

MSE 4793: Composite Materials and Processes (required)

Catalog Description: (3-0-3)

Prerequisites: CHEM 1310 and PHYS 2212

Basic principles of selecting component materials and manufacturing composites are presented. Polymeric, metallic, and ceramic systems are considered.

Textbook:

“Composites Manufacturing: Materials, Product, and Process Engineering”, by S.K. Mazumdar, CRC Press, ISBN 0-8493-0585-3 1. 2001.

“Fundamentals of Composites Manufacturing: Materials, Methods, and Applications (2nd Ed)”, A. Brent Strong, ISBN 13: 978-087263854-9, 2008.

Prepared by: Youjiang Wang

Topics Covered:

1. Introduction, Applications, Properties
2. Reinforcement Mechanisms, Mechanical Properties
3. Reinforcements: Fibers, Particles and Whiskers
4. Matrix Materials: Thermoset, Thermoplastic, Ceramic, Metal
5. Textile Preforms
6. Interface
7. Selection, Product Development, Design for Manufacturing
8. Manufacturing fundamentals
9. Polymer Matrix Composites: Manufacturing & Properties
10. Metal and Ceramic Matrix Composites
11. Cost estimation

Course Outcomes:

Outcome 1: The student will develop an understanding of composite materials.

- 1.1 The student will demonstrate a basic understanding of the basic mechanisms of reinforcement, suitable applications, and limitations.
- 1.2 The student will demonstrate an understanding of the characteristics of fibers, fabrics and matrix materials, and their effect on composites processing and properties.
- 1.3 The student will demonstrate an ability to select raw materials for composites.

Outcome 2: The student will gain a working knowledge on composites manufacturing methods.

- 2.1 The student will develop an understanding of the characteristics and limitations of different manufacturing methods.
- 2.2 The student will demonstrate a capability for selecting materials and processes to best suit specific applications.

Correlation between Course Outcomes and Student Outcomes:

Course Outcomes	Student Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
Course Outcome 1.1	X										
Course Outcome 1.2	X										
Course Outcome 1.3	X										
Course Outcome 2.1	X										
Course Outcome 2.2	X		X	X			X				
Entire Course	3	0	1	1	0	0	2	0	0	0	0
0 = None or insignificant; 1 = Some; 2 = Moderate; 3 = Strong											

School of Materials Science and Engineering Student Outcomes:

- (a) an ability to apply knowledge of mathematics, science and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.