

MAE-343 – Intermediate Mechanics of Materials – SP 2015

Instructor: Dr. E. J. Barbero—Rm. 511 ESB
Schedule:
Section 001: MO-WED-FR. 2:00—2:50, ESB 207 (CRN: 13845)
Section 002: MO-WED-FR. 4:00—4:50, ESB 207 (CRN: 15539)
Exams (both sections) **WED. 5:00—7:00, Rm. NRCCE 101 (CRN: both)**
Office hours: TBA

Textbook-required: Budynas, R.G. and Nisbett, J. K., “Shigley’s Mechanical Engineering Design, 10th Edition, with Engineering Connect”, ISBN-13: 9781259614507. This is sold as a package.

Textbook-additional reading: Askeland, D.R., Fulay, P.P., “Essentials of Materials Science and Engineering”, Cengage Learning, 2009.

Software: MATLAB, SolidWorks, and Engineering Connect.

Prerequisites: MATH 251 with a grade of C or better and MAE 243.

Course Objective: This course expands knowledge in mechanics of materials by considering aspects such as basic elasticity, failure theories, energy methods, buckling of columns, unsymmetric bending, and fatigue, fracture, and material science.

Key competences (mastery required on all of them to pass the course):

- (1) FBDs, shear, and moment diagrams. I know this is 241 and 243 material but it is needed in MAE 343 and 454.
- (2) Transverse deflection and slope at given locations. Slope is for bearing design, transverse is for gears.
- (3) Multi-axial failure criteria. Ductile failure. Distortion energy.
- (4) Understanding and calculating principal stresses in 2D and 3D.
- (5) Stress concentration factors. Apply stress concentration factors to ductile fatigue problems.
- (6) Fatigue with the five different failure theories presented in Shigley.
- (7) Understand the corrected endurance limit modifying factors.

Outcomes:

- A. An ability to apply knowledge of mathematics, science, and engineering.
- I. Recognition of the need for, and an ability to engage in life-long learning.

Ability to simulate material and structural behavior using available property data	A
Ability to apply modern computer tools for analysis	I

Updated: December 21, 2014

Outline (2015):

<http://catalog.wvu.edu/undergraduate/westvirginiauniversitycalendar/>

Week	Date	Topic	Chapter/Section	Notes	Hmwk due
1	1/12	Introduction	N/A	Must access Engineering Connect	
1	1/14	Internal Forces and Moments (F&M)	Review 243	F&M, FBD, reactions, diagrams may be taught in different order	
1	1/16	Free body diagrams	Review 243 and Section 3.1 Shigley's	FBD	
2	1/19	Recess	Recess	MLK recess	
2	1/21	Reactions on beams	Review 243	Reactions	Hmwk 1
2	1/23	Shear and Bending moment diagrams	Review 243 and section 3.2 Shigley's	Diagrams	
3	1/26	Stress	3.4—5	Axial, shear	Hmwk 2
3	1/28	Mohr circle 2D	3.6	Ex. 3.4	
3	1/30	Review	3.6	Pb. 3.5 or similar	
4	2/2	Mohr circle 3D	3.7		Hmwk 3
4	2/4	EXAM 1	F&M, FBD, reactions, diagrams, Mohr 2D	This is 243 material. Fail this test, fail the course.	NO MAKEUP
4	2/6	Review	Mohr circle 3-D		
5	2/9	Combined stress	3.9—10	2 plane bending	Hmwk 4
5	2/11	Un-symmetric	Un-symmetric section	Ex. 3-6	
5	2/13	Review	Un-symmetric section	Pb. similar to Ex. 3-6	
6	2/16	Shear	3.11		Hmwk 5
6	2/18	Torsion	3.12		
6	2/20	Review	Un-symmetric	Pb. 5.83 Hibbeler or similar	
7	2/23	Stress concentration	3.13 & 5.2		Hmwk 6
7	2/25	Failure (ductile)	5.3—4 MSS (Tresca)	Tresca (MSS)	
7	2/27	Review	Tresca (MSS)		
8	3/2	Failure (ductile)	5.5 Von Mises (DE) probs.		Hmwk 7
8	3/4	EXAM 2	3.7 to 5.2	No partial credit	NO MAKEUP
8	3/6	Review	Von Mises (DE) problems		
9	3/9	Mohr Coulomb (CM)	5-6		Hmwk 8
9	3/11	Failure (brittle)	5.8—9 (MNS, BCM, MM)	MNS and BMC	
9	3/13	Review	Brittle fracture problems	Mid-semester reports due	
10	3/16	Tension, compression, torsion, bending	4.2—3	Deformation (elongation, deflection); strain	Hmwk 9
10	3/18	Strain Energy and Castigliano	4.7—8	For influence coefficients (p. 384) need to know superposition	
10	3/20	Superposition (Review)	4.5. Superposition method and problems	Last day to drop. Miss this lecture at your own peril!	
11	3/23	Spring recess			Recess
11	3/25	Spring recess			
11	3/27	Spring recess			
12	3/23	Fracture Mechanics	5.12	Energy based explanation	Hmwk 10
12	3/25	Fracture Mechanics	5.12		
12	3/27	Review	Fracture mech. problems		

