisite(s): CHEM 1180 and PHYS 2120; and MENG 2230 or EMEC 2230 coreq. Not open to non-degree graduate students.

MATL 4600 MECHANICAL ASPECTS OF MATERIALS (3 credits)
Emphasizes those principles at the atomicistic or molecular level that relate mechanical properties and behavior of different classes of materials to their structure and environment.
Prerequisite(s)/Corequisite(s): MATL 3600; and MENG 3250 or EMEC 3250. Not open to non-degree graduate students.

MATL 4610 MATERIALS LABORATORY II (3 credits)
Application of scientific principles in the laboratory to the analysis of materials problems and selection of engineering materials. (Cross-listed with MATL 8616)
Prerequisite(s)/Corequisite(s): MATL 3600. Not open to non-degree graduate students.

MATL 4620 X-RAY DIFFRACTION (3 credits)
Prerequisite(s)/Corequisite(s): PHYS 2120, not open to nondegree students

MATL 4650 APPLIED PHYSICAL METALLURGY AND DESIGN (3 credits)
Principles of alloying; alloy selection; modification of the physical properties of structural alloys by thermal, mechanical, and chemical treatment; solidification and joining phenomena. (Cross-listed with MATL 8656)
Prerequisite(s)/Corequisite(s): MATL 3600. Not open to non-degree graduate students.

MATL 4660 MATERIALS SELECTION FOR MECHANICAL DESIGN (3 credits)
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.
Prerequisite(s)/Corequisite(s): MATL 3600; and MENG 3250 or EMEC 3250. Not open to non-degree graduate students.

MATL 4670 PRINCIPLES OF POWDER METALLURGY (3 credits)
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.
Prerequisite(s)/Corequisite(s): MENG 2000 and MATL 3600; and MENG 3250 or EMEC 3250. Not open to non-degree graduate students.

MATL 4680 FAILURE ANALYSIS: PREVENTION AND CONTROL (3 credits)
Metallurgical tools for analysis of failures; types and modes of failure; 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.
Prerequisite(s)/Corequisite(s): MENG 3250 or EMEC 3250; and MATL 3600. Not open to non-degree graduate students.

MATL 4690 PHYSICAL MATERIALS SYSTEMS (3 credits)
The principles controlling the formation of the structure of engineering materials. Phase diagrams, diffusion, interfaces and microstructures, solidification and diffusional transformation and diffusionless transformations.
Prerequisite(s)/Corequisite(s): PHYS 2120 and MATL 3600. Not open to non-degree graduate students.

MATL 4700 THERMODYNAMICS OF ALLOYS (3 credits)
Materials thermodynamics of closed systems, introduction to liquid and solid solution alloys, relationship to gas phase, application to binary systems.
Prerequisite(s)/Corequisite(s): MENG 2000 and MATL 3600; and MATH 1970 coreq. Not open to non-degree graduate students.

MATL 4710 ELECTRON MICROSCOPY OF MATERIALS (3 credits)
Prerequisite(s)/Corequisite(s): PHYS 2120, not open to nondegree students

MATL 4720 KINETICS OF ALLOYS (3 credits)
Kinetics of gas-liquid-solid reactions in alloy systems; analysis of diffusion models applicable to such systems.
Prerequisite(s)/Corequisite(s): PHYS 2120, not open to nondegree students

MATL 4730 CORROSION (3 credits)
Fundamentals of corrosion engineering, underlying principles, corrosion control, and materials selection and environmental control.
Prerequisite(s)/Corequisite(s): CHEM 1180 and CHEM 1184, not open to nondegree students

MATL 4740 EXTRACTION METALLURGY (3 credits)
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.
Prerequisite(s)/Corequisite(s): MENG 2000 and MATL 3600. Not open to non-degree graduate students.

MATL 4980 LAB & ANALYTICAL INVESTIGATION (1-6 credits)
Investigation and written report of research into specific problems in any major area of materials engineering.
Prerequisite(s)/Corequisite(s): Not open to nondegree students