Materials Science and Engineering
Spring 2019 Graduate Course Descriptions

Course: MSE 5305 - Phase Transformations in Solids
Instructor: Dr. Serge Nakhmanson
Day/Time: Thursdays, 5:00-7:30pm
Description: This course will cover essentials of phase diagrams reading, transitions involving diffusion, nucleation, melting and precipitate growth, spinodal decomposition, martensitic transformations, phase-field and Landau-Ginzburg theories, as well as magnetic and electronic phase transitions occurring in ferromagnetic and ferroelectric materials and nanostructures.

Course: MSE 5309 – Transport Phenomena in Materials Science and Engineering
Instructor: Dr. George Rossetti
Day/Time: Mondays/Wednesdays, 2:30-3:45pm
Description: Mechanisms and quantitative treatment of mass, energy, and momentum transfer will be discussed in the context of materials science and engineering applications. Increasingly complex and open-ended applications will be used to illustrate principles of fluid flow; heat conduction, radiation, and diffusion.

Course: MSE 5320-001 – Investigation of Special Topics: New Carbon Materials in Today's World (Online)
Instructor: Dr. Weiming Lu (New Adjunct Professor from UTC Aerospace Systems)
Day/Time: Wednesdays, 5:00-7:30pm
Description: This course provides the science and technology of various new carbon materials for those students who are interested in the applications of using carbon materials in automotive and aerospace industry, environmental protection and energy storage. The topics to be covered include: New Carbon Materials; Carbon Material Processing; The applications and Challenges in Industry. This course will also provide the fundamental principle of carbon material design and the linkage between carbon structure and material properties.

Course: MSE 5320-002 – Investigation of Special Topics: High Temperature Materials Oxidation and Corrosion
Instructor: Dr. Prabhakar Singh
Day/Time: Tuesdays, 5:00-7:30pm
Description: Metals and alloys of common industrial and commercial interests are subject to corrosion and oxidation during exposure to high temperatures. While metal corrosion rates and type of corrosion products vary widely from metal to metal, a number of alloy formulations offer corrosion protection by forming slow growing, dense and adherent oxides. The objective of this course is to familiarize students with the basic understanding of metal interactions with oxygen (and other oxidants), oxide chemistry (defect structure), and oxide growth process (parabolic to linear). Oxidation of binary alloys will be studied with emphasis on internal and external oxidation and transition from internal oxidation to external oxidation. Oxide chemistry, morphology and metal loss of select Fe and Ni base alloys (chromia and alumina forming stainless steels and super alloys) will be analyzed and accelerated corrosion due to carburization, sulfidation, and oxide evaporation will be discussed. Approaches for corrosion protection (coatings) will be examined.

Course: MSE 5330 – Classical Atomic-level Simulations in Materials Science and Engineering
Instructor: Dr. Avinash Dongare
Day/Time: Tuesdays/Thursday, 12:30-1:45pm
Description: Introduction to several classical atomic-scale simulation techniques (molecular dynamics, Monte Carlo methods) with an emphasis on learning the art of designing simulations and analyzing data generated. The capabilities of the methods to investigate properties and response of materials and the current limitations of materials at the atomic scales will be covered.

Course: MSE 5336 – Materials Selection in Mechanical Design
Instructor: Dr. Greg Ojard (Adjunct Professor from UTRC)
Day/Time: Mondays, 5:00-7:30pm
Description: The course consists of a study of materials and how they are chosen for various mechanical designs. A wide range of materials will be discussed (metal, ceramic, polymer, etc.) and their key properties (modulus, strength, density, etc.) in design will be reviewed. Guidelines for material selection will be shown. As part of the course, design trades will also be discussed.