MATERIALS SCIENCE (MATS)

MATS 221. THE SCIENCE, ENGINEERING AND SOCIAL IMPACT OF NANO TECHNOLOGY. (3 Credits)
Nanotechnology is an emerging engineering field that manipulates atoms and molecules to fabricate new materials and tiny devices. Properties of nanostructured materials, manufacturing methods, characterization methods, and impact on health and safety. Benefits and concerns about nanotechnology will be assessed. Lec/rec. CROSSLISTED as ENGR 221.
Equivalent to: ENGR 221
Recommended: One year of college science.

MATS 321. INTRODUCTION TO MATERIALS SCIENCE. (4 Credits)
Crystal structure, microstructure, and physical properties of metals, ceramics, polymers, composites, and amorphous materials. Also includes elementary mechanical behavior and phase equilibria. Lec. CROSSLISTED as ENGR 321.
Prerequisites: (CH 202 with C or better or CH 222 with C or better or CH 232 with C or better or CH 232H with C or better or CH 224H with C or better)
Equivalent to: ENGR 321

MATS 322. MECHANICAL PROPERTIES OF MATERIALS. (3 Credits)
Mechanical behavior of materials, relating laboratory test results to material structure, and elements of mechanical analysis. Lec/lab. CROSSLISTED as ENGR 322.
Prerequisites: (ENGR 213 with C or better or ENGR 213H with C or better) and (ENGR 321 [C] or ENGR 321H [C] or MATS 321 [C])
Equivalent to: ENGR 322

MATS 445. WELDING METALLURGY. (4 Credits)
Theory-based course focused on the metallurgy of welds. Topics covered include welding/joining processes, heat input, diffusion, solidification, phase transformation, materials compatibility and welding defects. This is NOT a practical welding class.
Prerequisites: (MATS 321 with C or better or ENGR 321 with C or better or ENGR 321H with C or better) or MATS 570 with C or better
Equivalent to: ENGR 322

MATS 455. EXPERIMENTAL TECHNIQUES IN MATERIAL SCIENCE. (4 Credits)
Materials processing, characterization, computational and data analysis techniques in materials science. Focus on processing-structure-property relationships. Lec/lab.
Prerequisites: (ENGR 321 with C or better or ENGR 321H with C or better)
This course is repeatable for 8 credits.
Recommended: ME 570

MATS 478. THIN FILM MATERIALS CHARACTERIZATION AND PROPERTIES. (4 Credits)
Processing of thin films and characterization of the microstructure; diffusion and solid state reactions; mechanical, magnetic and electronic properties of thin films.
Prerequisites: (ME 311 with C or better or ME 311H with C or better) and (ENGR 321 [C] or ENGR 321H [C] or MATS 321 [C]) and (ENGR 322 [C] or MATS 322 [C])

MATS 499. SPECIAL TOPICS. (1-16 Credits)
This course is repeatable for 16 credits.

MATS 509. MATERIALS SCIENCE SEMINAR. (1 Credit)
Student participation seminar experience for one credit; students will listen to seminars concerning ongoing research activities within materials science. Students will also have the opportunity to present their own research results periodically. Graded P/N. CROSSLISTED as ME 509.
Equivalent to: ME 509

MATS 545. WELDING METALLURGY. (4 Credits)
Theory-based course focused on the metallurgy of welds. Topics covered include welding/joining processes, heat input, diffusion, solidification, phase transformation, materials compatibility and welding defects. This is NOT a practical welding class.
Recommended: (MATS 321 or ENGR 321 or ENGR 321H) or MATS 570

MATS 555. EXPERIMENTAL TECHNIQUES IN MATERIAL SCIENCE. (4 Credits)
Materials processing, characterization, computational and data analysis techniques in materials science. Focus on processing-structure-property relationships. Lec/lab.
Prerequisites: ME 570 with C or better
This course is repeatable for 8 credits.
Recommended: ENGR 321 or ENGR 321H

MATS 570. STRUCTURE-PROPERTY RELATIONS IN MATERIALS. (4 Credits)
Equivalent to: ME 570

MATS 571. ELECTRONIC PROPERTIES OF MATERIALS. (4 Credits)
Recommended: CH 545 or ME 570

MATS 578. THIN FILM MATERIALS CHARACTERIZATION AND PROPERTIES. (4 Credits)
Processing of thin films and characterization of the microstructure; diffusion and solid state reactions; mechanical, magnetic and electronic properties of thin films.

MATS 581. THERMODYNAMICS OF SOLIDS. (4 Credits)

MATS 582. RATE PROCESSES IN MATERIALS. (4 Credits)
Diffusion in solids, including vacancy and interstitial and short-circuit diffusion. Phase transformations including classic nucleation and growth theory. Applications to materials development. Laboratory will emphasize microstructural evaluation and quantitative metallography. Lec/lab.

MATS 584. ADVANCED FRACTURE OF MATERIALS. (4 Credits)
Fracture mechanics will be used as a basis for predicting failure of materials, understanding failure mechanisms, and identifying causes of failure. Course will include discussion of recent journal articles, experimental demonstrations, and analysis of real fracture data. CROSSLISTED as ME 584.
Equivalent to: ME 584
Recommended: ENGR 322

MATS 587. DISLOCATIONS, DEFORMATION, AND CREEP (4 Credits)
The effects of point, line, and planar defects on plastic deformation and creep behavior in solids will be discussed with emphasis on the role of dislocations and vacancies.
Recommended: ENGR 322
MATS 588. COMPUTATIONAL METHODS IN MATERIALS SCIENCE. (4 Credits)
A broad introduction to important materials science simulation methods. These include molecular dynamics, density functional theory, and Monte Carlo methods. Learning is through a mixture of lecture and hands-on lab projects in which students use computational methods to explore and reinforce fundamental concepts in materials science. Lec/lab.
CROSSLISTED as ME 588.
Equivalent to: ME 588
Recommended: Experience with Matlab or Mathematica or an equivalent numerical and programming environment.

MATS 599. SPECIAL TOPICS. (1-16 Credits)
This course is repeatable for 16 credits.

MATS 671. ELECTRONIC PROPERTIES OF OXIDES. (4 Credits)
Band theory of solids applied to metal oxide materials. Includes metallic oxides, non-stoichiometric semiconductors and associated defect chemistry, high temperature superconductors, electrostatics, linear dielectrics, non-linear dielectrics, piezoelectrics, and the optical properties of oxides.
Recommended: ME 571 or MATS 571 or PH 575