NE 206 MECHANICS OF MATERIALS

Course Code	Course Name	Semester	
NE 206	Mechanics of Materials	Fall ☐ Spring ☒ Summer ☐	
Hours		**Credit**	**ECTS**
Theory	**Practice** / **Lab**	3	5
3	0 / 0		

Course Details	
Department	Nanotechnology
Course Language	English
Course Level	Undergraduate ☒ Graduate ☐
Mode of Delivery	Face to Face ☒ Online ☐ Hybrid ☐
Course Type	Compulsory ☒ Elective ☐
Lecturer(s)	
Course Objectives	• Understand and apply the concepts of stress and strain. • Analyze deformation of materials under different loading conditions. • Evaluate axial, torsional, and bending stress in structural members. • Design components considering strength and stiffness. • Apply knowledge of material behavior to solve practical engineering problems.
Course Content	Fundamental concepts of stress and strain Mechanical properties of materials and stress-strain relationships Axial loading and deformation of bars Thermal stress and strain Torsion of circular shafts Internal forces in structural members Shear force and bending moment diagrams Bending stress in beams Shear stress in beams and thin-walled members Stress and strain transformation, Mohr's Circle Principal stresses and principal strains Deflection of beams (integration and superposition methods) Combined loading conditions Design of members for strength and stiffness Thin-walled pressure vessels

Course Method/ Techniques	Lecture ☒ Question & Answer ☒ Presentation ☐ Discussion ☐
Prerequisites/ Corequisites	
Work Placement(s)	

Textbook/References/Materials

1. ***Mechanics of Materials*, 9th Edition, R.C. Hibbeler, Pearson**
2. ***Mechanics of Materials*, Ferdinand P. Beer, E. Russell Johnston Jr., John T. DeWolf**

Course Category				
Mathematics and Basic Sciences	☒		Education	☐
Engineering	☒		Science	☒
Engineering Design	☐		Health	☐
Social Sciences	☐		Profession	☐

Weekly Schedule

No	Topics	Materials/Notes
1	Introduction to Mechanics of Materials, Concept of Stress	Lecture notes
2	Strain and Stress-Strain Relationship, Hooke's Law	Lecture notes
3	Axial Deformation of Bars, Thermal Effects	Lecture notes
4	Torsion of Circular Shafts	Lecture notes
5	Shear Force and Bending Moment Diagrams	Lecture notes
6	Bending Stresses in Beams	Lecture notes
7	Shear Stresses in Beams and Thin-Walled Members	Lecture notes
8	Midterm Exam	
9	Beam Deflections: Methods of Integration and Superposition	Lecture notes
10	Combined Loadings	Lecture notes
11	Stress Transformation – Mohr's Circle	Lecture notes
12	Strain Transformation and Principal Strains	Lecture notes
13	Design of Thin Cylinders and Pressure Vessels	Lecture notes
14	Magnetic Properties and Applications in Nanomagnetism	Lecture notes
15	Review and Homework Presentation	Lecture notes
16	Final Exam	

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance	14	10
Lab		
Practice		
Fieldwork		
Course-specific internship		
Quiz/Studio/Criticize		
Homework	2	10
Presentation / Seminar	1	10
Project		
Report		
Seminar		
Midterm Exam	1	30
Final Exam	1	40
	Total	**100%**
Contribution of Midterm Studies to Success Grade		60
Contribution of End of Semester Studies to Success Grade		40
	Total	**100%**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hrs)**	**Total Workload**
Course Hours	14	3	42
Lab			
Practice			
Fieldwork			
Course-specific Work Placement			
Out-of-class study time	14	2	28
Quiz/Studio/Criticize			
Homework	2	5	10
Presentation / Seminar	1	5	5
Project			
Report			
Midterm Exam and Preparation for Midterm	1	25	25
Final Exam and Preparation for Final Exam	1	30	30
Total Workload			**125**
Total Workload / 25			**5**
ECTS Credit			**5**

Course Learning Outcomes	
No	**Outcome**
L1	Define and explain fundamental concepts such as stress, strain, and mechanical properties of materials.
L2	Analyze axial, torsional, and bending stresses in structural components under different loading conditions.
L3	Calculate deformations and deflections in members using analytical methods.
L4	Use Mohr's Circle and transformation equations to determine principal stresses and strains.
L5	Apply failure criteria to evaluate material strength and ensure safe design.
L6	Integrate mechanics of materials principles into engineering problem-solving and design processes.

Contribution of Course Learning Outcomes to Program Competencies/Outcomes

Contribution Level: 1: Very Slight, 2: Slight, 3: Moderate, 4: Significant, 5: Very Significant

	PO-1		PO-2		PO-3		PO-4		PO-5			PO-6			PO-7						PO-8		PO-9		PO-10			PO-11		Total
#	1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	7.3	7.4	7.5	7.6	8.1	8.2	9.1	9.2	10.1	10.2	10.3	11.1	11.2	#
L1	X	X												X	X															-
L2		X	X				X							X	X															-
L3	X	X			X									X	X															-
L4	X	X												X	X															-
L5			X	X	X									X	X															-
L6	X				X		X							X	X															-
																													Total=	-

1.1. Adequate knowledge in mathematics, natural sciences, and subjects specific to the relevant engineering discipline.

1.2. Ability to apply theoretical and practical knowledge in these areas to solve complex engineering problems.

2.1. Ability to identify, formulate, and solve complex engineering problems.

2.2. Ability to select and apply appropriate analysis and modeling methods for this purpose.

3.1. Ability to design a complex system, process, device, or product to meet specific requirements under realistic constraints and conditions.

3.2. Ability to apply modern design methodologies for this purpose.

4.1. Ability to select and use modern techniques and tools necessary for analyzing and solving complex problems encountered in engineering practice.

4.2. Ability to effectively utilize information technologies.

5.1. Ability to design experiments to investigate complex engineering problems or discipline-specific research topics.

5.2. Ability to conduct experiments.

5.3. Ability to collect data, analyze results, and interpret findings.

6.1. Ability to work effectively in intra-disciplinary teams.

6.2. Ability to work effectively in multi-disciplinary teams.

6.3. Ability to work independently.

7.1. Ability to communicate effectively both orally and in writing.

7.2. Knowledge of at least one foreign language.

7.3. Ability to write and comprehend effective reports, and to prepare design and production documentation.

7.4. Ability to deliver effective presentations.

7.5. Ability to give and receive clear and understandable instructions.

8.1. Awareness of the necessity for lifelong learning.

8.2. Ability to access information, follow developments in science and technology, and continuously renew oneself.

9.1. Acting in accordance with ethical principles and having professional and ethical responsibility.

9.2. Knowledge about standards used in engineering practices.

10.1. Knowledge of business practices such as project management, risk management, and change management.

10.2. Awareness of entrepreneurship and innovation.

10.3. Knowledge about sustainable development.

11.1. Knowledge of the global and societal impacts of engineering practices on health, environment, and safety, and understanding of contemporary issues reflected in the field of engineering.

11.2. Awareness of the legal consequences of engineering solutions.