ENGR 2103: Mechanics of Deformable Bodies

A. COURSE DESCRIPTION

Credits: 3
Lecture Hours/Week: 3
Lab Hours/Week: 0
OJT Hours/Week: *.*

Prerequisites:
This course requires the following prerequisite
ENGR 2101 - Statics (Number of Years Valid: 5)

Corequisites: None
MnTC Goals: None

This course explores the strength and physical performance of structures, both man-made and natural. Introduction to analysis of deformable bodies including stress and strain, Mohr’s circle, axially loaded members, deformations and displacements, elasticity and inelasticity, torsion, shear forces and bending moments, stresses and deflections of beams, statically indeterminate structures, column buckling, and centroids and moments of inertia. Students will learn about the concepts as the basis for the design and analysis of a wide variety of mechanical and structural systems.

B. COURSE EFFECTIVE DATES: 05/02/2024 - Present

C. OUTLINE OF MAJOR CONTENT AREAS

1. Define stress and strain
2. Recognize deformation of axially loaded members
3. Identify thermal deformation
4. Discuss torsion of circular bars
5. Draw shear force and bending moment diagrams
6. Discuss normal stress in beams
7. Describe properties of sections
8. Discuss shear stress in beams
9. Recognize built-up beams
10. Define elastic-perfectly plastic
11. Define unsymmetric bending
12. Define beam deflection
13. Apply curvature and beam deflection equation
14. Describe stress and strain transformation at a point
15. Define principal stresses and maximum shear stress
16. Discuss Mohr’s circle
17. Identify combined bending and axial loading

D. LEARNING OUTCOMES (General)
1. Solve problems involving the mechanical properties of materials under various types of loadings and calculate stresses and strains, and material deformation.

2. Demonstrate stress and strain in axially loaded structural members for uniform and nonuniform loading.

3. Demonstrate stress and strain in torsionally loaded structural members for uniform and nonuniform loading.

4. Compute the stress state both analytically and graphically at various orientation angles.

5. Compute the principal normal stresses and maximum shear stresses.

6. Sketch the shear force and bending moment diagrams and show the maximum shear and maximum bending moment for various types of beam loadings.

7. Calculate the normal and shear stresses in beams of various types of cross sections subjected to various loadings.

8. Compute stresses and strains in pressure vessels.

9. Compute stresses and strains in beams subjected to combined loadings.

10. Apply the equation of the deflection curve for various beam types and beam loadings for statically determinate and indeterminate beams.

E. Minnesota Transfer Curriculum Goal Area(s) and Competencies

   None

F. LEARNER OUTCOMES ASSESSMENT

   As noted on course syllabus

G. SPECIAL INFORMATION

   None noted