

# **COURSE OUTLINE**

**ENES-140**

**Mechanics of Materials**

**3 Credits**

## **HOWARD COMMUNITY COLLEGE**

### **Description**

The student will acquire a knowledge of the distortion of engineering materials in relation to changes in stress or temperature. The geometry of internal strain and external displacement will be studied. Applications will be presented and discussed which cover beams, columns, shafts, tanks and other structural machine and vehicle members. Prerequisite: ENES-120 and MATH-150 or MATH-182 or equivalent. (3 hours weekly)

### **Overall Course Objectives**

Upon completion of this course, the student will be able to:

1. Analyze a stress-strain diagram for a typical structural steel in tension.
2. Determine the normal stress and strain of members subjected to axial loads.
3. Determine the shear stress and strain of members subjected to bearing loads.
4. Compute the stresses in statically indeterminate structures.
5. Calculate the stresses set up in a bar due to temperature changes.
6. Explain the changes in stresses action on inclined planes.
7. Compute the shear stresses of solid or hollow shafts subjected to torques.
8. Analyze the structural effects of power transmission by circular shafts.
9. Discuss the shear forces and bending moments on various types of loaded beams.
10. Derive the relationships between load, shear force, and bending moment for a beam.
11. Construct shear force and bending moment diagrams for various types of loaded beams.
12. Develop the deflection curve of a beam.
13. Compute the normal strains and stresses in beams of different cross sections.
14. Evaluate the shear stresses in beams of different cross sections.
15. Design beams of various materials.
16. Compute the deflection of beam using integration or the moment-area method.
17. Design columns under different support conditions.

### **Major Topics**

- I. Stress and Strain
  - A. Stress and Strain Diagrams (Hooke's Law)
  - B. Axially Loaded Members
  - C. Statically Indeterminate Structures
  - D. Temperature and Prestrain Effects
  - E. Stresses on Inclined Sections

- II. Torsion and Loaded Beams
  - A. Torsion of Circular Bars
  - B. Transmission of Power by Circular Shafts
  - C. Shear Force and Bending Moment
  - D. Relationships Between Load, Shear Force and Bending Moment
  - E. Shear Force and Bending Moment Diagrams
  
- III. Stresses in Beams
  - A. Normal Strains and Stress in Beams
  - B. Cross-Sectional Shapes in Beams
  - C. Shear Stresses in Rectangular Beams
  - D. Shear Stresses in the Webs of Beams With Flanges
  - E. Built-Up Beams
  - F. Beams With Axial Loads
  
- IV. Deflection in Beams and Columns
  - A. Integration of Bending Moment Equation
  - B. Integration of the Shear Force and Load Equations
  - C. Moment-Area Method
  - D. Method of Superposition
  - E. Columns (Buckling and Stability)

### **Course Requirements**

Grading/exams: Grading procedures will be determined by the individual faculty member but will be based on homework, quizzes, unit tests, writing assignments and a final exam.

Writing: Specific writing assignments will be determined by the individual faculty member but will require at least 500 words. The writing assignments will deal with explanations of diagrams, methods of stress/deflection determination, procedures for solving problems in Mechanics of Materials, etc.

### **Other Course Information**

This course is an Arts and Sciences elective.