



## CE/EM 402/502: Introductory Finite Element Method Spring 2018

**Catalog Description:** (3 units) Theory and formulation procedures: energy and residual. One-dimensional problems: stress analysis in axial structures, steady and transient fluid and heat flow, consolidation, wave-propagation, beam-column. Two-dimensional problems: field and plane/axisymmetric, use of computer codes for solution to typical problems.

**Prerequisite(s):** CE 303, Advanced Standing.

**Course Objective:** To teach students the fundamentals of finite element analysis so that they can formulate finite element equations for solving one and two dimensional field problems (fluid flow, heat flow) and structural mechanics problems (stress, strain and displacement computation in bars, beams and frames). Students will also have hands on experience on using a commercial finite element code COMSOL Multiphysics.

**Instructor:** Professor Tribikram Kundu  
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**Class time & place:** Tu-Th 11-12:15 Meinel Optical Science, Room 432  
**Office Hours:** Tu-Th 9:30-10:45, Room # CE 324D

**Text:** *Introductory Finite Element Method*, C. S. Desai and T. Kundu, CRC Press, 2001, ISBN: 0-8493-0243-9

### Syllabus

#### Introduction:

Finite Elements, Nodes, Local and Global co-ordinates, Interpolation Functions

#### One-Dimensional Static Problems:

Stress Analysis, Fluid and Heat Flow Problems, Thermal and Initial Stress Problems.

#### One-Dimensional Time Dependent (Transient) Problems

Time Marching Technique using finite difference formulae for time derivatives

#### Beam Elements and Beam-Column Elements

#### Two Dimensional Problems

Constant Strain Triangles, fluid flow / heat flow field problems, Plane Stress / Plane Strain Problems

#### Quadrilateral Elements

Fluid flow / heat flow field problems, stress-strain problems

#### Variational Calculus for Finite Element Analysis

Use of variational calculus for forming functional needed to obtain the finite element equations.

### Grading Policy

Grades will be assigned based on the students' performance in the midterm (date will be announced in the class), final exam and homework. Weights for tests and homework are given below.

Homework & Term project*	30% (20% HW + 10% TP)
Midterm Exam	30%
Final Exam (May 8, Tuesday, 10:30 to 12:30)	40%

\*Term project is compulsory for graduate credit but optional bonus credit for undergraduate credit.

## **Free Webinar for learning COMSOL through step-by-step demonstration**

Go to link

<http://www.comsol.com/events/webinars/?topic=ALL&language=English>

### **Accessibility and Accommodations:**

It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, please let me know immediately so that we can discuss options. You are also welcome to contact Disability Resources (520-621-3268) to establish reasonable accommodations.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.