# NOVA COLLEGE-WIDE COURSE CONTENT SUMMARY EGR 246 – MECHANICS OF MATERIALS (3 CR.)

#### Course Description

Introduces concepts of stress, strain, deformation, internal equilibrium, and basic properties of engineering materials. Analyzes axial loads, torsion, bending, shear and combined loading. Studies stress transformation, principal stresses, and buckling. Lecture 3 hours. Total 3 hours per week.

## **General Course Purpose**

Prepare students for further studies in branches of engineering requiring mechanics.

### Course Prerequisites/Corequisites

Prerequisites: EGR 240 or departmental approval.

### **Course Objectives**

- Critical Thinking
  - Use stress concentration factors to find stresses in, or allowable loads on, axially loaded members.
  - Solve problems using plane stress (or strain) transformation equations and Mohr's circle under combined loading conditions to identify principal stresses (or strain), along with maximum in-plane shear stress (or strain) and absolute maximum shear stress (or strain).
  - o Communication
  - Draw shear and moment diagrams for beams subjected to some combination of concentrated loads, distributed loads, and concentrated moments.
- Quantitative Reasoning
  - Apply the theory of solid mechanics to calculate forces, moments, stresses, and strains in a wide variety of structural members subjected to axial, torsion, transverse, and bending loads, both individually and in combination.
  - Use the stress-strain relationships for linear, elastic, homogeneous, isotropic materials and the basic properties of materials (e.g., elastic moduli, Poisson's ratio) to appropriately solve problems related to isotropic elasticity.
  - Analyze constrained and unconstrained members subjected to linear thermal expansion.
  - Analyze statically indeterminate structures to compute reactions and internal loading.
  - Calculate the stress in thin-walled pressure vessels.
  - o Calculate area moments of inertia including use of parallel axis theorem.
  - Calculate the deflection of a beam using multiple approaches (e.g., direct integration, superposition)
  - Calculate the critical buckling loads for columns with different boundary conditions.

## Major Topics to be Included

- Definition for stress
- Definition for strain
- Hooke's Law and material properties

- Uniaxial loading and superposition
- Stress concentrations
- Thermal loading
- Torsion of circular cross-sections
- Moments of inertia
- Normal and shear stress in beams
- Deflection of beams
- Buckling of columns
- Mohr's circle
- Stress and strain transformations
- Pressure vessels
- Combined loading of structural members