

MSE 4025 Fiber Product Manufacturing

Credit hours and contact hours: 3-0-0-3

Instructor: Radhakrishnaiah Parachuru

Textbook: James Schaffer, *Science of Design and Engineering*, McG Custom, 2nd Edition, 1999.

Specific course information

Catalog description: The manufacture of fiber products and their process- structure-property relationships are detailed, covering fibers, yarns, fabrics, nonwovens, carpets, composites, and related materials.

Prerequisites: MSE 4775 – Polymer Science & Engineering I

Course: Selected Elective

Specific goals for the course

Outcomes of instruction:

Outcome 1: The student will develop a working knowledge of polymer materials manufacturing.

- 1.1 The student will demonstrate a basic understanding of manufacturing processes for a range of materials and products.
- 1.2 The student will demonstrate a basic understanding of several polymer and fiber manufacturing processes.
- 1.3 The student will demonstrate a basic understanding of the process-structure-property relationships for polymer and fiber products.
- 1.4 The student will demonstrate an understanding of the application of colorants and other chemicals to polymer and fiber products.

Outcome 2: The student will gain experience in applying manufacturing knowledge to practical manufacturing engineering problems.

- 2.1 The student will demonstrate the ability to analyze polymer and fiber structures to predict their mechanical behavior.
- 2.2 The student will demonstrate the ability to work with mathematical models presented in the literature for polymer and fiber products and structures.
- 2.3 The student will demonstrate an ability to work in teams to design a manufacturing plant for making a polymer or fiber product.
- 2.4 The student will demonstrate an ability to apply textile chemistry knowledge to

analyze realistic chemical processes for manufacturing polymer and fiber products.

Student Outcomes:

- (1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- (2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- (6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Topics covered:

- 1. Polymer/Fiber/Fiber Products Manufacturing Complex
- 2. Fiber Structure, Properties and Their Control
- 3. Natural Fibers (Cellulose Proteins) and Their Properties
- 4. Synthetic Fibers and Their Properties
- 5. Filament and Staple Yarn Formation Processes
- 6. Fabric Formation Processes and Structures
- 7. Application of Colorants, Chemicals and Polymers to Fiber Products
- 8. Carpet Formation Processes and Structures
- 9. Nonwoven Fabric Formation Processes and Structures
- 10. High Performance Fibers and Their Properties
- 11. Composite Formation Processes and Structures
- 12. Miscellaneous Fiber Products and Their Properties
- 13. Design and Specifications for Manufacturing Processes

Correlation between Outcomes of Instruction and Student Outcomes:

Outcomes of Instruction	Student Outcomes						
	1	2	3	4	5	6	7
1.1 The student will demonstrate a basic understanding of manufacturing processes for a range of materials and products.	X			X			
1.2 The student will demonstrate a basic understanding of several polymer and fiber manufacturing processes.	X				X		
1.3 The student will demonstrate a basic understanding of the process-structure-property relationships for polymer and fiber products.	X	X			X	X	
1.4 The student will demonstrate an understanding of the application of colorants and other chemicals to polymer and fiber products.	X	X					

2.1 The student will demonstrate the ability to analyze polymer and fiber structures to predict their mechanical behavior.	X	X				X	
2.2 The student will demonstrate the ability to work with mathematical models presented in the literature for polymer and fiber products and structures.	X				X	X	
2.3 The student will demonstrate an ability to work in teams to design a manufacturing plant for making a polymer or fiber product.	X	X	X	X	X	X	
2.4 The student will demonstrate an ability to apply textile chemistry knowledge to analyze realistic chemical processes for manufacturing polymer and fiber products.	X	X		X	X	X	

School of Materials Science and Engineering Student Outcomes:

- (1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- (2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- (3) An ability to communicate effectively with a range of audiences.
- (4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- (5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- (6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- (7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.