ME 261: Mechanics of Materials

Spring Semester 2025

Instructor: **Sayed Aziz**
Office: E 304-C
Office hours: by appointment
Phone: (201) 216-8264
E-mail: eaziz@stevens.edu

Class times: M 10:00 – 10:50 am, W 10:00 – 10:50 am, Fr 10:00 – 10:50 am Sec. (A)
Class location: Gateway North 204

TA:
-------- **E-mail:** -----@stevens.edu

Course Objective: This course is the continuation of E211 and builds towards ME361 Design of Machine Components. This course prepares students for structural design and optimization.

Course Description: Fundamental material response from a variety of loads. Concepts of stress and strain, applications including beams, columns and shafts, stresses are combined to determine principal stresses, deformation of structures and statically indeterminate structures.

Textbook: **Ferdinand** P. **Beer**, E. Russell **Johnston** Jr., **John** T. **DeWolf**, **David** F. **Mazurek**. "***Mechanics of Materials"***, 8th ed, McGraw Hill, 2020 / ISBN 1260113272.

Class Format: Class time will be used to deliver content through lectures, complete exercises/problems as in-class activities and additional assignments will be completed outside of class as homework. Each class lecture will be available on Canvas prior to meeting time for review and preparation BEFORE the next class.

FEA Projects: Class activities are accompanied by problem-solving based on the use of classical equations for stress determination and SolidWorks simulations. Please bring your COMPUTER to class, so you may refer to the lecture notes and use any course software needed to complete the activities. Please let me know if you will be unable to attend class.

Course Assessment:

In-Class Activities /Assignments / Attendance	20%
Reading Quizzes	10%
FEA Projects (SolidWorks Simulation)	10%
Exam #1 (Ch1, Ch2 & Ch3)	20%
Exam #2 (Ch4, Ch5 & Ch6)	20%
Exam #3 (Ch7, Ch8, Ch9 & Ch11)	20%

Required Software:

- **MDSolids:** it is a software designed to assist students in the study of Mechanics of Deformable Solids. After completing the hand solution, verify that the solution is correct by solving the problem with MDSolids.
- **SolidWorks Simulation:** it is a Finite Element Analysis (FEA) software for analyzing the structural behavior of mechanical components and systems.

Topics Covered:

– Introduction – Concept of Stress – Stress and Strain (Axial) – Torsion – Pure Bending – Shear Force and Bending Moment Diagrams	– Transverse Shear – Stress Transformations – Principal Stresses, Principal Strains and Mohr Circle – Beam Deformations, Statically Indeterminant Beams – Buckling – Energy Methods

Late submissions policy:

Canvas automatically deducts 0.4% for every hour a submission is late

Students with accommodations:

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. Student Counseling and Disability Services works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, and psychiatric disorders in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from SCDS staff. The SCDS staff will facilitate the provision of accommodations on a case-by-case basis. These academic accommodations are provided at no cost to the student.

Course learning outcomes and relationship of course to program outcomes:

Student Outcome 1: (Complex Engineering Problems) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Outcome 1-1: You are able to develop and utilize relevant free body diagrams and represent internal loads within a mechanism.

Outcome 1-2: You are able to solve 2D and 3D equilibrium problems that relate to mechanisms and machinery.

Outcome 1-3: You are able to determine the stress and strain in simple structures due to internal loads resulting from external applied forces.

Outcome 1-4: You are able to determine the deformation of beams and shafts and solve statically indeterminate problems using singularity functions and Castigliano's Theorem.

Student Outcome 2: (Design) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

Outcome 2-1: You are able to perform design calculations to determine the size, load, or mechanical property required to meet a specified design criterion (e.g. maximum allowable stress).

Course Schedule:

The following is a tentative schedule. Students will be notified of any changes.

ME 261 - Course Schedule - Spring 2025

Week	Date	Topic	Text	In-Class Activitie	Assignments	Quizzes
1	22-Jan	Course Welcome / Intro to Mech of Materials	1.1	-	HW 1 (Review of Statics) Due:	R_Quiz (1) Due:
	24-Jan	Prerequisites from statics: Forces, Supports, Free Body Diagrams, Equations of Equilibrium		Activity 1		
2	27-Jan			Activity 2		
	29-Jan	Stresses in the Members of a Structure: Normal – Shearing - Bearing Stresses	1.2	Activity 3		
	31-Jan					
3	3-Feb	Stresses on an Oblique Plane & Factor of Safety	1.3 - 1.5	Activity 4	HW 2 (Ch1 & Ch2) Due:	R_Quiz (2) Due:
	5-Feb	Stress-Strain Diagram - Hooke's Law; Poisson's Ratio	2.1 - 2.4	Activity 5		
	7-Feb					
4	10-Feb	Deformation of Memeber under Axial Loading	2.1G	Activity 6		
	12-Feb	Axial - Statically Indeterminate	2.2	Activity 7		
	14-Feb					
5	18-Feb	***Recitation (Ch1 & Ch2)***				
	19-Feb	Torsional Shear Strain and Stress	3.1	Activity 8	HW 3 (Ch3 & Ch4) Due:	R_Quiz (3) Due:
	21-Feb	Angle of Twist, Indeterminate Shafts	3.2-3	Activity 9		
6	24-Feb	Power Transmission	3.4	Activity 10		
	26-Feb	***Recitation (Ch1, Ch2 & Ch3)***				
	28-Feb					
7	3-Mar	**Exam #1 – Ch1, Ch2 & Ch3**				
	5-Mar	Bending kinematics, Flexure formula	4.1-3	Activity 11		
	7-Mar					
8	10-Mar	Eccentric Axial Loading in a Plane of Symmetry	4.7	Activity 12		
	12-Mar	***Intro to FEA, C-Clamp FEA Stress Analysis***				
	14-Mar					
9	16-23 Mar	***Spring Recess: No Classes***				
10	24-Mar	Beams, Shear and Bending-Moment Diagrams	5.1	Activity 13	HW 4 (Ch5, Ch6, Ch7 & Ch8) Due:	R_Quiz (4) Due:
	26-Mar	Relations Between w, V, and M	5.2	Activity 14		
	28-Mar	Transverse shear (kinematics & formula)	6.1	Activity 15		
11	31-Mar	***Recitation (Ch4, Ch5 & Ch6)***				
	2-Apr	**Exam #2 – Ch4, Ch5 & Ch6**				
	4-Apr	Stress Transformation - General Eqs	7.1	Activity 16		
12	7-Apr	Principal Stress and Max Shear Stress	7.1	Activity 17		
	9-Apr			Activity 18		
	11-Apr	Mohr's Circle for Plane Stress	7.2	Activity 19		
13	14-Apr	Combined Loadings - Beams and Shafts Design	Ch8	Activity 20		
	16-Apr			Activity 21		
	18-Apr	Deflection of Beams – Integration Method	9.1	Activity 22	HW 5 (Ch9 & Ch11) Due:	R_Quiz (5) Due:
14	21-Apr	Deflection of Statically Indeterminate Beams	9.2	Activity 23		
	23-Apr	Deflection of Beams - Singularity Functions	9.3	Activity 24		
	25-Apr	***Recitation (Ch7, Ch8 & Ch9)***				
15	28-Apr	Elastic Strain Energy	11.1-3	Activity 25		
	30-Apr	Castigliano's Theorem	11.4	Activity 26		
	2-May					
16	5-May	***Recitation* (Ch7, Ch 8, Ch9 & Ch11)**				
	7-May	**Exam #3 – Ch7, Ch8, Ch9 & Ch11**				