# ME 311 COURSE PROFILE

**DEGREE PROGRAM:** Mechanical Engineering

<table>
<thead>
<tr>
<th>COURSE NUMBER:</th>
<th>ME 311</th>
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</thead>
<tbody>
<tr>
<td>COURSE TITLE:</td>
<td>Strength of Materials</td>
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<tr>
<td>REQUIRED COURSE OR ELECTIVE COURSE:</td>
<td>Elective</td>
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<td>TERMS OFFERED:</td>
<td>Fall, Winter</td>
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<tr>
<td>PRE / CO-REQUISITES:</td>
<td>MECHENG 211, Math 216. I, II, IIIa (3 credits)</td>
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<tr>
<td>COGNIZANT FACULTY:</td>
<td>W. Lu</td>
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**BULLETIN DESCRIPTION:** Energy methods; buckling of columns, including approximate methods; bending of beams of asymmetrical cross-section; shear center and torsion of thin-walled sections; membrane stresses in axisymmetric shells; elastic-plastic bending and torsion; axisymmetric bending of circular plates.

**COURSE TOPICS:**

1. Castigliano's theorems
2. Rayleigh-Ritz methods
3. Beams with unsymmetric cross-sections
4. Buckling of columns
5. Elastic-plastic bending
6. Thermal Stresses

**COURSE STRUCTURE/SCHEDULE:** Lecture: 3 days per week at 1 hour
### COURSE OBJECTIVES:
for each course objective, links to the Program Outcomes are identified in brackets.

1. To use beams to introduce advanced concepts in solid mechanics [1, 2, 6]
2. To introduce student to the concepts in solid mechanics [1, 2, 6]
3. To teach students how to use the theorem of minimum potential energy [1, 2, 6]
4. To teach students how to use Castiglianos second theorem [1, 2, 6]
5. To teach students how to estimate a critical buckling load using an equilibrium approach [1, 2, 6]
6. To teach students how to use energy methods to estimate a critical buckling load [1, 2, 6]
7. To teach students how to account for plastic deformations in beams [1, 2, 6]

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

1. Apply the theorem of minimum potential energy [3]
3. Recognize when to use the theorem of minimum potential energy and Castigliano's second theorem [4]
4. Estimate the buckling load of a beam-column using the equilibrium method
5. Estimate the buckling load of a beam-column using the potential energy method [6]
6. Calculate stresses in a beam for elastic-plastic materials [1, 2, 7]
7. Calculate the limiting plastic moment for beam with symmetric cross-sections [7]

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

1. Regular homework assignments
2. Exams

**PREPARED BY:** A. Wineman  
**LAST UPDATED:** 6/5/2017 reviewed; no changes