

Lehigh University - Department of Mechanical Engineering and Mechanics

MECH 12 – Strength of Materials

Fall 2015

Class Meetings: Mon., Wed., & Fri. (9:10 – 10:00 AM; WH 203)

Instructor: Prof. Webb (PA 265)

Office Hours: please email to schedule

TAs: I-Han Liu and Abdullah Alghafis

Textbook: Beer, Johnston, DeWolf, and Mazurek, *Mechanics of Materials*, 7th ed. McGraw-Hill, 2014.

No	Day	Date	Topic to be Covered	Reading	HWK Assigned	Assignments Due
1	M	Aug. 24	Review of Axial Stress, Strain, and Deformations	Chapter 1; 2.1-2.2	W1, 2.24, 43	
2	W	Aug. 26	Finite Element Method Introduction; Element Stiffness Matrix for 1-D Bar	Notes #1 (pp. 1 – 3)	1, 2 (Notes #1)	W1, 2.24, 43
3	F	Aug. 28	Global Stiffness Matrix for 1-D Bar	Notes #1 (pp. 3 – 9)	3, 4	1, 2 (Notes #1)
4	M	Aug. 31	Wrap-up 1-D Bar FEM; Matlab System of Equation Solver; Intro to 2D Truss Elements	Notes #1a; Notes #2 (pp. 1-4)	5, W2	3, 4
5	W	Sep. 2	2-D Element Stiffness Matrix for Trusses; Project 1a Assigned	Project 1a Description	1, 2 (Notes #2)	5, W2
6	F	Sep. 4	Global Stiffness Matrix for Trusses; Proj. 1b Assigned	Notes #2 (pp. 5 – 12)	3, 4, 5	1, 2 (Notes #2); Proj. 1a
7	M	Sep. 7	2D Truss Elements and Reaction Forces; Truss Analysis using Autodesk Sim. Mechanical®	Notes #2a; Tutorial #1	W3	3, 4, 5
8	W	Sep. 9	Review of Beam Bending; Project 1c Assigned	4.1-3; Appendix A	4.3, 11, 19	W3; Project 1b
9	F	Sep. 11	Composite Beams	4.4 and Notes #3	4.38, 41, 56	4.3, 11, 19
10	M	Sep. 14	Plastic Deformation of Beams; Project 1d Assigned	4.6-4.6A	4.71, 76, 80	4.38, 41, 56 Project 1c
11	W	Sep. 16	Plastic Collapse and Residual Stresses	4.6B-4.6C	4.85, 90, 92	4.71, 76, 80
12	F	Sep. 18	Eccentric Axial Loading	4.7	4.103, 106, 115	4.85, 90, 92 Project 1d
	M	Sep. 21	** Class canceled **			
13	W	Sep. 23	General Eccentric Axial Loading	4.9	4.144, 146, 149	4.103, 106, 115
14	F	Sep. 25	Wrap-up Chapter 4			4.144, 146, 149
15	M	Sep. 28	Review			
	W	Sep. 30	4 o'clock Exam No. 1 (during class)			
16	F	Oct. 2	Transverse Loadings on Beams	6.1A	6.2, 3, 6	
17	M	Oct. 5	Shearing Stresses in Beams	6.1B-6.1C	6.13, 22, 24, 26	6.2, 3, 6
18	W	Oct. 7	Longitudinal Shearing Stresses in Beams; Thin Walled Beams	6.3-4	6.30, 34, 36	6.13, 22, 24, 26

19	F	Oct. 9	Stress under Rotation of Axes	7.1	7.6, 10, 15, 20	6.30, 34, 36
	M	Oct. 12	*** Pacing Break ***			
20	W	Oct. 14	Mohr's Circle for Stress in 2-D	7.2	7.42, 48, 52	7.6, 10, 15, 20
21	F	Oct. 16	Principal Stresses in 3-D	7.3-4	7.66, 73, 77	7.42, 48, 52
22	M	Oct. 19	Yield Criteria for Ductile Metals	7.5A	7.83, 84, 85, 86	7.66, 73, 77
23	W	Oct. 21	Thin-walled Pressure Vessels	7.6	7.119, 122, 125	7.83, 84, 85, 86
24	F	Oct. 23	Stresses under Combined Loading	8.3	8.37, 39, 40	7.119, 122, 125
25	M	Oct. 26	Stresses under Combined Loading (cont.)	8.3	8.41, 44, 51	8.37, 39, 40
26	W	Oct. 28	Project discussion; conclude combined loading			8.41, 44, 51
27	F	Oct. 30	Shear and Bending Moment Diagrams; Design of Beams	5.1-3	5.155, 5.157 6.18	
28	M	Nov. 2	Review			5.155, 5.157 6.18
	W	Nov. 4	4 o'clock Exam No. 2 (during class)			
29	F	Nov. 6	Singularity Functions and Shear/Moment Diagrams	5.4	5.99, 103, 105	
30	M	Nov. 9	Beam Deflections by Integration	9.1	9.7, 11, 18	5.99, 103, 105
31	W	Nov. 11	Singularity Function Method	5.4, 9.3	9.36, 43, 45	9.7, 11, 18
32	F	Nov. 13	Statically Indeterminate Beams I	9.2	9.23, 26, 27	9.36, 43, 45
33	M	Nov. 16	Statically Indeterminate Beams II; Programming Load/Deflection Curves	9.2	9.49, 52, 56	9.23, 26, 27
34	W	Nov. 18	Beam Deflection by Superposition	9.4 Tutorial #2	9.65, 78, 82	9.49, 52, 56
35	F	Nov. 20	Discuss Project 2, Stage 2	Notes #4		9.65, 78, 82
36	M	Nov. 23	2-D Elasticity and Stress Concentration Factors using Tables & FEM (A. S. M. ®)	2.11, 3.5, 4.5, and Tutorial #3	2.100, 3.86, 4.62 Quiz 11	
	W, F	Nov. 25, 27	*** Thanksgiving Break ***			
37	M	Nov. 30	Elasticity and Thick-Walled Cylinders	Notes #5	1, 2	2.100, 3.86, 4.62, Quiz 11
38	W	Dec. 2	Stresses in Thick-Walled Cylinders	Notes #5	3, 4	1, 2
39	F	Dec. 4	Review			3, 4
	Tue.	Dec. 8	Final Exam 12 – 3 PM (TBD)			

Supplemental Notes and Tutorials will be made available on CourseSite; as referred to in the syllabus, they are:
Notes #1 – Finite Element Method for 1D Bars
Notes #1a – Global K Construction Example for 1D Bars
Notes #2 – Finite Element Method for 2D Trusses
Notes #2a – Global K Construction Example for 2D Trusses

Notes #3 – Bending of Composite Beams

Notes #4 – Finite Element Method for Beams

Notes #5 – Thick Walled Cylinders

Tutorial #1 – Truss FEM Analysis in **Autodesk Mechanical** ®

Tutorial #2 – Beam FEM Analysis in **Autodesk Mechanical** ®

Tutorial #3 – 2D Elasticity Models in **Autodesk Mechanical** ®

Homework problems from the *Supplemental Notes* will be found at the end of each set of notes.

Grading: Final exam – 30%, Hourly exams – 30%, Projects – 15%, Mini-quizzes – 15%, Homework – 5%, Class Activities – 5%.

Accommodations for Students with Disabilities: If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, University Center 212 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.

Lehigh University endorses The Principles of Our Equitable Community (<http://www4.lehigh.edu/diversity/principles>). We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.