### ME 305 COURSE PROFILE

**DEGREE PROGRAM:** Mechanical Engineering

<table>
<thead>
<tr>
<th>COURSE NUMBER: ME 305</th>
<th>COURSE TITLE: Introduction to Finite Elements in Mechanical Engineering</th>
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<tbody>
<tr>
<td>REQUIRED COURSE OR ELECTIVE COURSE: Elective</td>
<td>TERMS OFFERED: Fall, Winter</td>
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<tr>
<td>TEXTBOOK / REQUIRED MATERIAL: Course Pack</td>
<td>PRE / CO-REQUISITES: MECHENG 211, Math 216. I, II (3 credits)</td>
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<td>COGNIZANT FACULTY: X. Huan</td>
<td>COURSE TOPICS:</td>
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1. Anatomy of Finite Element Analysis
2. Uniaxial rod element: rod stiffness matrix
3. Finite element assembly process
4. Finite element solution techniques
5. Truss elements
6. Beam/Frame elements
7. Plate/shell elements
8. Structural analysis
9. Selected analysis types: static analysis, modal analysis, buckling analysis
10. Introduction to design optimization using finite elements
11. Use and application of commercial finite element software

| COURSE STRUCTURE/SCHEDULE: Lecture: 3 days per week at 1.0 hour |  |
**COURSE OBJECTIVES:**
for each course objective, links to the Program Outcomes are identified in brackets.

1. To teach students how to model and analyze mechanical systems using finite element analysis [1, 2, 6]
2. To teach students the underlying concepts of finite element analysis and finite element software [1]
3. To teach students the basic skills in using commercial finite element software and effective presentation of their analysis results [1, 2, 3, 6]
4. To reinforce students' understanding of engineering through the analysis of real-world problems [1]

**COURSE OUTCOMES:**
for each course outcome, links to the Course Objectives are identified in brackets.

1. Given a structural engineering problem, identify the necessary information required to conduct a structural analysis using finite element software [1, 2, 3]
2. Assess the quality of finite element models of mechanical systems [1, 2, 4]
3. Use finite element software to develop models of mechanical systems [1, 3, 4]
4. Interpret the solutions obtained from finite element analyses [3, 4]
5. Using finite element software, conduct structural analyses and selected other analysis classes, e.g., normal modes/natural frequency analysis, buckling analysis, design optimization [1, 3, 4]
6. Recommend finite element software based upon company/client needs [2, 3, 4]

**ASSESSMENT TOOLS:**
for each assessment tool, links to the course outcomes are identified

1. Regular, weekly in-class homework exercises
2. Out-of-class homework problems for realistic mechanical systems

PREPARED BY: G. Hulbert
LAST UPDATED: 06/08/2023 by K. Oldham, reviewed by X. Huan