MECH 6306.001
Continuum Mechanics
Spring Semester, 2017, TTh 4:00 - 5:15 pm, FN 2.106

Instructor:	Hongbing Lu, Professor, Associate Head for Graduate Program Office: ECSN 2.528 Phone: (972) 883-4647 Email: hongbing.lu@utdallas.edu
Office Hours:	Wednesdays: 9:00 am - 11:00 pm, ECSN 2.528 and other times as available.
Teaching Assistant:	Sadeq Malakooti Email: smalakooti@utdallas.edu
TA Office Hours:	Wednesdays: 1:30 – 3:30 pm, North Lab (Phone: 765 717 9731)
Prerequisites:	MECH 4301
Textbook:	None.
Course Description:	This course provides an introduction to mechanics of continua within a rigorous mathematical framework. Topics of interest include tensor analysis, kinematics, analysis of deformation, analysis of stress, and constitutive equations. Other areas of discussion focus on material anisotropy, mechanical properties of fluids and solids, derivation of field equations, boundary conditions, and solutions of initial and boundary value problems for continua.
Homework:	Homework will be assigned throughout the semester and must be turned in at the beginning of the class of the due day. No late homework will be accepted. Discussion of homework problems among students is acceptable; however, each student must sit down and work problems without assistance. A logical progression from problem to solution must be shown. It is not allowed to refer to last year's homework solutions.
Homework Solutions:	Homework Solutions will be posted on the website eLearning.utdallas.edu

Grade Basis:	Homework:	20 points
	Mid-term Exam #1	25*
	Mid-term Exam #2	25*
	Mid-term Exam #3	25*
	Final Exam	30
	Total	100

*The grades from the two better scores in the three mid-term exams will be used to calculate the overall grade of the course.

Policy on the Use of Electronics: Prohibited in class.

COURSE OBJECTIVES

A. Elements of Cartesian Tensors

- Indicial notation, definition of a Cartesian tensor, operations between tensors.
- Principal values and principal directions of second order tensors, symmetric and skew-symmetric tensors, spectral representation theorem.
- Decomposition theorems for second order tensors, including polar decomposition.
- Tensor calculus.

B. General Concepts

The motion and definition of a body, configurations of a body, deformations of a body, motions of a body. Admissible motions/deformations.

C. Kinematics
C1. Study of Deformations

- Displacement and deformation gradients.
- Locally volume preserving deformations, incompressibility, homogeneous deformations, rotations and stretches, polar decomposition.
- Special homogeneous deformations, general deformations, Lagrangian and Eulerian strain tensor fields, principal strains.

C2. Study of Motions

- Eulerian, Lagrangian velocity and acceleration fields, velocity gradient tensor field, stretching and spin tensor fields.
- Irrorational motions, rigid motions.

D. Kinetics

- Mass, mass density, mass conservation.
- Linear and angular momentum, force, traction, stress.
- Global linear and angular momentum balance, Cauchy's theorem, properties of Cauchy stress.
- Local version of balance laws, equations of motion, equilibrium equations.
- Principal Cauchy stress, power theorem, referential version of balance laws, nominal (Piola-Kirchoff) stress.

E. Constitutive Descriptions

Axiom of special classes of constitutive laws for the materials without memory.

F. Two Dimensional Problems

Plane stress and plane strain problems, deformation compatibility, Airy stress function. Asymptotic stress distribution in 2-D crack problems.

References

Mathematics:

Apostol, T. M., *Mathematical Analysis*, Addison-Wesley, 1974

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Thompson, P. A., *Compressible-Fluid Dynamics*, Maple Press Co., 1984.

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