MASSACHUSETTS MARITME ACADEMY
DEPARTMENT OF ENGINEERING
EN3112 – Strength of Materials

COURSE: EN3112 Strength of Materials
SEMESTER: Fall 2022
ROOM: TBD

INSTRUCTOR: Pete Carroll, P.E.
210A Harrington
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MEETING TIME: Monday, Wednesday, Friday, 1300 – 1350.

ACADEMICS & LEADERSHIP: I have a high expectations for the display of leadership, character, morals, ethics and respect. This is in regard to one another and between you and I. I expect all students to be on-time to classes, purchase Connect subscription for homework, and take notes during class. I expect all of you to pay attention to the lecture through eye contact and engaged with insightful questions. This will be a fast-paced, rigorous course and will require your understanding of the homework, quizzes, in class exercises and readings, in order to do well on the tests. **Attitude is everything**.

COURSE DESCRIPTION: This course studies the fundamental concepts of mechanics of materials, including stress, and deformation due to tensile and compressive forces, torsion, bending moments, transverse shear, and temperature changes. It also studies statically indeterminate problems, power transmission, stress concentration factors, beam design, columns, and buckling.

PREREQUISITE: EN-2211 Mechanics

PRACTICAL EXERCISES: Each class will do a practical problem for you to try and individually solve. I will give you hints to think about and methods to use to try and reach the answer. We'll go over this practical problem in class.

TEXT: Mechanics of Materials, 8th Edition by Beer, Johnston, DeWolf, and Mazurek. The textbook is mandatory, but the e-book can be found here: https://www.mheducation.com/highered/product/mechanics-materials-beer-johnston/M9781260113273.html or, I highly recommend buying a hard-copy text (used or rental) for the same price as an e-book.

COURSE OBJECTVES: At the completion of this course, the student should be able to:

- Determine the normal and shear stresses due to forces and torques on simple structures
- Understand and interpret a stress-strain diagram and Hooke's Law
- Predict and calculate thermal stress for simple structures
- Apply the concepts of Factor of Safety and different failure modes
- Predict and calculate the shear stress and angle of twist including stress concentrations for power transmission shafts
- Draw and evaluate shear and bending moment diagrams for use in beam design
- Design the most economical beam for a given load
- Calculate principle stresses algebraically and through the use of Mohr's circle
- Calculate stresses in thin walled pressure vessels
- Calculate the deflection of a beam for various loadings
- Calculate the critical buckling load for simple columns

HOMEWORK: All homework will be completed on engineering graph paper and in the format specified at the beginning of class. See homework and test schedule attached to this syllabus and in Blackboard. All homework shall be completed on engineering graph paper.

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DEPARTMENT OF ENGINEERING
EN3112 – Strength of Materials

GRADING: Homework – 20 %
2 Exams - 40 % (20 % each)
2 Team Projects - 40 % (20 % each)

CALCULATORS: No cell phones or **any electronics** are allowed on exams, quizzes or any other graded material. Only calculators approved by NCEES (National Council of Examiners for Engineering and Surveying) are allowed on exams and quizzes, (See http://ncees.org/Exams/Examday_policies/Calculator_policy.php for details)

ATTENDANCE: You are expected to provide advance notice and rationale for any absence; 4% will be deducted from your final grade for each unexcused absence. For excused absences, a legitimate excuse needs to be provided by text, phone or email before the beginning of class. There will be no make-up for unexcused absences during an exam or quiz.

FOOD & DRINK POLICY: Small portions of food and drink are allowed if the classroom is kept clean.

CONTRIBUTION TO THE PROFESSIONAL COMPONENT: Strength of Materials, a required course for Marine Engineering, Facilities Engineering and Energy Systems Engineering, requires that students use the fundamental knowledge from other courses in the program, such as: mathematics, physics, and mechanics. This course contributes 3 semester hours to the engineering topic requirement.

STUDENT ACCOMMODATIONS: The Academy offers, upon request, accommodations to students with documented learning disabilities. The ADA Coordinator, Asst. Dean Elaine Craghead, evaluates the documentation provided, determines appropriate services, and is available to discuss accommodations with students. The Disability Resources office is located in the Academic Resource Center, ABSIC 320. Students can drop in during normal business hours, M-F 0800-1600, or call x5120, or email ADAcompliance@maritime.edu.

