SEMESTER S2

MECHANICS OF SOLIDS

Course Code	MOS205	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3-1-0-0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30mins
Prerequisites (if any)	Engineering Mechanics	Course Type	Theory

Course Objectives:

1. To provide students with a fundamental understanding of the mechanics of deformable bodies and help them develop their analytical and problem-solving skills.
2. To introduce students to the various internal effects induced in structural members and their deformations due to different types of loading.
3. To enable students to determine the stress, strain, and deformation of loaded structural elements.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Concept of stress and strain – types, stress – strain relation - Hooke's law, Young's modulus of elasticity. Stress-strain diagram of mild steel. Factor of safety, working stress. Axially loaded bars with uniform and uniformly varying cross section–stress, strain and deformation. Temperature effects, temperature stress in composite bars. Shear stress and shear strain, Modulus of rigidity, simple shear, punching shear. Lateral strain, Poisson's ratio, volumetric strain. Bulk modulus of elasticity, relationships	11

	between elastic constants. Strain energy – concept. Strain energy due to normal stress. Strain energy in bars carrying axial loads. Strain energy due to shear stress.	
2	Beams – different types. Types of loading on beams. Concept of bending moment and shear force. Relationship between intensity of load, shear force and bending moment. Shear force and bending moment diagrams of cantilever beams, simply supported beams and overhanging beams for different type of loads. Point of contraflexure.	11
3	Theory of simple bending, assumptions and limitations. Calculation of normal stress in beams, moment of resistance. Shear stress in beams. Beams of uniform strength. Strain energy due to bending – calculation of strain energy in beams. Derivation of differential equation for calculating the deflection of beams – Macaulay's method.	10
4	Stresses on inclined planes for uniaxial and biaxial stress fields. Principal stresses and principal planes, maximum shear stress in 2D problems. Mohr's circle of stress for 2D problems. Short coluMin – direct and bending stress. Kern of a section. Slender coluMin – Euler's buckling load, slenderness ratio, limitation of Euler's formula. Rankine's formula. Torsion of circular and hollow circular shafts, Power transmitted by circular shafts and hollow circular shafts. Strain energy due to torsion.	12

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Recall the fundamental terms and theorems associated with mechanics of linear elastic deformable bodies.	**K1**
CO2	Explain the behaviour and response of various structural elements under various loading conditions.	**K2**

CO3	Apply the principles of solid mechanics to calculate internal stresses/strains, stress resultants and strain energies in structural elements subjected to axial/transverse loads and bending/twisting moments.	**K3**
CO4	Choose appropriate principles or formula to find the elastic constants of materials making use of the information available.	**K3**
CO5	Perform stress transformations, identify principal planes/ stresses and maximum shear stress at a point in a structural member	**K3**
CO6	Analyse the given structural member to calculate the safe load or proportion the cross section to carry the load safely.	**K4**

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1										
CO2	2	2									
CO3	3	2									
CO4	3	2									
CO5	3	2									
CO6	3	3	2								

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl No.	Title of the book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Mechanics of Structures	H. J. Shah and S. B. Junnarkar	Charotar Publishing House	32ndEdition2016
2	A Text book of Strength of Materials	R. K. Bansal	Laxmi Publications	6th Edition2018
3	Mechanics of Materials	B. C. Punmia, Ashok K. Jain, Arun Kumar Jain	Laxmi Publications	RevisedEdition 2017

Reference Books				
Sl No.	Title of the book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering Mechanics of Solids	Egor P. Popov	Prentice Hall International Series	2nd Edition 2015
2	Mechanics of Materials	James M Gere, S.P. Timoshenko	CBS Publishers and Distributors	2nd Edition 2004
3	Mechanics of Materials	R.C. Hibbeler	Pearson	10th Edition 2018
4	Strength of Materials	S. Ramamrutham and R. Narayanan	Dhanpat Rai Publishing Co	18th Edition 2014
5	Strength of Materials	Rattan	McGraw Hill Education India	3rd Edition 2016

Video Links (NPTEL, SWAYAM…)	
Sl. No	**Link id**
1	https://archive.nptel.ac.in/courses/105/104/105104160/