



Department of

Mechanical Engineering

M e r c e r U n i v e r s i t y

Syllabus for MAE 691
Special Topics: Continuum Mechanics
Fall Semester 2010
Meeting Days: Tuesday - Thursday
6:00 –7:15 pm
EGC Room 218

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

Office: Suite 105F, School of Engineering
Hours: MWF 9:00 am – 10:00 am
TTh 2:00 pm – 3:00 pm
and by appointment

Phone: 478-301-4061

Email: kunz_rk@mercer.edu

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Textbook:

Required

- *Romesh C. Batra, *Elements of Continuum Mechanics*, AIAA, 2006, ISBN-10: 1-56347-699-1, ISBN-13: 978-1-56347-699-0

Reference:

- *Theory and Problems of Continuum Mechanics*, G. E. Mase, Schaum's Outline Series, McGraw-Hill, 1970.
- *Continuum Mechanics*, A. J. M. Spencer, Dover, 1980.
- *Continuum Mechanics: Concise Theory*, P. Chadwick, Dover, 1999
- *Introduction to the Mechanics of Continuous Media*, L. E. Malvern, Prentice-Hall, 1969.
- *Mechanics of Continua*, A. C. Eringen, Krieger, 1980
- *A First Course in Continuum Mechanics*, Y. C. Fung, Prentice-Hall, 1969
- **Continuum Mechanics for Engineers*, 2nd ed., G. E Mase and G. T. Mase, CRC Press, 1999
- **Nonlinear Solid Mechanics: A Continuum Approach for Engineering*, G. A. Holzapfel, Wiley, 2000.

*Available in Tarver Library

Course Description:

Material and spatial descriptions of motion of a continuous medium. Kinematics of finite deformation. Definitions of stress. Balance principles: mass, momentum, and energy. General theory of constitutive equations. Application to elastic, hyperelastic, viscoelastic, and fluid continua.

Course Objectives: Provide a physically based but primarily analytical and theoretical introduction to the subject of continuum mechanics as preparation for advanced study in linear and nonlinear solid and fluid mechanics and the reading of current literature in these fields.

Develop the common foundations of solid mechanics and fluid mechanics in a unified manner:

- Kinematics of deformation, strain, strain rate, and flow
- Stress
- Balance laws of mass, momentum, and energy
- Constitutive equations

Apply the basic principles to specific classes of problems in solid and fluid mechanics

Prerequisites:

MAE 320: Solid Mechanics II, or equivalent

MAE 330: Fluid Mechanics, or equivalent

Grading:

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

Course Standards:

1. **Homework** problems will be assigned in class approximately weekly. They will generally be due at the start of the class one week after 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. **Tests:** There will be two 75-minute tests during the semester. No make-up tests will be given without a documented excuse. Test dates will be announced in class at least one week in advance.
4. **Final Exam:** There will be a comprehensive final exam.

Tentative Course Coverage

We will be covering the following chapters in some detail:

Chapter 1:	Introduction
Chapter 2:	Mathematical Preliminaries
Chapter 3:	Kinematics
Chapter 4:	The Balance Laws, Stress Tensors
Chapter 5:	Constitutive Relations

This will be followed by selected applications from solid mechanics and fluid mechanics (Chapters 6 – 10).

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 and pagers 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