C-ID Descriptor
Strength of Materials

Descriptor Details

- **Descriptor Title**: Strength of Materials
- **C-ID Number**: 240
- **Units**: 3
- **Date of Last Revision**: 10/12/2017 11:44:08 PM GMT+0000

General Description

This course is a study of stresses, strains and deformations associated with axial, torsional and flexural loading of bars, shafts and beams, as well as pressure loading of thin-walled pressure vessels. The course also covers stress and strain transformation, Mohr's Circle, ductile and brittle failure theories, and the buckling of columns. Statically indeterminate systems are also studied.

Prerequisites

Engineering Statics (C-ID ENGR 130)

Corequisites

None

Advisories

None

Content

1. Review of Statics/Equilibrium/Factor of Safety
2. Stress and Strain
    a. Normal Stress/Strain Curves, Young's Modulus, Poisson's Ratio, Energy Density
    b. Shear Stress/Strain Curves, Shear Modulus, Shear Energy Density
    c. Plane Stress and Plane Strain
    d. General 3-D Stress-Strain relationships (optional)
3. Axial Members
    a. Members with constant internal force/area/material
    b. Members with varying (discontinuous/continuous) internal force/area
    c. Displacement Methods to determine movement of a point
    d. Energy Methods
    e. Statically Indeterminate Systems (optional)
4. Pressure Vessels (Thin-walled)
5. Torsion Members
    a. Members with constant internal force/area/material
    b. Members with varying (discontinuous/continuous) internal force/area
    c. Displacement Methods to determine movement of a point
    d. Statically Indeterminate Systems (optional)
6. Beams
    a. Shear and Moment Diagrams
    b. Bending Stress
    c. Beam Displacement
    d. Shear Stress
    e. Shear Flow
    f. Shear Center (optional)
    g. Statically Indeterminate Systems (optional)
7. Combined Loads and Stresses
8. Stress Transformation
    a. Transformation Equations
    b. Principal Stresses/Maximum Shear Stress
    c. Mohr's Circle
    d. Strain Transformation (optional)
9. Failure Criteria

a. Brittle Failure (Maximum Normal Stress)
b. Maximum Shear Stress (Tresca)
c. Maximum Strain Energy (von Mises)

10. Buckling of Columns

Lab Activities

None

Objectives

Upon successful completion of the course, students will be able to:

1. given a loading condition on a structural system. determine the forces (torques and/or moments) applied on each structural member of a system, and the internal forces and couples at internal sections.
2. given the forces (torques/moments) applied to structural members, identify the applicable theory, and apply the appropriate equations to calculate the internal stresses, strains and/or displacements,
3. perform coordinate transformations of the state of stress and strain at a point, including using Mohr's Circle.
4. determine if a structural system meets its design specifications, and/or determine how the system will fail, given or having calculated the stresses, strains and displacements.

Evaluation Methods

Tests, examinations, homework or projects where students demonstrate their mastery of the learning objectives and their ability to devise, organize and present complete solutions to problems.

Textbooks

Beer and Johnston, *Mechanics of Materials*

Gere and Goodno, *Mechanics of Materials*,

Hibbler, *Mechanics of Materials*

Leckie and Dal Bello, *Strength and Stiffness of Engineering Systems*