ME 305: Mechanics of Materials - Spring 2015

Professor Douglas P. Holmes – *dpholmes@bu.edu*

Lecture - Four Credits
205 Photonics
Tuesday & Thursday
8:00a.m. – 10:00a.m.

Office: 730 Commonwealth Ave., EMA 213
Phone: (617) 358-1294
Office Hours: Wed. 1:00p.m.– 3:00p.m.
Thurs. 1:00p.m.– 3:00p.m.

Prerequisite: EK 301: Engineering Mechanics I
Teaching Fellow: Xin Jiang (ssjiang@bu.edu), Zenan Qi (zenanqi@bu.edu)
Course Website: Blackboard (https://learn.bu.edu)

Textbook:
Mechanics of Materials, 9^{th} *Ed.*,
R.C. Hibbeler, Pearson Prentice Hall, 2014

Course Description:
Concepts of stress, strain, and deformation. Factor of safety. Stress-strain relationships and material properties. Stress concentrations. Area moments of inertia. Axially loaded members, torsionally loaded members, bending of beams. Shear and moment diagrams. Stresses due to combined loading. Thin-walled pressure vessels. Transformation of stress including Mohr's circle. Beam deflections and buckling stability.

Goals:

1. To identify and calculate stresses in various engineering structures.
2. To determine how mechanical structures deform in response to external loads.
3. To understand how stress and strain combine to enable problems with complex loads to be solved.

Learning Objectives:

1. Calculate stresses (normal, shearing) in a structure or machine component under various loading conditions.
2. Find stresses in, or allowable loads on, axially loaded members using stress concentration factors.
3. Calculate normal and shearing strains/deformations for bodies subjected to loads and/or temperature changes.
4. Design members using criteria based on strength and/or deformation.
5. Solve statically indeterminate problems subjected to one or a combination of axial, torsion, and bending loads.
6. Apply Hooke's Law in one, two, and three dimensions.
7. Determine stresses and/or deformations in a circular member subjected to torsional loading.
8. Solve problems using stress transformation equations and Mohr's circle.
9. Calculate stresses in thin-walled pressure vessels.
10. Draw shear and moment diagrams for beams subjected to some combination of concentrated loads, distributed loads, and concentrated moments.
11. Calculate normal and shearing stresses in beams.
12. Determine the deflections of statically determinate and indeterminate beams using double integration and superposition.
13. Apply Euler's equation to solve buckling problems for various end conditions.

Course Schedule (Tentative):

Wk.	Dates	Subjects	Reading	Homework
1	Jan. 20^{th}, 22^{nd}	Average normal and shear stresses, factor of safety	1.1-1.2, 1.3-1.6	HW 1
2	Jan. 27^{th}, 29^{th}	Average normal and shear strains, Hooke's law	2.1-2.2, 3.1-3.2, 3.6-3.7	HW 2
3	Feb. 3^{th}, 5^{th}	Axial loading, statically indeterminate, thermal effects	4.1-4.2, 4.3-4.6	HW 3
4	Feb. 10^{th}, 12^{th}	Torsional deformation and shear strain, power transmission		
5	Feb. 17^{th}, 19^{th}	Angle of twist, statically indeterminate shafts, *Review*	5.1-5.5	HW 4
6	**Feb. 24**th, 26^{th}	**Test 1**, Moments of area, shear & moment diagrams	A.1-A.2, 6.1-6.2	HW 5
7	Mar. 3^{th}, 5^{th}	Bending deformation and stress in prismatic beams	6.3-6.5	HW 6
	Spring Break			
8	Mar. 17^{th}, 19^{th}	Deformation and stress under transverse shear	7.1-7.3	HW 7
9	Mar. 24^{th}, 26^{th}	Shear flow in built-up members, pressure vessels	8.1-8.2	HW 8
10	Mar. 31^{st}, Apr. 2^{nd}	Stress transformation, & principal stresses		
11	Apr. 7^{th}, 9^{th}	Mohr's circle (2D & 3D), maximum shear stress	9.1-9.4	HW 9
12	Apr. 14^{th}, **16**th	*Review*, **Test 2**		
13	Apr. 21^{st}, 23^{rd}	Deflection of beams, Elastic curve and superposition	11.1-11.2, 12.1-12.2	HW 10
14	Apr. 28^{th}, 30^{th}	Statically indeterminate beams, buckling of columns	12.5-12.9, 13.1-13.3	HW 11
		Final Exam – May 8th (Fri.) 9:00a.m. – 11:00a.m.		

