COURSE OUTLINE

CIV229
Course Number

Mechanics of Materials
Course Title

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<th>Credits</th>
<th>Lecture/Laboratory Hours</th>
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<td>3/3</td>
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COURSE DESCRIPTION

With an introduction to engineering materials and their mechanical properties, examines strains that occur in elastic bodies subjected to direct and combined stresses, shear and bending moment diagrams, deflections of beams, and stresses due to torsion. Lab testing involves various materials such as cast iron, steel, brass, aluminum, and wood to determine their physical properties and to demonstrate various testing techniques. Fall Offering.

Text (s): Statics & Strength of Materials
Author: Cheng, Fa-Hwa
Publisher: McGraw Hill/Glencoe
ISBN#: 0-02-803067-2

Prerequisites: CIV106 with a minimum C grade

Co-requisites:

Course Coordinator: Jim Maccariella
Latest Review: Spring 2019
I. GENERAL OBJECTIVES

A. To provide the student with an understanding of the relationship between external forces applied to an engineering structure and the resulting action of the members of the structure.

B. To demonstrate that mechanics of materials is the basis of engineering design but it is not itself a course in design.

C. To utilize the student’s background in mathematics, physics, statics, and engineering drawing so that he may solve various mechanics of materials problems in a simple, logical manner.

D. To stimulate the student’s interest to investigate the many well-written texts on this subject.

Course Competencies/Goals:

The student will be able to:
1. Demonstrate basic engineering materials terminology.
2. Demonstrate the relationship between external forces member reactions.
3. Analyze various types of materials problems.
4. Generate and interpret loading diagrams.
5. Solve problems in a well-organized and logical manner.
6. Complete laboratory testing of various materials to determine their physical properties.
7. Demonstrate the relationship of engineering materials to the study of advanced topics in engineering.

Course-specific General Education Knowledge Goals and Core Skills.

General Education Knowledge Goals
Goal 1. Communication. Students will communicate effectively in both speech and writing.
Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

MCCC Core Skills
Goal A. Written and Oral Communication in English. Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.
Goal B. Critical Thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.
Goal F. Collaboration and Cooperation. Students will develop the interpersonal skills required for effective performance in group situations.

II. SPECIFIC OBJECTIVES

Unit I (3 weeks) INTRODUCTION (Stress-strain, Statics)

A. The student must be able to define the term “Strength of Materials” and clearly distinguish that only the basic fundamentals of Mechanics of Materials will be covered in this course and that advanced courses such as machine design, structural design, and others will cover specific details. (Course Competency 1; Gen Ed Goal 1; Course Skill A).

B. The student should be able to compute the stress or strain of an axial loaded member. He should also be able to determine shearing and bearing stresses. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Course Skills A, B & F).

C. He will review his statics to such an extent that he should be able to find the reactions in simple, overhanging, and cantilever beams loaded with concentrated, uniform and non-uniform loadings. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Course Skills A, B & F).
D. He will define centroid and moments of inertia, and be able to compute the same for a rectangle, circle, and triangle. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Corse Skills A, B & F).

E. He should also be able to draw free body diagrams and define equilibrium by numerically solving the free body diagram. He should also know the difference between a statically determinate and statically indeterminate structure. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Corse Skills A, B & F).

F. Complete laboratory testing and reports for various materials such as: cast iron, steel, brass, aluminum, and wood to determine their physical properties. (Course Competency 1, 2, 3, 4, 5, 6 & 7; Gen Ed Goals 1, 2 & 3; Corse Skills A, B & F).

Unit II (1 week) TORSION

A. The student will be able to solve for torsional stresses that are caused by twisting loads. He will study the effect of torsional or shearing stresses have on circular shafts (hollow and solid) and concern himself only with the maximum shearing stress. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Corse Skills A, B & F).

Unit III (3 ½ weeks) SHEAR AND MOMENT DIAGRAMS

The student will analyze the various methods and techniques of computing the shear and moments in beams. The method of drawing shear and moment diagrams in this unit will be called the conventional method. The method of approach will be as follows:

A. The basic methods of determining shear and moment will be made by taking a section of the beam and analyzing this section as a free body diagram; he will then write shear and moment equations. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Corse Skills A, B & F).

