

# MATERIALS SCIENCE (MATL)

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## **MATL 6982 Graduate Research 1-6 s.h.**

Individual investigation of advanced topics under the guidance of selected program faculty. May be repeated for a maximum of 30 semester hours. ,.

## **MATL 6990 Seminar in Materials Science and Engineering 1 s.h.**

Presentations of ongoing research in materials science and engineering. Includes presentations by guest speakers, faculty and graduate students. May be repeated for a maximum of 3 semester hours.

## **MATL 7010 Analytical Methods for Materials Science 1 3 s.h.**

A laboratory course where the student will receive hands-on training with instruments commonly used in materials research. Techniques covered include electrical response methods, spectroscopic methods, X-ray techniques, and thermal analysis and surface profiling techniques. (2 hour lecture/3 hour lab).

## **MATL 7020 Analytical Methods for Materials Science 2 3 s.h.**

A laboratory course where the student will receive hands-on training with instruments commonly used in materials research. Instruments covered include light microscopes, scanning electron microscopes, transmission electron microscope, focused ion beam, X-ray photoelectron spectrometer, Auger spectrometer, X-ray microscope, and dynamic mechanical analyzer. (2 hour lecture/3 hour lab).

## **MATL 8010 Structure of Materials 3 s.h.**

A study of the structure/property relationship of materials at the electronic, atomic, and molecular level. Using quantum chemistry, symmetry, chemical bonding and electrochemistry, this course will introduce the student to the classification and properties of amorphous, crystalline, and semi-crystalline structures including metals, semiconductors, ceramics, polymers, and hybrid materials. The properties to be studied include mechanical, thermal, electrical, and magnetic properties.

## **MATL 8020 Mechanical Properties of Materials 3 s.h.**

This course addresses the mechanical behavior of materials, assuming knowledge of elasticity, plasticity, fracture and creep, and aims to provide a robust analytical treatment of these topics across size scales and material types. The course is split into three sections: (a) Continuum mechanics, (b) Advanced phenomena in mechanics of materials, and (c) Case studies focused on the design and processing of materials.

**Prereq.:** MATL 8010.

## **MATL 8030 Thermodynamics and Phase Behavior 3 s.h.**

Detailed examination of chemical equilibria and chemical changes with an emphasis on the theoretical basis for these phenomena and the properties of phase diagrams. The use of computer models for chemical equilibrium calculations utilizing extensive thermodynamic databases.

## **MATL 8040 Kinetics, Diffusion, and Rate Processes 3 s.h.**

Essential topics covered include diffusion in solids and liquids; complex motion of dislocations and interfaces; complex kinetics of phenomena such as phase transformations and morphological evolution; and the rate at which these and other kinetic phenomena occur.

**Prereq.:** MATL 8030.

## **MATL 8050 Materials Internship 1-6 s.h.**

Supervised experience in approved external industrial, government lab, or other comparable environment, working on advanced problems in materials. For materials science and engineering doctoral students or by permission of program coordinator. May be repeated for a maximum of 6 semester hours.

**Prereq.:** MATL 8020.

## **MATL 8060 Dissertation 1-9 s.h.**

Design, proposal, completion, and reporting of scholarly research deemed acceptable to the program faculty. Culminates in an oral presentation to dissertation committee.

**Prereq.:** completion of qualifying exam and research proposal.