Mastering Engineering:
In this course, we will use Mastering Engineering (*www.masteringengineering.com*) for completing all of our homework and extra credit assignments. The Course ID is: **MEHOLMES29467**.

Grading:
All homework will be completed through the Mastering Engineering platform. There will be one homework assignment due each Sunday at 11:59p.m., except during exam weeks. There will be three exams, plus one final exam. Each homework assignment will be worth 10 points (unless otherwise noted), and will be graded through the Mastering Engineering platform. Additionally, there will be one optional Tutorial assignment on Mastering Engineering per week that will be worth 2 points of extra credit towards your overall homework grade. Your overall grade will be determined by the following weighting:

Homework	5%
Quizzes	5%
Lab Reports	15%
Course Project	15%
Tests	60%

Final Examination:
The Mechanics of Materials Final Exam is scheduled for 9:00 a.m. – 11:00 a.m., Friday, May 8^{th}, 2014 in PHO 205.

Exceptions:
Missed homework assignments and examinations will only be excused with *written permission from the Office of the Dean of the College of Engineering.* If an assignment is missed and properly excused, you will have a week upon return to complete the assignment. All complaints related to grading labs, projects and exams must be reported to the instructor within one week after the grades are announced.

Important Dates:

February 2^{nd}, 2015: Last day to ADD classes.
February 24^{th}, 2015: Last day to drop without a 'W' grade.
April 3^{rd}, 2015: Last day to DROP with a 'W' grade.
April 15^{th}, 2015: Last day to officially take a Leave of Absence or Withdraw from the University for Spring 2015.
May 1^{st}–May 4^{th}, 2015: Study Period.

Discussion Sections:
All discussion sections are open to any student enrolled in the course. The discussion sections will focus on solving problems assigned for homework and other, similar problems.

1. Mon. 2:00p.m. – 3:00p.m. BRB 122
2. Mon. 4:00p.m. – 5:00p.m. PSY B36
3. Wed. 4:00p.m. – 5:00p.m. PSY B40
4. Thu. 10:00a.m. – 11:00a.m. PSY B42

Labs (in EPIC):
There will be three laboratories in the course. Laboratory scheduling will be accomplished by a sign-up sheet outside the main laboratory for the course: Room B01, 110 Cummington Mall (ENG).

1. Mon. 12:00p.m. – 2:00p.m.
2. Tue. 6:00p.m. – 8:00p.m.
3. Wed. 12:00p.m. – 2:00p.m.
4. Thu. 4:00p.m. – 6:00p.m.

Academic Conduct:

1. Students must follow the COE Academic Conduct Code, which is found in the COE Undergraduate Student Handbook (www.bu.edu/academics/eng/policies/academic-conduct/). Any violation of this conduct code will be reported to the COE Academic Conduct Committee.
2. Plagiarism is discussed briefly in the conduct code. However, for several reasons, this subject warrants additional emphasis. In engineering, just as in humanities, science, and social science disciplines, plagiarism is unacceptable. Plagiarism is theft of another person's ideas and is a punishable offense in the same way that any form of theft is an offense. Plagiarism harms the individual whose ideas have been stolen. Original thought is highly valued in engineering and is expected from students in this course in preparing and completing all course assignments.
3. Quizzes and Exams: These assignments are to be completed by each student individually with no consultation with any other person other than the proctor. All quizzes and exams are closed note and closed book.
4. Homework, Lab Reports, and Course Project: Students are permitted to consult with each other regarding approaches to solving problems in these assignments. However, everything that is written down and turned in must be authored by the student getting credit for the assignment, and any sources that were consulted while completing the assignment must be referenced. For example, if you consult with another person in preparing one section of a laboratory report, you should write "Consulted with <person's name> in preparing this section" in that section of the report. Similarly, if you consult with a textbook other than the course text or a webpage, acknowledge this in writing in the relevant section of the report or project.

How to Succeed in ME 305:

1. Don't fall behind.
2. Work lots of problems. Work through them more than once. Work problems not assigned.
3. Do the reading.
4. Understand the Statics: Draw careful and neat Free-Body Diagrams.