

Western Michigan University
Department of Industrial and Manufacturing Engineering
IME 2810 (Statics and Strength of Materials)
Spring 2011

Instructor: Alamgir A. Choudhury
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Class: T 5:30 – 7:20 PM, CEAS D-205
R 5:30 – 7:20 PM, CEAS D-206
Office hours: MW11:00 AM -1:00 PM

Catalog Description: Forces on structures, moments, equilibrium. Stresses and deformation in axially-loaded members, torsion members and beams. Elementary design of structural members.

Prerequisites: MATH 1220 or MATH 1700 or MATH 2000 and basic knowledge in algebra, geometry, trigonometry and vector.

Text (Required):

Spiegel, L. and Limbrunner, G., Applied Statics and Strength of Materials, 5th Edition, Prentice Hall Inc., 2009.

Reference (Optional):

Hibbeler, R. C., Statics and Mechanics of Materials, Prentice Hall Inc., 2004.

Learning objective¹:

1. Understand how to establish static equilibrium in rigid bodies. (a,b,d,f)
2. Know how to draw the free-body diagram for a rigid structure. (a,b,d,f)
3. Be able to resolve multiple component forces into one resultant force. (a,b,d,f)
4. Be able to break down forces into components to facilitate analysis. (a,b,d,f)
5. Understand how force couples and moments are related. (a,b,d,f)
6. Be able to develop shear, and bending moment diagrams on beams. (a,b,d,f)
7. Be able to calculate centroids and moments of inertia for beam cross sections. (a,b,d,f)
8. Understand the concept of stress as it developed from axial, bending, and torsional loads. (a,b,d,f)

(Letter in parenthesis refers to ABET EAC Criterion 3 / TAC Criterion 2, categories a – k.)

Evaluations: Grade in this class will be based on a modified class average according to the following schedule. A minimum of 60% is required to receive a passing grade in this course.

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|----|----------------------------------|-------|
| 1. | Homework and computer assignment | (30%) |
| 2. | Quizzes | (15%) |
| 3. | Midterm | (25%) |
| 4. | Final | (30%) |

Quiz: One quiz per week. Quiz day may not be announced in advance. There is no makeup for missed quizzes.

Performance Criteria:

1. Ability to apply static equilibrium conditions for solving both internal and external forces on structure or rigid body [1,2,3,4]
2. Knowledge of how boundary conditions affect loading [1,2,3,4]
3. Understanding of internal force and moment distribution in a structural member [1,2,3,4]
4. Knowledge of axial, bending, shear and torsional stresses due to loading conditions. [1,2,3,4]

(Number in parenthesis refers to the evaluation method)

Calculus usage: Calculus will be used to clarify the concepts of centroids and moments of inertia.

Homework: 4-6 problems will be assigned every class. It is due at the beginning of next class. All homework should be completed according to the format provided in *Homework Procedure Handout*. Late submission: Late homework grades will be reduced by 10% per day. No late work will be accepted after the graded assignment is returned. Irrespective of study habit all work submitted should be done individually. This class will be conducted on an interactive basis, i.e., during discussion of concepts and problem solving, your participation is expected. Attendance and punctuality is essential for success in this class.

For the purpose of assigning final grades, the following scale will be used.

| <u>Grade</u> | <u>Range</u> |
|--------------|--------------|
| A | 90 – 100 |
| B/A | 88 – 89.9 |
| B | 80 – 87.9 |
| C/B | 78-79.9 |
| C | 70 – 77.9 |
| D/C | 68 – 69.9 |
| D | 60 – 67.9 |
| F | Below 60 |

Note: Cell phone use is not allowed during class time. Turn off and put them away.

Academic Honesty: You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate and Graduate Catalogs that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. [The policies can be found at <http://catalog.wmich.edu> under Academic Policies, Student Rights and Responsibilities.] If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.

Course schedule:

| <u>Week</u> | <u>Topic</u> | <u>Chapter</u> | |
|------------------|---|--------------------------|---|
| 1. (Jan 11, 13) | Introduction | 1 | } |
| 2. (Jan 18, 20) | Principles of statics | 2 | |
| 3. (Jan 25, 27) | Resultants of coplanar force systems | 3 | |
| 4. (Feb 1, 3) | Equilibrium of coplanar force system | 4 | |
| 5. (Feb 8, 10) | Analysis of structures | 5 | |
| 6. (Feb 15, 17) | Analysis of structures | 5 | |
| 7. (Feb 22, 24) | Review and MIDTERM (2/24/2011) | 1-5 | |
| 8. (Mar 1, 3) | Spring break – No classes | -- | |
| 9. (Mar 8, 10) | Centroid and area moments of inertia | 7, 8 | |
| 10. (Mar 15, 17) | Stress and strain concepts | 9 | } |
| 11. (Mar 22, 24) | Stress, strain and material properties | 10, 11 | |
| 12. (Mar 29, 31) | Torsion in circular sections | 12 | |
| 13. (Apr 5, 7) | Shear force and bending moment in beams | 13 | |
| 14. (Apr 12, 14) | Stresses in beams | 13, 14 | |
| 15. (Apr 19, 21) | Stresses in beams and review | 14 | |
| 16. (Apr 26) | FINAL – COMPREHENSIVE | Chapter 1-5, 7-14 | |
| | Date and time: Tuesday, April 26, 7:15 – 9:15 PM | | |