

**Course Information: MTH 444/544 Fundamentals of Applied Mathematics II  
Spring 2012  
B. Spencer**

**Course Description:**

This course develops the mathematical description of material behavior for solids, liquids and gases using the unified framework of continuum mechanics.

There are two main themes:

1. derivation of the equations governing material behavior
2. application of the equations to describe material phenomena

**Books:** both references will be available as a "coursepack" from Great Lakes Graphics and Printing in the UB Commons:

[LS] C.C. Lin and L.A. Segel, "Mathematics Applied to Deterministic Problems in the Natural Sciences" (SIAM, 1988), Chapters 13-15

[S] L.A. Segel, "Mathematics Applied to Continuum Mechanics" (Dover, 1987), Chapters 1-6.

**Prerequisites:**

- Students must have completed MTH 141, 142, 241, 306 with minimum grade C, preferably with grade B or above.
- Students should feel comfortable with lengthy calculations involving more than one page of work, have good working knowledge of "gradient, divergence and curl" as well as how to solve differential equations.
- While not required, some exposure to partial differential equations (e.g. MTH418 or other courses) and the physically-oriented view of science/engineering is beneficial.
- It is not necessary to have taken MTH 443/543.

**Tentative Outline of Topics:**

1. The continuum model of a substance (Ch 13 of [LS], 1 week)
2. Derivation of the equations of continuum mechanics (Ch 14 of [LS], 3 weeks)
3. Inviscid fluid flow (gas dynamics - sound waves, airplane lift) (Ch 15 of [LS], 2 weeks)
4. Introduction to tensors (Ch 1, 2 of [S], 1 week)
5. Viscous liquid flow (pipe flow, drag, boundary layers, liquid films) (Ch 3 of [S], 4 weeks)
6. Elastic solid behavior (stress in plates, sound propagation, earthquakes) (Ch 4-6 of [S], 3 weeks)

**Coursework/Grading:**

(tentative plan) 2 midterm exams (20% each), final exam(40%); homework (20%)