A. CATALOG DESCRIPTION
1. Credits: 3
2. Hours/Week: 3
3. Prerequisites (Course discipline/number): ENGR 2211 Statics
4. Co-requisites (Course discipline/number): None
5. MnTC Goals (if any): NA

This course includes the study and analysis of simple stress and strain, shear and bending moment, flexural and shearing stresses in beams, combined stresses, deflection of beams, statically indeterminate members, and columns.

B. DATE LAST REVISED (Month, year): October 2010

C. OUTLINE OF MAJOR CONTENT AREAS:
1. Stress
   a) Equilibrium of a deformable body
   b) Stress
   c) Average normal stress in an axially loaded bar
   d) Average shear stress
   e) Allowable stress
   f) Design of simple connection

2. Strain
   a) Deformation
   b) Strain

3. Mechanical properties of materials
   a) The tension and compression test
   b) The stress-strain diagram
   c) Stress-strain behavior of ductile and brittle materials
   d) Hooke's Law
   e) Strain energy
   f) Poisson's Ratio
   g) The shear stress-strain diagram
   h) Failure of materials due to creep and fatigue

4. Axial load
   a) Saint-Venant's Principle
   b) Elastic deformation of an axially loaded member
   c) Principle of superposition
   d) Statically indeterminate axially loaded member
   e) The force method of analysis for axially loaded members
   f) Thermal stress
   g) Stress concentrations

5. Torsion
   a) Torsional deformation of a circular shaft
   b) The torsion formula
   c) Power transmission
   d) Angle of twist
   e) Statically indeterminate torque-loaded members
   f) Stress concentrations
C. OUTLINE OF MAJOR CONTENT AREAS: Continued...

6. Bending
   a) Shear and moment diagrams
   b) Graphical method for constructing shear and moment diagrams
   c) Bending deformation of a straight member
   d) The flexure formula
   e) Asymmetric bending
   f) Stress concentrations

7. Transverse shear
   a) Shear in straight members
   b) The shear formula
   c) Shear stresses in beams
   d) Shear flow in built-up members
   e) Shear flow in thin-walled members

8. Combined loadings
   a) Thin-walled vessels
   b) State of stress caused by combining loadings

9. IX. Stress transformation
   a) Plane-stress transformation
   b) General equations of plane-stress transformation
   c) Principal stresses and maximum in-plane shear stress
   d) Mohr's circle-plane stress
   e) Absolute maximum shear stress

10. Strain transformation
    a) Plane strain
    b) General equations of plane-strain transformation
    c) Strain rosettes
    d) Material-property relationships

11. Design of beams and shafts
    a) Basis for beam design
    b) Stress variations throughout a prismatic beam

D. LEARNING OUTCOMES (GENERAL): The student will be able to:

1. Utilize statics to perform equilibrium analysis.
2. Draw the stress-strain diagram for an elastic material.
4. Perform engineering analysis on axially-loaded members.
5. Perform engineering analysis on torsion-loaded members.
6. Perform engineering analysis on members loaded in bending.
7. Draw shear and moment diagrams.
8. Perform engineering analysis on members loaded in transverse shear.
9. Perform engineering analysis on combined-loaded members.
11. Draw and use Mohr's Circle for stress-strain transformation analysis.
12. Design a beam.

E. LEARNING OUTCOMES (MNTC): NA
F. METHODS FOR EVALUATION OF STUDENT LEARNING:
The final grade is determined by:
1. Grades earned on homework problems
2. Periodic examinations,
3. Design project
4. Comprehensive final examination

G. SPECIAL INFORMATION (if any):
This course aligns with the following RCTC Core Outcomes:
1. Critical Thinking