

ME 412 COURSE PROFILE**DEGREE PROGRAM:** Mechanical Engineering

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| COURSE NUMBER: ME 412 | COURSE TITLE: Advanced Strength of Materials |
| REQUIRED COURSE OR ELECTIVE COURSE: Elective | TERMS OFFERED: Fall |
| TEXTBOOK / REQUIRED MATERIAL: | PRE / CO-REQUISITES: MECHENG 311. II (3 credits) |
| COGNIZANT FACULTY: J. Barber | COURSE TOPICS: <ol style="list-style-type: none"> 1. Review of energy methods, Betti's reciprocal theorem 2. Axisymmetric thick cylinders and rotating discs, thermoelastic and elastoplastic analyses 3. Beams on elastic foundations 4. Axisymmetric bending of cylindrical shells 5. Torsion of prismatic bars |
| BULLETIN DESCRIPTION: 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. | |
| COURSE STRUCTURE/SCHEDULE: Lecture: 2 days per week at 1.5 hours | |

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| <p>COURSE OBJECTIVES: for each course objective, links to the Program Outcomes are identified in brackets.</p> | <ol style="list-style-type: none"> 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] |
| <p>COURSE OUTCOMES: for each course outcome, links to the Course Objectives are identified in brackets.</p> | <ol style="list-style-type: none"> 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] |
| <p>ASSESSMENT TOOLS: for each assessment tool, links to the course outcomes are identified</p> | <ol style="list-style-type: none"> 1. Regular homework assignments 2. Exam(s) and/or project(s) |

PREPARED BY: J. Barber

LAST UPDATED: 5/11/2023 – K. Oldham