# ME 412 COURSE PROFILE

**DEGREE PROGRAM:** Mechanical Engineering

<table>
<thead>
<tr>
<th>COURSE NUMBER: ME 412</th>
<th>COURSE TITLE: Advanced Strength of Materials</th>
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<tbody>
<tr>
<td>REQUIRED COURSE OR ELECTIVE COURSE: Elective</td>
<td>TERMS OFFERED: Fall</td>
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<td>TEXTBOOK / REQUIRED MATERIAL:</td>
<td>PRE / CO-REQUISITES: MECHENG 311. II (3 credits)</td>
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<td>COGNIZANT FACULTY: J. Barber</td>
<td>COURSE TOPICS:</td>
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<tr>
<td><strong>BULLETIN DESCRIPTION:</strong> Review of energy methods; Betti's reciprocal theorem; elastic, thermoelastic, and elastoplastic analysis of axisymmetric thick cylinders and rotating discs; bending of rectangular and circular plates, including asymmetric problems; beams on elastic foundations; axisymmetric bending of cylindrical shells; torsion of prismatic bars.</td>
<td>1. Review of energy methods, Betti's reciprocal theorem</td>
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<td>2. Axisymmetric thick cylinders and rotating discs, thermoelastic and elastoplastic analyses</td>
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<td>3. Beams on elastic foundations</td>
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<td>4. Axisymmetric bending of cylindrical shells</td>
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<td>5. Torsion of prismatic bars</td>
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<td><strong>COURSE STRUCTURE/SCHEDULE:</strong> Lecture: 2 days per week at 1.5 hours</td>
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### COURSE OBJECTIVES:
for each course objective, links to the Program Outcomes are identified in brackets.

1. To use advanced application of energy methods in structural analysis [1, 2, 6]
2. To teach students how to formulate problems involving axisymmetric thick cylinders and rotating discs [1]
3. To teach students how to solve problems involving axisymmetric thick cylinders and rotating discs for different surface conditions and temperature distributions [1, 2, 6]
4. To teach students how to determine the elastic and plastic response in axisymmetric thick cylinders and rotating discs [1, 2, 6]
5. To teach students how to formulate and solve problems involving beams on an elastic foundation [1, 2, 6]
6. To teach students how to formulate and solve problems involving axisymmetric bending of cylindrical shells [1, 2, 6]
7. To teach students how to formulate and solve the problem of the torsion of prismatic bars [1, 2, 6]

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

1. Apply Betti's reciprocal theorem [1]
2. Formulate problems involving axisymmetric thick cylinders and rotating discs [2, 3, 4]
3. Determine stresses and displacements in axisymmetric thick cylinders and rotating discs for different conditions at the surfaces, or due to temperature changes [2, 3, 4]
4. Determine stresses associated with plastic yield in axisymmetric thick cylinders and rotating discs [2, 3, 4]
5. Determine deflections and stresses in beams on an elastic foundation [5]
6. Determine stresses and deformations due to axisymmetric bending of cylindrical shells [6]
7. Determine stresses and deformations due to torsion of prismatic bars [7]

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

1. Regular homework assignments
2. Exam(s) and/or project(s)

PREPARED BY: J. Barber

LAST UPDATED: 5/11/2023 – K. Oldham