H.L. Schreyer **ME 512: CONTINUUM MECHANICS** **FALL/2014**
TR 2:00-3:15 ME 214

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Office Hours: TR by appointment before or after class.

Course notes: Provided as PDF Files

Course Credit:	6 wk exam	20%
	12 wk exam	20%
	Final	40%
	HW	40%
	Worst 20% expunged.	

HW: One Assignment a week – given out on TH and due the following TH.
Your submission may be either paper or a PDF file. Handwritten quite OK. Material must be logically structured so I can follow what you are attempting to do – much more important than algebraic accuracy.

Exams: Closed book with heavy emphasis on definitions and short derivations. Old exams will be distributed.

CONTINUUM MECHANICS
Fall 2014 H.L. Schreyer

1. Course Objective:

The course is an introduction for engineers, physicists and applied mathematicians to the notations used in the field, to tensor calculus, to kinematics of deformation and to the basic principles that are common to all continuous media such as solid and fluid bodies. After taking this introductory material you will be in a position to read and enjoy most of the books listed as references.

2. Abstract:

Tensor calculus is the backbone for the course. Direct, indicial and matrix notations are introduced as convenient methods for representing tensors and components of tensors. Transformation relations, eigensystems and elementary tensor calculus complete this introductory phase.

The segment on kinematics of deformation includes reference and spatial gradient operators, rates of deformation, and a couple of measures of strain and their rates. The mappings that allow time derivatives to be taken inside a volume integral follow naturally. The background is then in place for developing any one of a number of strain tensors that exist in the literature.

Basic principles involving thermodynamics, momentum, moment of momentum and conservation of mass are introduced. The concepts of stress together with some of the various stress tensors arise naturally in this context.

Because of a lack of time, very little effort is spent on constitutive equations other than a discussion of objectivity. The more specialized courses of elasticity, plasticity and fluid mechanics are really applications of continuum mechanics with restrictions to particular constitutive assumptions.

3. Required Background:

Students at the senior or first year graduate level in engineering, mathematics and physics can handle the course if they are truly interested in the material. Normally students should have at least one, and preferably two, of the undergraduate courses on Mechanics of Materials, Vector Analysis and Linear Algebra

4. Course Text

There is no required text. I will be providing summary notes as we go along. This will cover the essential material and will closely follow the lectures.

A fairly complete, but old, set of notes will also be provided as a PDF file. The following table of contents for these notes provides a list of topics of which most, but not all, will be covered and some topics will be presented in a different order and with a different emphasis.

TABLE OF CONTENTS

References (In random order):

R. Brannon — All material by Professor Brannon – top notch. Links to some of her work will be provided later.

G.A. Holzapfel, (Highly recommended) — Nonlinear Solid Mechanics: A Continuum Approach J. Wiley & Sons, Ltd., 2000

L.E. Malvern — Introduction to the Mechanics of a Continuous Medium, Prentice-Hall, Inc., 1969

R.M. Bowen — Introduction to Continuum Mechanics for Engineers Plenum Press, NY, 1989

W.M. Lai, D. Rubin and E. Krempl — Intoduction to Continuum Mechanics Pergamon Press Inc., 1978

M.N.L. Narasimhan — Principles of Continuum Mechanics J. Wiley & Sons, Inc., NY, 1993

G.E. Mase and G.T. Mase — Continuum Mechanics for Engineers, CRC Press, 1992

Y.C. Fung — Foundations of Solid mechanics, Prentice-Hall, Inc., 1965

Y.C. Fung — A First Course in Continuum Mechanics Prentice Hall, 1977

T.J. Chung — Continuum Mechanics Prentice-Hall, Inc., 1988

D.C. Leigh — Nonlinear Continuum Mechanics, McGraw Hill, 1968

L.A. Segal — Mathematics Applied to Continuum Mechanics Dover, 1987 (Paperback)

P.G. Hodge, Jr., Engineers — Continuum Mechanics: An Introductory Text for McGraw-Hill, 1970.

D.S. Chandrasekharaiah and L. Debnath — Continuum Mechanics Academic Press, 1994

Related Topics

H.F. Davis and A.D. Snider	Introduction to Vector Analysis Allyn & Bacon, Inc., 1961, 4rth Ed. (Good book - proof of Stoke's Th'm without coords.)
C. Truesdell	Essays in the History of Mechanics Springer-Verlag, NY., Inc., 1968.
L. Brillouin	Tensors in Mechanics and Elasticity Academic Press, 1964
T.Y. Thomas	Concepts from Tensor Analysis and Differential Geometry Academic Press, 1964
H. Guggenheimer	Differential Geometry McGraw Hill, 1963