13	3/30	Buckling	4.11-12	From Jones' book	Hmwk 11
	4/1	EXAM	5.3 to 5.9 and 4.2 to 4.8	Failure and deformations	NO MAKEUP
13	4/3	Review	Buckling problems		
14	4/6	Fatigue (3 weeks)	6.1	Intro	Hmwk 12
14	4/8	Fatigue	6.4, 7, 8	Stress-life	
14	4/10	Review	Fatigue problems		
15	4/13	Fatigue	6-9	Modifying factors	Hmwk 13
15	4/15	Fatigue	6-10	SCF and notch sensitivity	
15	4/17	Review	Fatigue problems		
16	4/20	Fatigue	6.11--12	Fluctuating	Hmwk 14
16	4/22	Fatigue	6.14	Last day to withdraw	
16	4/24	Review	Fatigue problems	Last day of classes	
17	April 6	Final Rm.: NRCCE 101	5:00—7:00 PM Wednesday	(*)	
		001		Final	
		002		Final	

(*) Conflicts with COMM 100-001 and -002. Choose section 003 instead or rearrange final with COMM Studies Dept.

Grading:

Homework	20%
Midterm (s)	20% each of 3
Final: comprehensive	20%
A	>90/100
B	>80/100
C	>70/100
D	>60/100
F	Otherwise
Grade curving	None.

Homework: Assigned weekly. Answers are due electronically by the due date/time. Paper solution due on instructor's desk before the class starts. Homework accepted up to immediately following lecture, with 50% penalty.

Midterms: No make ups under any circumstances. Combined single exams and final for both sections at the same time (5:00 pm Wednesdays). Need a letter signed by both WVU Health services and by the Associate Dean for Academic Affairs to be excused (for documented own illness only) to have the %grade for up to a maximum of one exam applied for the final (that is, final grade applied to the missing exam). Exam dates are given to you in advance and shall not be rescheduled, and no excuses other than noted shall be accepted. No excuses will be accepted on the final. No I-grades will be given.

Documentation: Must be able to submit ALL graded material back to the instructor, if requested, to receive credit. Failure to produce your own original graded materials may lead to lost credit for the missing material.

Teamwork: Although discussions are encouraged, are forbidden to work together and/or present essentially similar work. Similarities in their work will be penalized. Innovative content and presentation quality will be rewarded.

Computer usage: MATLAB is used in assignments and may be used in exams.

Professionalism: Lectures and Exams: All electronics forbidden. Phones tablets, laptops must be OFF. Except calculators, if it has a battery it is forbidden.

Academic Honesty: Cheating in any way or form is unacceptable at WVU and may result in an F grade and disciplinary action, regardless of overall performance. For definition of "Academic Dishonesty" and code of conduct, refer to the WVU Student Handbook or "Mountie Publication" (<http://www.arc.wvu.edu/admissions/integrity.html>) and the WVU Undergraduate Catalog.

Equal Opportunity: WVU is committed to social justice. WVU does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to foster an open environment in this class will be appreciated and given serious consideration.

NO AUDIT STUDENTS ALLOWED, WITHOUT EXCEPTION.