ME 257 Composite Materials Spring 2006

Time and Location: MWF 12:20-1:10, Terrill 222
CRN #: 11294
Instructor: James C. Iatridis, Ph.D.
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Office Hours: TBA
Text: "Introduction to Composite Materials Design" by EJ Barbero, Taylor & Francis, Inc., 1999. ISBN: 1-56032-701-4
Prerequisite: ME 101.

Objectives:

To develop a fundamental understanding of the mechanics of composite materials with an emphasis on material design and applications.

week	date	Topic	sub-topic	Chapter
1	18-Jan	Introduction	Class syllabus, Basic concepts	1,2,3
1	20-Jan		fibers, matrices, processing, applications	
2	23-Jan	Micromechanics	Basic Concepts	4
2	25-Jan		Prediction of stiffness values, hygrothermal and transport	
2	27-Jan		Stress partitioning parameter*, Continuous strand mat*	4.2.6, 4.2.7
3	30-Jan		Strength predictions, simple and empirical models	
3	1-Feb	Software	Cadec/Matlab	5
4	6-Feb	Ply Mechanics	Intro, stress-strain relations, anisotropy	
4	8-Feb		anisotropy, Plane stress, shear, off-axis stiffness	
5	13-Feb	Exam 1		
5	15-Feb	Macromechanics		
6	20-Feb	Holiday	President's Day	
6	22-Feb		Plate stiffness and compliance	
7	27-Feb	lab exercise, macro mech	Laminate description & types of laminates	
7	1-Mar		Computation of stresses & strains	
8	6-Mar	Brief presentations/composite project goals		
8	8-Mar		examples of stress computations	
9	13-Mar		Carpet plots, hygrothermal stresses	
9	15-Mar	failure	Intro, failure modes, layer failure criteria	
10	20-Mar	Spring Break		
10	22-Mar	Spring Break		
11	27-Mar		Laminate strength*, hygrothermal stresses*	
11	29-Mar	Beams		
12	3-Apr		design for deflection and strength, thin-walled beam	
12	5-Apr		thick-walled beams	
13	10-Apr	Exam 2		
13	12-Apr		"	
14	19-Apr	Advanced concepts	interlaminar shears, examples	
14	21-Apr		examples with failure analysis	
15	24-Apr		examples with estimation of parameters	
15	26-Apr	**Class presentations**	**Final Presentations**	
16	1-May	"	"	
16	3-May	"	"	

Final Exam Date Friday May 12th, 4:00pm

Computer Resources & Requirements:

Look for updates to the course schedule and announcements at: http://www.cems.uvm.edu/~iatridis/me257
Students are expected to check the course web-site regularly for updates.
*Download course software (CADEC) from: http://www.mae.wvu.edu/~barbero/
* A strong knowledge of linear algebra (i.e., matrix addition and multiplication) is expected for this course.

Computational programs such as MATLAB, Mathematica, or the use of macros in Microsoft Excel are helpful. A MATLAB tutorial may be scheduled if necessary.

Homework:
Homework will be assigned regularly (approximately every other week).

- Group Collaboration on the homework is acceptable; however, each student is required to submit their own solution set which is to be written with their own explanations.
- Format. Solution sets must be neatly written and documented. Explanations of problem-solving approaches and key assumptions made should be provided.
- Due Dates. At the time at which it is assigned, a deadline for the homework will also be given. An assignment is considered on-time provided that it is in my mailbox or under my office door prior to my arrival (usually between 8:30-9:00 am) on the day following the due date.
- Lab Assignment. An assignment this year will be the manufacture and testing of a composite beam. Carbon, fiberglass, and epoxy will be provided and the students will layup a beam in a process similar to that described at the following URL: http://www.mae.wvu.edu/~barbero/lab-1.html

Guest lecture
Students are strongly encouraged to participate in class! Particularly important is asking of questions during guest lectures and final presentations.

Each student is expected to give a guest lecture on at least one course topic. The student is expected to research their topic using the class text and other references. The guest lecture must be prepared in a clear and concise manner and will last 15-30 minutes, depending on the topic. Lecture notes (available for posting on the web-site) are required. Volunteers will be solicited approximately two classes in advance, guest lecturers will be assigned if necessary.

Class Project
The student will chose a topic based on specific applications of composite materials in industry or nature, or on processing, testing or analysis of composite materials. *The topic must be approved by the instructor.* If the project topic is similar to material covered in the course, then the project should cover this topic in greater depth and detail. Students will be graded on a mid-project report, and on a final presentation. Lecture notes are required and must include extended derivations and elaboration on lecture material that demonstrates the student's expertise on the topic. The length of each presentation will be approximately 20-25 minutes, which includes 5 minutes allocated for questions and answer. Several references in addition to the course text are required. The class presentations will be open to the public. A professional and 'polished' technical presentation will be required.

Grading:

Homework assignments including guest lecture: 25%
Exam 1: 25%
Exam 2: 25%
Class Project: 25% total (Mid-project report: 5%; Final presentation: 20%)

Course Number and Name: ME 257 – Composite Materials

#	**Outcomes Common to all Engineering Programs**	Level of Contribution 0 – no contribution 1 – very low level 5 – very high level					
		0	1	2	3	4	5
a	An ability to apply knowledge of mathematics, science, and engineering to the analysis of mechanical engineering problems [Engineering Criterion 3(a)].						X
b	An ability to design and conduct scientific and engineering experiments, as well as to analyze and interpret data [Engineering Criterion 3(b)].					X	
c	An ability to plan, specify, design, implement, and operate 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 [Engineering Criterion 3(c)].				X		
d	An ability to function on multidisciplinary teams [Engineering Criterion 3(d)].		X				
e	An ability to identify, formulate, and solve mechanical engineering problems [Engineering Criterion 3(e)].						X
f	An understanding of professional, legal, and ethical responsibility [Engineering Criterion 3(f)].			X			
g	An ability to convey technical material through formal written work products which satisfy accepted standards for writing style, and an ability to convey technical material through oral presentation and interaction with an audience, [Engineering Criterion 3(g)].						X
h	The broad education necessary to understand the impact of mechanical engineering solutions in a global and societal context [Engineering Criterion 3(h)].				X		
i	A recognition and appreciation of the need for, and ability to engage in life-long learning and critical thinking [Engineering Criterion 3(i)].				X		
j	A knowledge of contemporary issues [Engineering Criterion 3(j)].					X	
k	An ability to use modern engineering techniques, skills, and tools necessary for analysis and design [Engineering Criterion 3(k)].						X
	Outcomes Specific to Mechanical Engineering Programs						
l	Knowledge of chemistry and calculus-based physics with depth in at least one.				X		
m	The ability to apply advanced mathematics through multivariate calculus and differential equations.						X
n	Familiarity with statistics and linear algebra.						X
o	The ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems.			X			