Miami University
School of Engineering and Applied Science
Department of Engineering Technology

ENT 272	Mechanics II: Strength of Materials	3
Course Number	**Title**	**Credit Hours**

DESCRIPTION:
This course provides a comprehensive coverage of the important topics in strength of materials with an emphasis on engineering applications, problem solving and mechanical system analysis. It is the intension of this course to provide an appropriate coverage of principles of strength of materials, and problem-solving and design approach that is useful for the practicing designer or engineer. There is a heavy emphasis on the applications of the principles of strength of materials to mechanical problems while providing a firm foundation of understanding of those principles.

PERIODS PER WEEK: 2 Lecture, 1 Lab

PREREQUISITE(S): ENT 271 Mechanics I: Statics
CO-REQUISIRE(S): none

TEXT:
Applied Strength of Materials, ISBN 0-13-088578-9
Robert L. Mott, 4th Edition, Prentice Hall 2002

METHOD OF EVALUATION:
You will be graded on your performance on exams, quizzes, homework, and class projects. The following is a tentative breakdown of the distribution of the grading.

Homework Problems	25%
Assigned Projects	15%
Quizzes and Midterm	30%
Final Examination	30%

Homework assignments will be due on the assigned date before the beginning of the class. Work will not be accepted unless a valid reason is presented and prior arrangement has been made for late submission.
Additional information are on ENT server http://ent.ham.muohio.edu

OBJECTIVES:
Upon Completion of this course, students will be able to:
1. Apply elementary stress analysis and mechanical properties of materials for the purpose of designing simple structural and machine members

COURSE ASSESSMENT CRITERIA
This is course is a constitute course and is therefore not directly assessed. It will contribute to **Outcome 3** "The ability to apply creative technical skills to the analysis and design of mechanical components and systems."

ASSESSMENT TOOLS USED IN ENT 272
Employer Surveys
Graduate Surveys
Student Evaluations
Design/Lab Projects and Tests from ENT 272
Instructor Course Evaluation Form from ENT 272

TOPICAL OUTLINE

Chapter 1. Basic concepts in strength of materials
This section presents the basic concepts in strength of materials that will be expanded on in later chapters. Define the concepts of normal and shear stresses, normal and shear strain components, Poisson's ratio, and modulus of elasticity.
Problems: 41, 47, 65,70, 73
Chapter 2. Design properties of materials
Understand the stress-strain relationship, define the ultimate tensile strength, yield point, elastic behavior, and proportional limit of the materials. Also, define the Hook's law, and understand the ductile and brittle properties of metallic and non-metallic materials.
Problems: 8, 10,11, 18

Chapter 3. Design of members under direct stresses

The primary emphasis in this section is on design; where the designer must make decisions about the selection of materials, shapes, and sizes of load-carrying members. We will discuss the relationship among the design stress, allowable stress, and working stress, design factor, and factor of safety etc.

Problem: 3, 4, 7, 9, 22, 33, 34

Chapter 4. Axial deformation and thermal stresses

This section will extend your knowledge in deformation. Two main types deformations, elastic deformation due to the application of external loads, and thermal deformation due to change in temperature, will be studied. We will learn how to compute the amount of elastic deformation due to axial tensile or compressive loads. Also, define the coefficient of thermal expansion and compute the thermal deformation due to the change in temperature.

Problems: 4, 15, 16, 20, 24, 28, 30, 42, 49

Chapter 5. Torsional shear stress and torsional deformation

Learn how too compute the amount of torsional deformation in torsionally loaded member. Also, use the angle of twist equation in the analysis of a torsionally loaded member to ensure that the loaded member is safe for the applied torsional load and sufficiently rigid to perform properly.

Prolbems: 6, 9, 12, 19, 27, 32, 37

Chapter 6. Shearing forces and bending moments in beams

Determine the magnitude of shearing forces and bending moments anywhere within a beam due to several types of loading conditions such as concentrated loads, uniformly distributed loads, and concentrated moments, etc.

Problems: 5, 9, 18, 26, 40, 61, 74

Chapter 7. Review of centroids and moments of inertia of areas

Briefly review the centroids of simple and complex shapes, find the moment of inertia of the common cross-sectional areas of beams, and use the formulas to computer the moment of inertia of complex shapes by considering them as a composite of simple shapes and use the parallel axis theorem.

Problems: 5, 7, 11

Chapter 8. Stress due to bending

In this section, we will analyze the beams to find the stress due to bending. This will help us to determine the suitable materials, cross sectional shapes, and dimensions for a given design. We will learn to apply the flexural formula to compute the maximum stress due to bending of beams.

Problems: 8, 14, 20

Chapter 9. Shearing stresses in beams

The emphasis in this section is to study the shearing stresses in a beam. We will computer the magnitude of shearing stresses in a beam using general shear formula, compute the distribution of shear stress at any point on a cross-section, and learn how to determine the maximum shear stress.

Problems: 10, 15, 18, 59, 64

Chapter 12. Deflection of beams

The methods in analyzing beams for deflections under load are studied in this section. There are many ways to compute the deflections including formula method, superposition method, etc. Advantages and limitations of each method will be discussed in detail. We will be able to graphically show the relationships among the load, shearing force, bending moment, slope, and deflection curves for beams. Standard formulas will be used to compute the deflection curves for a beam. We will use the principle of superposition to solve problem of greater complexity. There are several computer-assisted beam-analysis programs to reduce the time and computation required to determine the deflection of beams. During this course, we will use ANSYS for validation and comparison of our computations.

Problems: 7, 22, 26

Chapter 14. Buckling of columns

Buckling of beams is an important concept. In this section, we will describe the phenomenon of elastic instability and use the Euler's formula for the computation of critical buckling load for long columns.

Miami University Learning Community:

Miami University is committed to fostering a supportive learning environment for all students irrespective of individual differences in gender, race, national origin, religion, handicapping conditions, sexual preferences, or age. Students should expect, and help create, a learning environment free from all prejudice. Disparaging comments, sexist or racist humor, or questioning the academic commitment of students based upon these individual differences are behaviors that undermine our leaning community. If such behaviors occur in class, please seek the assistance of your instructor or department chair.

Prepared by: Professor Gary Drigel April 5, 2007