

1. Course number and name
EML 4930 Advanced Materials
2. Credits and contact hours
 3 cr, 2.5 contact hours (2 hrs. 30 min. lecture)
3. Instructor's or course coordinator's name
 Instructor: Dr. Peter Kalu, Coordinator: Dr. William Oates
4. Text book, title, author, and year
 Materials Science and Engineering: An Introduction w/ CD, Callister, W. D. Jr., 2006
5. Specific course information
 - a. *brief description of the content of the course (catalog description)*
 This Advanced Materials Science course is intended for seniors or first-year graduate students interested in materials science and engineering. It builds upon the concepts learnt in EML3234, EML 3011C and EML 3012C. Apart from providing a comprehensive survey of the fundamentals of structure, properties, processing, and applications of various classes of materials, the course addresses the connection between the structure (molecular to mesoscale) of materials and their properties (structural, electric, and magnetic properties, plus thermodynamic characteristics).
 - b. *prerequisites or corequisites*
 Prerequisites: EML 3234, EML3011C, EML 3012C
 - c. *indicate whether a required, elective, or selected elective course in the program*
 Selected Technical Elective course
6. Specific goals for the course
 - a. *Course Outcomes*
 1. Identify the fundamental differences between various classes of materials: metals, ceramics, polymers, composites
 2. Identify the important properties of various classes of materials and the general application area for each class of materials
 3. Identify the linkage between molecular structure and microstructure of materials and their properties
 4. Identify the important processes used to fabricate various classes of materials, as well as the impact of processing conditions on microstructure and properties of materials
 5. Identify the microstructure length scale effects on materials properties, including the effects of nanoscaling of materials dimensional features on their properties
 6. Identify and use the simple theoretical models to answer questions related to all of the above
7. Brief list of topics to be covered
 - Atomic Structure and Interactive Bonding
 - Imperfections in Solids
 - Structures, Synthesis, Fabrication and Processing of: Metals, Ceramics and Polymers
 - Diffusion in Materials
 - Phase Diagrams (Ceramics and Metals)
 - Phase Transformation in Metals
 - Deformation and Strengthening Mechanisms
 - Mechanical Properties

- Electrical Properties
- Thermal Properties
- Optical Properties
- Magnetic Properties