Department of Materials Science and Engineering
University of Maryland

ENMA 421: Design of Composite Materials (Elective) – 3 credits

Class Schedule: Monday and Wednesday, 3:30 to 4:45 PM

Instructor: Prof. S. Ankem


Catalog/Course Description: This course covers fundamentals of design, processing and selection of composite materials for structural applications. The topics include a review of all classes of engineering materials, an in-depth analysis of micro and macro mechanical behavior including interactions at the two-phase interfaces, modeling of composite morphologies for optimal microstructures, material aspects, cost considerations, processing methods including consideration of chemical reactions and stability of the interfaces and material selection considerations.

Prerequisites: Permission of the department.

Course Goals: The main objective of this course is to teach fundamentals of composite materials as related to design, processing selection for structural applications. Satisfactory completion of the course should demonstrate the ability to:
1. Understand the basic principles of composites materials.
2. Learn about various types of composites including processing.
3. Predict composite behavior from the knowledge of component phases properties and
4. Design and select composites for a given structural application.

Student Outcomes for the Course:

ABET A: Ability to apply mathematics, science and engineering principles;
ABET B: Ability to design and conduct experiments, analyze and interpret data.
ABET C: Ability to design a system, component, or process to meet desired needs.

Topics Covered:

1. Introduction
3. A Review of Mechanical Properties
Strength, Hardness, Fatigue, Toughness, Damping capacity, Creep, Thermal shock resistance, Wear, Corrosion.

4. Overview of Composites
   Definition and classification
   Prediction of mechanical properties

5. Reinforcement and the Reinforcement-Matrix Interface

6. Types of Composites
   Metal Matrix Composites
   Ceramic Matrix Composites
   Polymer Matrix Composites

7. Joining

8. Special Topics

   Energy analysis, Local stresses, Fracture initiation, Impact, Toughening mechanisms.