Department of Mechanical Engineering
Mercer University

Syllabus for *MAE 661*
Laminated Composite Materials
Fall Semester 2012
Meeting Days TR 6:00 – 7:15 pm
Room EGC *210*

Instructor: Richard K. Kunz, Ph.D., P.E.
Associate Professor
Department of Mechanical Engineering

Office: Suite 105F, School of Engineering

Hours: MWF 11:00 am – 12:00 am
TTh 11:00 am – 12:00 noon, 1:00 pm – 2:00 pm
and by appointment

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Textbook:

Required

Introduction to Composite Materials Design, 2nd ed., Ever J. Barbero, CRC Press, 2011 (ISBN: 978-1-4200-7915-9)

References

- *Mechanics of Composite Materials,* Robert M. Jones, 2nd ed., Taylor and Francis, 1999 (ISBN: 1-56032-712-X)
- *Mechanics of Composite Materials,* Autar K. Kaw, 2nd ed., CRC Press, 2006
- *Engineering Mechanics of Composite Materials,* I. M. Daniel, O. Ishai, Oxford University Press, 2006.
- *Introduction to Design and Analysis with Advanced Composite Materials,* S. R. Swanson, Prentice-Hall, 1997
- *Mechanics of Composite Materials with MATLAB,* G. Z. Voyiadjis, P. I. Kattan, Springer, 2005.
- *Finite Element Analysis of Composite Materials,* E. J. Barbero, CRC Press, 2008

Catalog Description:

The structure and mechanical properties of composite laminates.

Course Objectives:

Introduce fundamental concepts in the analysis and design of laminated composite structures, with specific focus on:

- Classical lamination theory
- Considerations of stiffness and strength of composite structures
- Design considerations and applications

Provide the necessary background to apply the general principles of solid mechanics and structural analysis to laminated composite structures

Prerequisites:

EGR 252: Probability and Statistics for Engineers, or equivalent
MAE 320: Solid Mechanics II, or equivalent

Grading:

Homework	20%
Tests (2)	25% each
Final Exam	30%

Course Standards:

1. **Homework** will be assigned approximately weekly and will generally be due at the beginning of class one week after the date assigned.

2. **Reading** assignments will be posted at each class meeting. You are expected to read the listed sections before the next class to prepare for the material to be covered.

3. There will be no class on Thursday, 11October (Fall Break) and on Thursday, 22 November (Thanksgiving).

4. **Tests:** There will be two in-class 75-minute tests during the semester. **Tentative** test dates are 27 September and 8 November. Firm dates for the tests will be announced a minimum of one week prior.

5. **Final Exam:** There will be a comprehensive final exam during final exam week. **Tentative** date and time for the final exam is **Wednesday, 12 December, 6:00 – 9:00 pm**

Additional Information:

1. Please feel free to arrange a meeting with me at any point that you feel you need it. If you would like to see me, catch me after class to schedule a time, call, email, or stop by my office.

2. The **honor code** provisions as outlined in the *Catalog* and in the student handbook, *The Lair*, and on the web at http://www2.mercer.edu/HonorCouncil/default.htm apply to everyone and to all work handed in. By turning in a paper to the instructor, each student certifies that he/she has neither given nor received unauthorized aid in its completion. Plagiarism is a violation of the honor code and is prohibited. When in doubt, please ask to avoid potentially embarrassing situations.

3. Please turn off cell phones before entering the classroom.

4. Electronic communication is an important adjunct to face-to-face communication, including from professor to students, students to professor, and students to students. You must have regular access to your Mercer e-mail. If you do not have an active e-mail address on the first day of class, please secure one.

5. Students requiring accommodations for a disability should inform the instructor at the close of the first class meeting or as soon as possible. If you are not registered with Disability Services, the instructor will refer you to the Disability Support Services office for consultation regarding documentation of your disability and eligibility for accommodations under the ADA/504. In order to receive accommodations, eligible students must provide each instructor with a "Faculty Accommodation Form" from Disability Services. Students must return the completed and signed form to the Disability Services Coordinator on the 3rd floor of the Connell Student Center. Students with a documented disability who do not wish to use academic accommodations are also strongly encouraged to register with Disability Services and complete a Faculty Accommodation Form each semester. For further information, please contact Carole Burrowbridge, Disability Services Coordinator, at 301-2778 or visit the website at http://www.mercer.edu/stu_support/swd.htm

Tentative Course Coverage

Chapter

Introduction 1
Materals 2
- Fiber reinforcements
- Fiber forms
- Matrix materials

Manufacturing Processes 3
Micromechanics 4
- Basic concepts
- Models for stiffness
- Models for strength

Ply Mechanics 5
- Stress and strain
- Stress-strain relations for an orthotropic lamina
- Stress and strain transformations

Macromechanics 6
- Classical Lamination Theory (CLT)
- First-Order Shear Deformation Theory (FSDT)
- Common laminate types

Laminate Strength 7
- Lamina failure criteria
- Laminate first ply failure
- Laminate strength

Beams 10
Plates and Stiffened Panels 11
Design Examples
- Sandwich structures
- Composite pressure vessels