

## **ENGR 3024: Mechanics of Materials**

This course is required for all Engineering majors.

Course Coordinator:

William E. Howard

Catalog Description:

Study of the behavior of deformable bodies subjected to axial loading, torsion, and bending. Included are stress-strain relations, elastic deflections of beams, effects of combined loading, and buckling of slender columns. Failure criteria for ductile and brittle materials will be addressed. Laboratory exercises will reinforce the lecture material.

Course Structure:

Two 50-minute lectures and one two-hour laboratory/recitation session per week (three credits)

Prerequisites:

ENGR 2022 Statics and ENGR 2070 Materials and Processes

Required Materials:

1. *Mechanics of Materials, Sixth Edition*, R.C. Hibbeler, Pearson Prentice Hall, 2005. ISBN 0-13-191345

Course Outcomes:

- Upon completion of this course, students shall be able to:
- Analyze relationships between stress, strain and displacement in deformable bodies.
- Find the stress state of bodies subjected to axial, torsional, transverse, and/or bending loads.
- Find the displacements of bodies subjected to axial, torsional, and/or bending loads.
- Transform plane stresses into a different coordinate system
- Find principal stresses for a state of plane stress.
- Describe widely used failure theories for ductile and brittle materials.
- Find the stability limits of members subjected to axial compressive loads.
- Conduct experiments involving load, deflection, and/or strain measurements, analyze experimental data, and write concise laboratory reports.

Lecture Topics:

- Review: Rigid-Body Equilibrium (1 class)
- External and Internal Forces (1 class)
- Stress, Strain, and Deformation: Axial Loading (3 classes)
- Torsion (3 classes)
- Shear and Bending Moment Diagrams (4 classes)
- Stresses in beams (3 classes)
- Beam Deflections (3 classes)

- Combined Loading (4 classes)
- Failure Criteria (3 classes)
- Column Buckling (3 classes)

Laboratory/Recitation Topics:

Laboratory Topics:

- Tensile testing
- Shear stresses in bonded joints (2 sessions)
- Beam deflections
- Beam stresses
- Flexural testing
- Compression testing
- Buckling of thin rods

Recitation Topics:

- Shear and bending moment diagrams (spreadsheet exercise)
- Beam deflections (spreadsheet exercise)
- Introduction to the finite element method
- Exams (2 sessions)

Relevant Program Outcomes:

Graduates of the Engineering Program will demonstrate

- a) an ability to apply knowledge of mathematics, science, and engineering.
- b) an ability to design and conduct experiments, as well as to analyze and interpret data.
- e) an ability to identify, formulate, and solve engineering problems.
- g) an ability to communicate effectively.

Professional Component Content:

Math/Science: 0;            Engineering: 3 credits;            General Education: 0

Assessment Requirements:

Student Work Samples:

- Laboratory report (Outcomes b and g)
- Assignment demonstrating ability to solve mechanics of materials problems (Outcome e)

Targeted Exam Questions

- Solution of engineering problems (Outcome e)

Student Course Survey

Last Review:

September 20, 2006 by William E. Howard