Letter Grade Cut-Offs:

$93 \leq X \leq 100$	A	$77 \leq X \leq 79$	C+
$90 \leq X \leq 92$	A−	$73 \leq X \leq 76$	C
$87 \leq X \leq 90$	B+	$70 \leq X \leq 72$	C−
$83 \leq X \leq 86$	B	$67 \leq X \leq 69$	D+
$80 \leq X \leq 82$	B−	$63 \leq X \leq 66$	D
		$X < 63$	F

There will be no D− grades given. You must have an average ≥ 63 in order to pass this class

MASSACHUSETTS MARITME ACADEMY
DEPARTMENT OF ENGINEERING
EN3112 – Strength of Materials

#	CLASS	-	READING	TOPIC	Homework	DUE
	Thurs	9/1/2022		**Orientation Day – No Classes**		
	Mon	9/5/2022		**LABOR DAY - NO SCHOOL**		
1	Wed	9/7/2022		Introduction, Statics Review		
2	Fri	9/9/2022	1.1-1.2	Axial Loading & Average Normal Stress	1.2, 1.10, 1.12	9/12/2022
3	Mon	9/12/2022	1.1-1.2	Shearing Stresses & Bearing Stresses	1.15, 1.16, 1.21	9/14/2022
4	Wed	9/14/2022	1.5	Factor of Safety and Design Considerations	1.37, 1.41	9/16/2022
5	Fri	9/16/2022		Project Assignment-Tension/Compression/Buckling	-	
6	Mon	9/19/2022	2.1	Normal Strain under Axial Loading	2.1, 2.3, 2.4	9/21/2022
7	Wed	9/21/2022	2.1	Stress-Strain Diagram & Hooke's Law	2.5, 2.6, 2.8	9/23/2022
8	Fri	9/23/2022	2.3	Problems Involving Temperature Changes	2.47, 2.50	9/26/2022
9	Mon	9/26/2022	2.2	Statically Indeterminate Problems	2.33, 2.34, 2.39	9/28/2022
10	Wed	9/28/2022	2.4	Poisson's Ratio & Multiaxial Loading	2.61, 2.64	9/30/2022
11	Fri	9/30/2022	10.1-10.2	Stability & Euler's Formula	10.9, 10.11, 10.15	10/3/2022
12	Mon	10/3/2022	10.3	Centric Load Design	10.57, 10.58, 10,59	10/5/2022
13	Wed	10/5/2022		Project Workshop	-	
14	Fri	10/7/2022		**Project #1 Due**	-	
	Mon	10/10/2022		**COLUMBUS DAY**	-	
15	Tues	10/11/2022	2.7-2.11	Shearing Strain & Stress Concentrations	2.75, 2.79, 2.93, 2.97	10/12/2022
16	Wed	10/12/2022	3.1	Circular Shafts in Torsion	3.4, 3.13, 3.19	10/14/2022
17	Fri	10/14/2022	3.2	Angle of Twist	3.32, 3.33	10/17/2022
18	Tues	10/17/2022	3.3	Statically Indeterminate Shafts (1)	3.51, 3.55, 3.56	10/19/2022
19	Wed	10/19/2022	3.4	Statically Indeterminate Shafts (2)	-	-
20	Fri	10/21/2022	3.5	Stress Concentrations in Circular Shafts	3.64	10/24/2022
21	Mon	10/24/2022		**Exam #1**	-	
22	Wed	10/26/2022	4.1-4.2	Stress and Deformation in Pure Bending	4.1, 4.3	10/28/2022

MASSACHUSETTS MARITME ACADEMY
DEPARTMENT OF ENGINEERING
EN3112 – Strength of Materials

23	Fri	10/28/2022	4.3	Stress and Deformation in the Elastic Range	4.18, 4.24, 4.37	10/31/2022
24	Mon	10/31/2022	4.7	Project Assignment #2	-	
25	Wed	11/2/2022	5.1-5.2	Shear and Bending Moment Diagrams	5.7, 5.9, 5.12	11/4/2022
26	Fri	11/4/2022	5.3	Design of Prismatic Beams	5.67, 5.72, 5.82	11/7/2022
27	Mon	11/7/2022	6.1	Horizontal Shearing Stress in Beams	6.1, 6.5	11/9/2022
28	Wed	11/9/2022	6.3	Longitudinal Shear in Arbitrary Cut	6.11, 6.13, 6.18	11/14/2022
	Fri	11/11/2022		**VETERAN'S DAY**	-	
29	Mon	11/14/2022	6.4	Thin-Walled Members	6.29, 6.35	11/16/2022
30	Wed	11/16/2022	9.1	Equation of the Elastic Curve	9.1, 9.2	11/18/2022
31	Fri	11/18/2022	9.2, 9.4	Superposition	9.65, 9.73	11/21/2022
32	Mon	11/21/2022	9.4	Statically Indeterminate Beams	9.79	11/28/2022
	Wed	11/23/2022		**THANKSGIVING BREAK**	-	
	Fri	11/25/2022		**THANKSGIVING BREAK**	-	
33	Mon	11/28/2022	9.1-9.4	Superposition/Elastic Curve Workshop	-	
34	Wed	11/30/2022		Project #2 Due + Presentation	-	-
35	Fri	12/2/2022		Project #2 Due + Presentation	-	
36	Mon	12/05/22	7.1	Stress Transformation - Plane	7.1, 7.7, 7.11	12/7/2022
37	Wed	12/7/2022	7.3-7.5	Mohr's Circle	7.32	12/9/2022
38	Fri	12/9/2022	7.3-7.5	Stresses in Thin-Walled Pressure Vessels	7.99, 7.100, 7.109	12/12/2022
39	Mon	12/12/2022		Review Stress Transformations	-	
40	Wed	12/14/2022		**Exam #2**	-	