22.596 Composite Materials
Department of Mechanical Engineering, UMass Lowell

Spring 2013 (last updated 1/17/2013**)**

Instructor: Christopher Hansen
Office: 223A Perry Hall
Office phone: 978-934-2932 (x2932 from campus phone)
Email: Christopher_Hansen@uml.edu

Textbook: Stress Analysis of Fiber-Reinforced Composite Materials,
Michael W. Hyer. DEStech Publications. ISBN: 978-1932078862
Note: The 3rd edition will be used in class. However, editions 1 and 2 are substantially similar and will be acceptable for class content.

References: Assorted book chapters and journal articles
ASTM STPs (Selected Technical Papers)

Class: Tuesdays 6:30-9:30pm

Office hours: Contact me via email or phone to schedule an appointment.

Grades:

Homework	25%
Midterm exam	25%
Final report	25%
Final presentation	25%

Note: the final report and presentation will replace a final exam.

Homework: Homework will be assigned in class and be due Friday by 9am the following week (10 days after being assigned). Solutions will be handed out in class two weeks after homework is assigned. Late homework will be docked by 33% for each day late, unless prior arrangements are made.

Midterm exam: The midterm exam will cover material discussed in class on and prior to March 5 2013. Make-up exams will not be given, and all exam conflicts must be discussed with me at least 2 weeks prior to the exam.

Final report: The final report will compare analytical and experimental results for a composite sample produced and tested during the course lab component.

Final presentation: The final presentation will present a literature analysis of a particular topic in modern composite materials. Topics and a grading rubric will be provided during the semester.

Course Objectives

- Develop orthotropic stress-strain relations and failure criteria for a broad range of composite materials
- Be familiar with standard fabrication and experimental test methods
- Calculate the stress-strain response and failure of a laminated composite material under in-plane loading and/or bending using classical laminated plate theory.
- Analyze a specific composite design to determine if it meets appropriate design criteria, such as a failure or deflection criteria.
- Apply theories to analysis of experimental data and understand theory and experimental limitations.

Academic integrity:
All homework, exams, and projects are to represent their own original work. Students are prohibited from infractions of academic integrity, which includes cheating, fabrication, plagiarism, or facilitating dishonesty. Infractions will not be tolerated and will be reported the department chair to initiate a formal process. For more information, the university policy on academic integrity is available at:
http://www.uml.edu/catalog/graduate/policies/academic_dishonesty.htm

Topic schedule: (subject to revision)

Date	Lecture topic	Reading
1/22	Introduction. Fibers, matrix, interface, rule of mixtures	Ch. 1, 3.4
1/29	Stress-strain matrices, plane-stress. Orientation transformations	Ch. 2, 4, 5
2/5	CLT – Kirchhoff hypothesis, ABD matrices	Ch. 6, 7
2/12	CLT examples	Ch. 8
2/19	**No class – Presidents' Day creates a Monday schedule on 2/19**	**NA**
2/26	Composite fabrication/lay-up	Ch. 14/appendix
3/5	In-class mid-term exam	**NA**
3/12	**No class – Spring Break**	**NA**
3/19	Failure: maximum stress, Tsai-Wu	Ch. 9, 10
3/26	Composite mechanical testing	Supplemental
4/2	Hygrothermal effects. Residual stresses	Ch. 11
4/9	Special topic: composites design	Supplemental
4/16	Special topic: environment and applications	Supplemental
4/23	Special topic: nanocomposites	Supplemental
4/30	Final project presentations	**NA**