

Solid Mechanics I (MCEN 5023)

Mechanics of Aerospace Structures (ASEN 5012)

Fall 2006

MWF 3:00PM-3:50PM

ECCR 200

http://www.colorado.edu/MCEN/MCEN5023/MCEN_5023.html

Mail List: mcen5023_2006@lists.Colorado.EDU

Course Description

Introduces tensor analysis, deformation and strain measurements, stress and its relation to force and moment, the basic principles of equilibrium, geometric compatibility, and material behaviors. Discusses energy methods, finite deformation theory, and constitutive equations. Applies these concepts to the analysis of some engineering problems.

Instructor

Dr. H. "Jerry" Qi
Office: ECME 124
Telephone: 2-1270
E-mail: qih@colorado.edu

TA

TBD
Office:
Telephone:
E-mail:

Office Hours

Instructor: WF: 4:00PM-6:00PM.

TA: TBD.

In addition to the regularly scheduled hours, the instructor and TA are also available by appointment.

Prerequisites

MCEN 2063 for ME; APPM 2360 and ASEN 2001, 2003, and 3112, or equivalent.

Reference Books

Elasticity in Engineering Mechanics, 2nd edition, by Arthur R. Boresi, Ken P. Chong. Wiley Interscience Publication, New York, 2000.

Classical and Computational Solid Mechanics, Fung, Y.C., Tong, P., World Scientific Publishing, Singapore, 2001

Nonlinear Solid Mechanics, A Continuum Approach for Engineering, Holzapfel, G.A., John Wiley & Sons, New York, 2000.

Continuum Mechanics: Concise Theory and Problems, Chadwick, P. Dover Publications, 1999.

Grading

Your grade in this course will be assessed by homework, exams, (projects), and class discussions. Grading will follow one of two options below, depending on the preference of the class.

Option A:

Homework 30%

Two mid-term exams: 30%

A project and presentation: 30%

Class discussion: 10%

Option B:

Homework 30%

Two mid-term exams: 30%

One two-hour final exam: 30%

Class discussion: 10%

Your final grade will depend on the overall performance of your classmates.

For the projects option, attendance of final presentation, which will take about two evenings, is mandatory for both in classroom full time students and distance learning students.

For distance learning students, there will be no class discussion requirement. The class discussion portion will be equally distributed into to midterm exams and projects (or final exams), i.e. two midterm exams will account 35% and final exam (or project) will account 35%.

Attendance

You are required to attend the class and are responsible for all materials and announcements in the class. Make-up class is only available in very special circumstances, such as illness.

Homework

Homework will be released on Wednesday on the website through an announcement via class e-mail list. Homework will be due next Wednesday before the class. E-mailing your homework is not accepted. Late homework will not be accepted unless arrangement is made with the instructor in advance and only under special circumstances, such as illness. Documents, such as doctor's note, should be presented to prove these special circumstances. Discussions on the homework are encouraged. Copying other people's homework, however, will result in no credit.

Joining E-mail List

All the students are required to join the e-mail list: mcen5023_2006@lists.colorado.edu. To join this list, send an e-mail to listproc@lists.colorado.edu with subject line empty and

SUBSCRIBE MCEN5023_2006 Your Name

as the content.

Policy Regarding Disabilities

If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and www.Colorado.EDU/disabilityservices.

Policy Regarding Religious Observance

Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, it is your responsibility to notify faculty at least two weeks in advance of the conflict to request special accommodation for your religious observance. In general, one day religious holiday is not qualified as a reason for a delayed homework. In the case of conflict of religious holiday with exam, special arrangement can be made.

Policy Regarding Classroom Behavior

Students and faculty each have responsibility for maintaining an appropriate learning environment. Students who fail to adhere to such behavioral standards may be subject to discipline. Faculty have the professional responsibility to treat all students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which they and their students express opinions. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

Sexual Harassment Policy

The University of Colorado Policy on Sexual Harassment applies to all students, staff and faculty. Sexual harassment is unwelcome sexual attention. It can involve intimidation, threats, coercion, or promises or create an environment that is hostile or offensive. Harassment may occur between members of the same or opposite gender and between any combination of members in the campus community: students, faculty, staff, and administrators. Harassment can occur anywhere on campus, including the classroom, the workplace, or a residence hall. Any student, staff or faculty member who believes s/he has been sexually harassed should contact the Office of Sexual Harassment (OSH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. Information about the OSH and the campus resources available to assist individuals who believe they have been sexually harassed can be obtained at:

<http://www.colorado.edu/sexualharassment/>

Policy Regarding University Honor Code

All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic

misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at <http://www.colorado.edu/policies/honor.html> and at <http://www.colorado.edu/academics/honorcode/>

Course Content

- 1. Concepts and Fundamentals of Scalar, Vectors, and Tensors**
 - a. Concepts of scalar, vectors, and tensors
 - b. Basic operations of scalar, vectors, and tensors
- 2. Stress and Strain Tensors**
 - a. Stress Tensor
 - i. Traction and stress tensor
 - ii. Stress transformation and Mohr's circle
 - iii. 3D Mohr's circle
 - iv. Stress invariant and stress
 - b. Equation of static equilibrium
 - c. Strain Tensor
 - i. Deformation and strain
 - ii. Strain tensor and transformation of strain tensor
 - iii. Stress invariant and stress deviations
 - d. Compatibility of strain fields
- 3. Linear Elasticity-Boundary Value Problem**
 - a. General Hooke's Law
 - b. Governing equations and uniqueness of boundary value problems
 - c. Saint Venant's theory of torsion
 - d. Plane stress and plane strain
 - e. Airy stress function in Cartesian coordinates
- 4. Energy Theorems and Variational Method**
 - a. Principle of virtual displacement; strain energy; complementary energy; Potential Energy; Energy principles
 - b. Variational Method
- 5. Constitutive Equations**
 - a. Classification of materials
 - b. Plastic material behavior
 - c. Constitutive equations for plasticity
- 6. Advanced Topics**
 - a. Finite deformation
 - b. Fracture Mechanics
 - c. Plate theory