MESABI RANGE COMMUNITY & TECHNICAL COLLEGE – VIRGINIA/EVELETH

Course Outline

Course Title: Mechanics of Materials
Semester Course Prefix and Number: ENGR 2430
Old Quarter Course Prefix and Number:
Submitted By: M. Threapleton
Approval Date: April 2002
Revision Date: April 2002

Number of Credits: 3
Semester(s) Offered:
Negotiated Class Size: 30
Number of Lecture Credits: 3
Number of Lab Credits:
Number of Lab Hours: 0
Number of Studio/Demonstration/Internship Credits:

Course Purpose Code:

_____ **0 –** Developmental Courses
_____ **1 –** Non-transferable, General Education
_____ **2 –** Technical course related to career programs
_____ **3 –** College course which has the primary goal of applying certain concepts (e.g. vocal ensemble)
X **4 -** Other college course not considered a part of general education (MNTC) e.g. computer science, health, physical education
_____ **5 –** Course which is intended to fulfill the Minnesota Transfer Curriculum (MNTC) requirements.
_____ **9 –** Continuing Education/Customized Training specialized credit course (not occurring in 0-5)

Catalog Description:
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.

Prerequisites and/or recommended entry skills/knowledge:
Course Prerequisite(s): ENGR 2410 – Statics
Reading Prerequisite: None
Composition Prerequisite: None
Mathematics Prerequisite: None

Career Programs and Transfer Majors Accessing this Course:
Engineering transfer students in aerospace, chemical, civil, and mechanical engineering.

Minnesota Transfer Curriculum Goal(s) partially met by this course if applicable: Notes: No more than two goals may be met by any one course. (Curriculum Committee review and the Chief Academic Officer's approval are required).

0. **X** None
1. _____ Communications
2. _____ Critical Thinking
3. _____ Natural Sciences
4. _____ Mathematical/Logical Reasoning
5. _____ History and the Social and Behavioral Sciences
6. _____ The Humanities and Fine Arts
7. _____ Human Diversity
8. _____ Global Perspectives
9. _____ Ethical and Civic Responsibility
10. _____ People and the Environment

Learning outcomes, including any relevant competencies listed in the Minnesota Transfer Curriculum:

The student will:

1. utilize statics to perform equilibrium analysis.
2. draw the stress-strain diagram for an elastic material.
3. use Hooke's Law to perform stress-strain analysis.
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.
10. perform stress-strain transformation analysis.
11. draw and use Mohr's Circle for stress-strain transformation analysis.
12. design a beam.
13. complete an extensive capstone design project in a team environment and submit a professional report.

Student assessment methods:

The final grade is determined by grades earned on homework problems, periodic examinations, a comprehensive design project, and a comprehensive final examination.

Use of instructional technology (includes software, interactive video and other instructional technologies):

The students will use Microsoft Office computer software, Graphical Analysis computer software, and computer projection equipment.

Outline of the major course content:

Stress

- A. Equilibrium of a deformable body
- B. Stress
- C. Average normal stress in an axially loaded bar
- D. Average sheer stress
- E. Allowable stress
- F. Design of simple connection

II. Strain

- A. Deformation
- B. Strain

III. 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

IV. 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

V. 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
VI. 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. Unsymmetric bending
   F. Stress concentrations
VII. Traverse 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
VIII. Combined loadings
   A. Thin-walled vessels
   B. State of stress caused by combining loadings
IX. Stress transformation
   A. Plane-stress transformation
   B. General equations of plane-stress transformation
   C. Principle stresses and maximum in-plane shear stress
   D. Mohr's circle-plane stress
X. Strain transformation
   A. Plane strain
   B. General equations of plane-strain transformation
   C. Strain rosettes
   D. Material-property relationships
XI. Design of beams and shafts
   A. Basis for beam design
   B. Stress variations throughout a prismatic beam

Additional special information (special fees, directives on hazardous materials, etc.)
A scientific calculator with exponential and logarithmic capabilities is required for this course. Engineer's paper will be required for all homework assignments.

Transfer Information: (Please list colleges/majors that accept this course in transfer.)
University of Minnesota; University of Minnesota-Duluth; Minnesota State University, Mankato; St. Cloud State University; Michigan Technological University; North Dakota State University; University of North Dakota all accept for engineering majors.

Approvals:

Body	Representative Signatures	Date
Curriculum Committee	Kim Giermann	April 2, 2002
Faculty Association	Georgia Suoja	April 8, 2002
Meet and Confer	Dr. Jill Peterson	April 17, 2002
Chief Academic Officer	Dr. Jill Peterson	April 17, 2002

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