Department of Mechanical Engineering Technology

Course number/name:
MECH 4730: Finite Element Methods

Credits/contact hours:
3 course credits, 2 classroom hours, 2 Lab hour

Instructor/coordinator:
Gaffar Gailani, Assistant Professor of Mechanical Engineering Technology

Text book/title/author/year

Specific course information
Catalog description:
The analysis of complex static and dynamic problems involves, in essence, three steps: selection of a mathematical model; analysis of the model; interpretation of the predicted response. The course will deal with deriving analytical solutions and comparing them with Finite Element Analysis.

Pre/Corequisites:
MECH3650, MAT2680

Required/elective/selected elective:
Required for Mechanical Engineering Technology and Industrial Design Technology

Course learning objectives:
1. Understand the fundamentals of FEA concepts.
2. Solve one-and two-dimensional structural and boundary value problems by FEM
   Evaluate and verify FE solutions
3. Apply FEA to the computer-aided design and optimization process
4. Effectively use a major FEA software tool
5. Broaden/enhance modeling, problem-solving and written communication skills

Course addresses ABET student outcomes: 3a, 3b, 3e, 3f, PC-1, and PC-2

Brief list of topics to be covered:

- Introduction to FEA and numerical methods. History of FEA, numerical methods, basic steps in finite element, some practical problems. Laboratory work: None


- Trusses. Definition, FE formulation, Examples using FE software, Verification of results, Laboratory work: FEA software.
• Axial Members, Beams, and Frames. Members under axial loading, beams, FE formulation of beams and frames, 3D beam element, FE software Example, Laboratory work: FEA software.

• 1-D elements. Linear elements; quadratic elements; cubic elements; global, local, and natural coordinates; isoparametric elements; numerical integration, examples, Laboratory work: FEA software.

• Analysis of 1-D problems. Heat transfer problems, a fluid mechanics problem, examples and verification of results, Laboratory work: FEA software.

• Design and material selection. Engineering design process; material selection; electrical, mechanical, and thermophysical properties of materials, fluid materials.

• Optimization in Design. Introduction to optimization; the design language; examples of batch files, examples of optimization files, Laboratory work: FEA software.

• Presentations and Design Project Due