MATERIALS SCIENCE (MTS)

MTS 533 Introduction to Theory of Materials (3 Credits)
Engineering & Comp Sci
Theoretical concepts that describe the electronic structure of crystals. Models of electron and ion interactions to correlate electronic, magnetic, and thermal properties of metals, alloys, and compounds.
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

MTS 537 Introduction to Diffusion in Solids (3 Credits)
Engineering & Comp Sci
Diffusion mechanisms, diffusion equations and their methods of solution.

MTS 570 Nondestructive Testing (3 Credits)
Engineering & Comp Sci
Determination of defects in structural materials. Nondestructive inspection methods include noise emission techniques, X-ray radiography, leak detectors, ultrasonics, magnetic and electrical methods.
Repeatable

MTS 581 X-Ray Diffraction (3 Credits)
Engineering & Comp Sci
Kinematic theory of X-ray diffraction and its applications in materials science. Experimental methods. Integrated intensity, line broadening, and peak shift analyses. Crystal structure. X-ray effects of imperfections in crystals.

MTS 625 Topics in Solid-State Thermodynamics (3 Credits)
Engineering & Comp Sci
Application of classical and statistical thermodynamic principles to the behavior of solids. Phase equilibria, diffusion, defects, interfaces, use of tabulated data in real problems, elastic, magnetic, and electric systems.

MTS 631 Advanced Physical Metallurgy (3 Credits)
Engineering & Comp Sci
Solid-state processes. Structure of pure metals. Phase diagrams. Solid solutions, eutectic and peritectic reactions. Diffusion, nucleation, and growth phenomena. Transformation processes.

MTS 632 Transformations in the Solid State (3 Credits)
Engineering & Comp Sci
Reactions and transformations in solids. Allotropy, critical phenomena in solid solutions, nucleation, growth, precipitation from supersaturated solid solutions, recovery, recrystallization and growth, eutectoid transformations. Martensite transformations, etc.
Advisory recommendation Prereq: MTS 631

MTS 655 Electron Transport Phenomena in Crystals (3 Credits)
Engineering & Comp Sci
Electron states. Dynamics of electrons. Electron spin. Thermal energy. Interaction of electrons with the lattice and crystal defects. Thermoelectricity. Hall Effect, magneto resistance. Optical properties. Superconductivity.

MTS 671 Mechanical Behavior of Materials (3 Credits)
Engineering & Comp Sci
Mechanical behavior of metallic materials. Effects of stress systems on deformation. Static and dynamic properties of metals and alloys. Plastic deformation. Residual stresses. Stress concentrations. Metal forming.

MTS 672 Dislocation Theory (3 Credits)
Engineering & Comp Sci
Deformation laws on the basis of dislocation theory. Types of dislocations. Stress field of dislocations. Interaction between dislocations. Yield point phenomenon; strain hardening. Age hardening. Fracture initiation and crack propagation.

MTS 682 Electron Diffraction and Electron Microscopy (3 Credits)
Engineering & Comp Sci
Kinematic theory of electron diffraction and electron microscopy. Dynamics theory. Contrast from perfect and imperfect crystals. Specimen preparation and experimental methods.
Advisory recommendation Prereq: MTS 581

MTS 684 Modern Microstructural Techniques (3 Credits)
Engineering & Comp Sci
Cross-listed with SST 684
Basic principles, capabilities and applications of various microstructural methods not covered in MTS 581 and MTS 682. Scanning electron microscopy, electron probe microanalysis, X-ray fluorescence, field ion microscopy.
Advisory recommendation Prereq: MTS 581

MTS 690 Independent Study (1-6 Credits)
Engineering & Comp Sci
Exploration of a problem, or problems, in depth. Individual independent study upon a plan submitted by the student. Admission by consent of supervising instructor(s) and the department.
Repeatable

MTS 720 Formation of Thin Solid Films (3 Credits)
Engineering & Comp Sci
Science and engineering of the formation of thin solid films. Vacuum technology, film formation, theories of nucleation and accommodation, growth and structure of single crystal films.
Repeatable

MTS 721 Properties of Thin Solid Films (3 Credits)
Engineering & Comp Sci
Topics chosen principally from: mechanical, piezoelectric, magnetic, electron transport , superconductive, and optical properties.

MTS 748 Theory of Alloys (3 Credits)
Engineering & Comp Sci
The application of bond theories in prediction of: structure, stability and reactivity of alloy phases, intermetallic compounds, carbides, nitrides, etc. Topics covered include valence bond theory, crystal field theory, Engel-Brewer correlation as well as other periodic classifications of properties which are of value in making the above types of predictions.

MTS 756 Magnetic Phenomena in Crystals (3 Credits)
Engineering & Comp Sci
Orbital magnetic susceptibility, spin paramagnetism, fero, ferri, antiferromagnetism, exchange interaction, Ising model, domain structure, fine particles, thin films, magnetic anisotropy, reversible and irreversible magnetization processes.
Advisory recommendation Prereq: MTS 631

MTS 800 Selected Topics in Mechanics of Materials (1-6 Credits)
Engineering & Comp Sci
Imperfections in solids, fracture and yielding criteria, fatigue, creep, ultrasonic effects, radiation damage, surface phenomena and related subjects of current interest.
Repeatable

MTS 820 Selected Topics in Materials Science (1-4 Credits)
Engineering & Comp Sci
Recent developments in the field of materials science.
Repeatable

MTS 837 Advanced Problems in the Physics of Metals (3 Credits)
Engineering & Comp Sci
Quantitative treatment of the theory of the properties of metals and alloys.
Advisory recommendation Prereq: PHY 662

MTS 867 Theory of Surfaces and Interfaces (3 Credits)
Engineering & Comp Sci
Fundamental theory of the interfaces formed between various combinations of solids, liquids, and gases based on the thermodynamic and electronic models. Phenomena of adsorption, capillarity, catalysis, electronic emissions, double layer effects, and heterojunctions.

MTS 890 Metallurgical Research Techniques (3 Credits)
Engineering & Comp Sci
Topics selected from the following and related areas: high and low temperature research, high vacuum, high pressure experimental stress analysis, quantitative metallograpy, nondestructive testing, electron microscopy, mass spectrometry, X-ray and electron diffraction.
Repeatable 2 times for 6 credits maximum

MTS 960 Advanced Seminar in Materials Science (3 Credits)
Engineering & Comp Sci
Recent scientific and engineering advances in specific fields of materials science.
Repeatable

MTS 990 Independent Study (1-6 Credits)
Engineering & Comp Sci
Exploration of a problem, or problems, in depth. Individual independent study upon a plan submitted by the student. Admission by consent of supervising instructor(s) and the department.
Repeatable

MTS 997 Masters Thesis (1-6 Credits)
Engineering & Comp Sci

MTS 999 Dissertation (1-15 Credits)
Engineering & Comp Sci