MECH4450 Introduction to Finite Element Analysis

Course Code: MECH4450	**Course Title:** Introduction to Finite Element Analysis
Required Course Or Elective Course: Elective	**Terms Offered (Credits):** Fall (3 credits)
Faculty In Charge: Wenjing Ye	**Pre/Co-Requisites:** MECH 2040
Course Structure: Lecture: 2 sessions/week, 80 minutes/session	
Textbook/Required Material: Notes from the instructor	
Course Description: Basic concepts of finite element methods; element equations for basic structural elements; implementation and application of FEM in 1-D and 2-D structural analysis and heat conduction	
Course Topics: 1. Introduction 2. Review of basic numerical methods 3. Finite element analysis of 1-D problems a. axially loaded bar b. heat conduction 4. Finite element analysis of truss structure 5. Finite element analysis of bending beam a. Shape functions b. Element equation c. Solution procedure and methods 6. Finite element analysis of 2-D problems a. Formulation of 2-D heat conduction b. Interpolation function and 2-D elements c. Assembly of stiffness matrix d. Solution of 2-D heat conduction problems 7. Finite element analysis of 2-D problems – applications in plane stress/plane strain a. Review of linear elasticity theory b. Finite element model of plane stress/plane strain 8. Advanced topics	
Course Objectives:	1. To teach students the basic principles of finite element methods. 2. To teach students the basic implementation method of finite element methods. 3. To teach students how to perform 1-D and 2-D structural analysis using finite element methods. 4. To teach students how to perform 1-D and 2-D heat conduction analysis using finite element methods.
Course Outcomes:	A. Students have a basic understanding of the principles and concepts related to finite element methods. B. Students are able to implement finite element methods for simple 1-D problems such as truss analysis and 1-D heat conduction either by hand calculation or by programming.

	C. Students are able to numerically solve for stresses, strains and deformation of a structural component due to axial load, torsion, and bending, acting individually or in combination. D. Students are able to numerically solve for temperature profile and heat flux in 1-D and 2-D heat conduction problems. E. Students are able to numerically solve for stresses, strains and deformation of a structure under either plane-stress or plane-strain conditions. F. Students have a basic knowledge about finite element methods for solving time-dependent and/or non-linear problems. G. Students are able to use commercial software package to perform structural analysis and heat transfer modeling, and are able to conduct engineering design in a team work environment .
Assessment Tools:	• Regular homework assignments -20% • In class discussion • Mid-term examination – 40% • Term project and presentation – 40%