

MATERIALS SCIENCE & ENGINEERING (MTSE)

MTSE 501 Materials Thermodynamics and Kinetics 3 Credit Hours

A lecture course that provides an understanding of thermodynamics and kinetics in materials and materials processing. Students will develop skills to evaluate the stability of materials under various external conditions, design processes to produce desired materials structures (microstructure and nanostructure), and predict the evolution of materials structures under different operating conditions. Topics will include laws of thermodynamics, equilibrium of single and multiphase systems, chemical thermodynamics, statistical thermodynamics of solid-solutions, equilibrium phase diagrams (unary, binary, and ternary), chemical kinetics, diffusion in solids, nucleation and growth processes, coarsening, glass transition, and phase transformations. Students will be exposed to various software commonly used in industries to evaluate materials thermodynamics and kinetics: Thermo-Calc, CALPHAD, and JMatPro. (YR).

Restriction(s):

Can enroll if Level is Doctorate or Rackham or Graduate or

Can enroll if Major is

MTSE 502 Introduction to Materials Characterization 3 Credit Hours

Designed for graduate students to gain an in-depth understanding of principal methods in materials characterization and analysis. This course will survey bulk as well as nanoscale structural characterization, such as identity, chemical composition and hierarchical arrangement. Analysis techniques such as optical microscopy, X-ray diffraction, electron microscopy, scanning probes and spectroscopy will all be reviewed. Students will learn principles of image formation and interpretation, resolution, contrast and chemical analysis. Focuses on fundamental concepts of different methods as well as practical applications. The intent is to allow the student to make an educated selection of characterization techniques, or critical analysis of data, for materials and defect analysis. (YR).

Restriction(s):

Can enroll if Level is Doctorate or Rackham or Graduate or

Can enroll if Major is

MTSE 600 Study or Research in Selected Materials Engineering Topics 1 to 3 Credit Hours

Individual or group study or design in an area of materials engineering under the supervision of a member of the graduate faculty. The student will submit a report on the project and give an oral presentation to a panel of faculty members at the close of the term. Graduate standing or special permission. (YR).

Restriction(s):

Can enroll if Level is Rackham or Graduate

Can enroll if Major is

MTSE 699 Master's Thesis 1 to 6 Credit Hours

Graduate students electing the course, while working under the general supervision of a member of the department faculty, are expected to plan and carry out the work themselves and submit a thesis for review and approval, and also present an oral defense of the thesis. Students must satisfactorily complete 6 credit hours in MTSE 699, but these hours may be spread over more than one term. Graduate standing or special permission. (YR).

Restriction(s):

Can enroll if Level is Rackham or Graduate

Can enroll if Major is