Course: CE 57000 – Advanced Structural Mechanics

Type of Course: Elective for CE program and ME program (Group 1).

Catalog Description: Studies of stress and strain, failure theories, and yield criteria; flexure and torsion theories for solid- and thin-walled members; and energy methods.

Credits: 3

Contact Hours: 3

Prerequisite Courses: CE 27000 or CE 27300

Corequisite Courses: None

Prerequisites by Topics:
1. Analysis of stress: concepts and definitions
2. Analysis of strain: concepts and definitions
3. Material properties and stress-strain relationships
4. Axial Loading applications and thin-pressure vessels
5. Torsional loading of circular shafts
6. Stresses in beams
7. Beam deflections
8. Buckling
9. Combined loading and yield theories of failure
10. Statically Indeterminate members
11. Thermal stress and strain


Course Objectives: This course is concerned with the development of analytical methods for solving problems in mechanics of materials that are generally considered beyond the scope of basic course in the discipline. As such, the developments tend to evolve from fundamentals principles such as equilibrium and conservation of energy.
Course Outcomes

Students who successfully complete this course will be able to:

1. Understand the concepts of three-dimensional stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials. [a, e]
2. Calculate the stresses and strains in axially loaded members, torsion of noncircular cross section members, and members subject to nonsymmetrical flexural loading. [a,e]
3. Calculate the stresses and strains associated with thick-wall cylindrical pressure vessels and rotating disks. [a, e]
4. Determine the stresses resulting from bending of curved beams and flat plates. [a, e]
5. Apply the theories of strength and fracture. [a, e]
6. Apply energy methods for the determination of the deflections and rotations. [a, e]
7. Design of beams, cylinders and shafts for allowable stresses and loads. [c, g, k]

Lecture Topics

1. Three-dimensional theories of stress
2. Three-dimensional theories of strain
3. Hooke’s law for orthotropic materials
4. Yield Criteria
5. Energy methods
6. Torsion of non circular sections
7. Unsymmetrical bending
8. Flexural stresses in curved beams
9. Shear center
10. Thick-wall cylinders
11. Flat plates
12. Fracture mechanics
13. Contact stresses
14. Applied elasticity

Computer Usage

Low

Laboratory Experience

None

Design Experience

Low

Coordinator

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Date

1 October 2015