AE 526 Advanced Composites Manufacturing
Spring 2025

Professor: Jeff Baur jwbaur@illinois.edu

Lecture Hours: 2-3:20 pm in 169 Davenport Hall
Office Hours: Thursday 9:30-11pm, 305 Talbot Lab
(or by appointment)

Logesh Shanmugam, Senior Research Scientist
Office Hours: Monday 3:00-5:00 PM, 309E Talbot Lab
(or by appointment)

Recommended Textbook: Gutowski, Advanced Composites Manufacturing, John Wiley and Sons, Inc., 1997 (https://www.wiley.com/en-us/Advanced+Composites+Manufacturing-p-9780471153016)

Canvas Site: https://canvas.illinois.edu/courses/52809

Prereq.: Mechanical Behavior of Composite Materials (MSE456/TAM 428/AE 428)

Grading Breakdown:

30%	Homework (3 – 10% each)
30%	Lab Report (2 - 15% Each)
25%	Final Design Project (1)
15%	Fabrication Report/Test or Literature Review (1)

Approximate Grade Scale:
(based on class average, the minimum for the range could be scaled lower)

A+	96-100
A-/A	88-95
B-/B/B+	75-87
C-/C/C+	62-74
D-/D/D+	49-61

Class Policies:

- **Homework:** Homework will be due approximately 1 week after being assigned. Solutions will be available after the assignments are graded.
- **Late assignments**: Late homework will be accepted at a penalty of 10% a day until the solutions are made available. Hence, homework can only be a maximum of 10 days late.
- **Lab Reports**: Should follow the prescribed template, will be given roughly 1.5 weeks to complete, and is considered an assignment (late assignment policy applies).
- **Final Design Project**: Should follow the prescribed template for a fuselage design, will be given ~9 weeks to complete, and is an assignment (late assignment policy applies).

- **Fabrication Report/Test or Literature Review**: The student will have the option of either fabricating their fuselage design or completing a short review paper and presentation of an approved advanced composites manufacturing topic (not their research).
- *Academic Integrity* - Any homework or exam handed in by an individual must represent their own original work. It is the responsibility of the student to refrain from infractions of academic integrity, which includes cheating, fabrication, and plagiarism. Infractions will be given no credit and will be subject to penalties outlined by the University of Illinois code of conduct.

Learning Objectives:

- Be familiar with common reinforcement and matrix materials used in advanced composites.
- Understand fiber processing techniques, interfacial treatments, and fiber architecture nomenclature
- Understand common manufacturing methods for composite materials with special emphasis on polymer matrix composites
- Comprehend fundamental processes and analytical models or aspects of process modeling including heat transfer, cure kinetics, resin flow, and residual stresses.
- Design and manufacture a composite

AE526 Course Topics/Section:

- Fiber Manufacturing - Glass, Carbon, Polymer
- Matrix Materials
- Interfacial Treatments
- Composites Manufacturing Methods
- Processing Science of Thermosetting Composites
  - Reaction Kinetics
  - Void Modeling
  - Flow Modeling
  - Heat Transfer Modeling
  - Process Simulations
- Processing Science of Thermoplastic Composites
  - Crystallization
  - Consolidation
- Elastic Deformation of Fiber Bundles
- Autoclave Processing of Composites
  - Fundamentals
  - Tooling
- Filament Winding Process Modeling
- Liquid Composite Molding
  - Fundamentals
  - Process Modeling
- Processing-Induced Stresses
- Processing of Textile Composite Preforms
  - Linear Assemblies
  - Planar Assemblies

AE 526 Composite Manufacturing - Dates subject to change

Date	Lecture	Lecture	Assigned HW	HW Due
Tuesday, January 21, 2025	Syllabus, Course outline, Survey, Intro Fuselage Contest	1	on-board survey	
Thursday, January 23, 2025	Review Survey, Lecture #0 - Review Composite Mechanics	2		
Tuesday, January 28, 2025	Lecture: #1 Ceramics	3	**Final Design Project**	
Thursday, January 30, 2025	Lecture: #2 Polymers	4		
Tuesday, February 4, 2025	Lecture: #2 Polymers	5		
Thursday, February 6, 2025	Lecture: #3 Composites	6	**HW#1: Composite Materials & GF Processing**	
Tuesday, February 11, 2025	Lecture: #4 Glass Fibers	7		
Thursday, February 13, 2025	Finish Lecture: #4 Glass Fibers Start Lecture: #5 Carbon Fibers	8		
Tuesday, February 18, 2025	**Hot Press Lab Work**	Lab	**Lab Report #1: Hot Press Laminates**	**HW#1: Composite Materials & GF Processing**
Thursday, February 20, 2025	**Hot Press Lab Work**	Lab		
Tuesday, February 25, 2025	Finish Lecture: #5 Carbon Fibers	9		
Thursday, February 27, 2025	Lecture: #6 Polymer Fibers Start Lecture #7 Matrices	10	**HW#2: CF & PF Processing**	**Lab Report #1: Hot Press Laminates**
Tuesday, March 4, 2025	Finish Lecture #7 Matrices	11		
Thursday, March 6, 2025	Lecture #8 Interfaces	12	**HW#3: Matrices & Interfaces**	**HW#2: CF & PF Processing**
Tuesday, March 11, 2025	Lecture #9 Composite Manufacturing	13		
Thursday, March 13, 2025	Lecture #10 Cure Kinetics	14		**HW#3: Matrices & Interfaces**
Tuesday, March 18, 2025	Spring Break			
Thursday, March 20, 2025	Spring Break			
Tuesday, March 25, 2025	Lecture #11 Mechanistic Cure Models	15		
Thursday, March 27, 2025	Lecture #11 Mechanistic Cure Models	16		
Tuesday, April 1, 2025	Lecture #12 Void Modeling	17		
Thursday, April 3, 2025	Lecture #12b Void Stability	18		**Final Design Project**
Tuesday, April 8, 2025	Lecture #13 Resin Flow Lecture #14 RTM	19	**Fabrication Report or Literature Review**	
Thursday, April 10, 2025	Lecture #15 Polymer Rheology	20	**Lab Report #2: Resin Infusion Video HW**	
Tuesday, April 15, 2025	Lecture #16 Thermocehmical Modeling	21		
Thursday, April 17, 2025	Lecture #17 Residual Stress	22		
Tuesday, April 22, 2025	Lecture #18 Thermoplastic Modeling	23		**Lab Report #2: Resin Infusion Video HW**
Thursday, April 24, 2025	Lecture #18 Thermoplastic Modeling	24		**Fabrication Report or Literature Review**
Tuesday, April 29, 2025	Lecture #19 Additive Manufacturing of Composites	25		
Thursday, May 1, 2025	Current Topic Presentations	26		
Tuesday, May 6, 2025	Current Topic Presentations	27		
Wednesday, May 7, 2025	End of Instruction			