B. Shear and moment diagrams (graphs) will be constructed by substituting values into the shear and moment equations. Values of maximum moment will be calculated. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Corse Skills A, B & F).

C. Simplified (short-cut) techniques of construction of shear and moment diagrams will be developed and directly used to draw the diagrams. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Corse Skills A, B & F).

Unit IV (2 weeks) STRESSES IN BEAMS

A. In this unit, the flexural formula for beams will be derived and the student should list the assumptions that commonly are made in using this formula. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Corse Skills A, B & F).

B. He will solve the two general types of problems of analysis and design. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Corse Skills A, B & F)

1. In analysis, the student will be given the dimensions of the beam and will be asked to find the maximum stress for a given loading or the permissible loading for a given allowable stress.

2. In design, the student will be given the span length, loading conditions, and allowable stress and be asked to solve for the required dimensions of the cross-section of the beam.

3. The student will be introduced to standard, commercially available sections and will learn how to design a basic steel wide-flange member.
Unit V (1 week)  COMBINED STRESSES

A. The student should be able to solve problems for stresses in beams that are caused by both axial loads and bending loads. He will solve these problems by use of the combined stress formula. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Course Skills A, B & F).

B. He should be able to manipulate the equation so that any one of the variables, if unknown, could be computed (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Course Skills A, B & F).

Unit VI (3 weeks) DEFLECTION IN BEAMS

A. The student will be able to solve for deflections in cantilever, simple, and overhanging beams for both maximum deflection and the deflection at a particular location. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Course Skills A, B & F).

B. Methods of computing deflections will be discussed but the student will master the area-moment method. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Course Skills A, B & F).

C. He shall see that excessive deflections of beams (or other similar structures) would also cause failure. (Course Competency 1, 2, 3, 4, 5, 6 & 7; Gen Ed Goals 1, 2 & 3; Course Skills A, B & F).

D. Reinforce the student’s ability to solve for deflections in beams, he will also learn a new method of drawing moment diagrams (moment diagram by parts). This method of drawing moment diagrams will enable the student to solve problems by a simpler approach, as far as the mathematics involving areas and centroids is concerned. He/she will compare this method (conventional method) and show that both methods are legitimate. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Course Skills A, B & F).

Unit VII (1 ½ weeks) INDETERMINATE STRUCTURES

A. The student will use the area-moment method to solve for the reactions of indeterminate structures. He will show that by adding additional supports to a beam – which may make it indeterminate – that it becomes more rigid and that the maximum moment decreases. (Course Competency 1, 2, 3, 4, 5 & 7; Gen Ed Goals 1, 2 & 3; Course Skills A, B & F).

B. He will do this by drawing the conventional shear and moment diagrams for the indeterminate beam and compare them to the statically determinate beam.

III. METHOD OF PRESENTATION

A lecture/discussion approach is used and transparencies taken from the course text are used as well as printed handouts made by the instructor. Class participation is emphasized by asking the students questions on their reading assignments, homework problems, or actual field experience. Transparencies will also be used to review test problems.

IV. EVALUATION

A test is given at the end of Units I & II, III, IV & V, and VII. The length of the test is approximately 1 ½ hours. It will include four or more problems covering the materials of the respective units.

A quiz will be given every week which will be approximately 5-10 minutes long. These quizzes will cover the material which was included in the homework and reading assignments. Homework assignments will be collected periodically and graded instead of giving a quiz.
**Academic Integrity Statement**

Students are expected to comply with the college-wide requirements for academic integrity. Mercer County Community College is committed to Academic Integrity—the honest, fair, and continuing pursuit of knowledge, free from fraud or deception. This implies that students are expected to be responsible for their own work. Presenting another individual’s work as one’s own and receiving excessive help from another individual will qualify as a violation of Academic Integrity. The entire policy on Academic Integrity is located in the Student handbook and is found on the college website:  
(http://www.mccc.edu/admissions_policies_integrity.shtml)

V. **GRADING SYSTEM**

(1) Quizzes (20%)
(2) Lab (20%)
(3) Tests (45%)
(4) Final Exam (15%)

VI. **REFERENCES**


Mercer County Community College is committed to ensuring the full participation of all students in all activities, programs, and services. Please refer to the Student Handbook to review accommodations available for Students with Special Needs.