QP Code: RN23BTECH065 | Reg. No | | | | | | | | | | | AY 23

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, ODISHA, GUNUPUR
(GIET UNIVERSITY)

B. Tech (Third Semester - Regular) Examinations, November – 2024

23BMEPC23002 – MECHANICS OF SOLIDS

(Mechanical Engg.)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right-hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	Define Hook's Law and explain its significance in stress-strain analysis.	CO1	K1
b.	What is Mohr's Circle, and how is it used in biaxial stress analysis?	CO2	K2
c.	State the relationship between shear force and bending moment.	CO3	K1
d.	Explain the theory of simple bending	CO4	K2
e.	What is the difference between solid and hollow circular shafts under torsion?	CO5	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	Explain the stress-strain diagram for ductile materials and its engineering applications.	5	CO1	K3
b.	A rod of length 2m and diameter 10mm is subjected to a tensile force of 5kN. Calculate the stress and strain if the modulus of elasticity is 200 GPa	5	CO1	K3
	(OR)			
c.	Determine the principal stresses and orientation of principal planes for a state of biaxial stress with σ_x= 80 MPa, σ_y= = 40 MPa, and ζ_{xy}= = 20 MPa.	5	CO1	K3
d.	Derive the Relationship between the Elastic constants 1. Modulus of Elasticity, E and Modulus of Rigidity G. 2.Bulk Modulus (K) and Young's Modulus (E)	5	CO1	K3
3.a.	A circular bar of diameter 20 mm is subjected to an axial load of 50 kN. Determine the principal stresses and the maximum shear stress at a point on the bar. Assume it is uniaxial loading	5	CO2	K3
b.	A steel rod has a length of 2 meters and is subjected to a tensile load of 10 kN. The Young's modulus of steel is 210 GPa. Calculate the elongation of the rod.	5	CO2	K3
	(OR)			
c.	Calculate (i) increase in diameter (ii) increase in volume of spherical shell of 0.9m internal diameter 1cm thick and 3m long when subjected to internal pressure of 1.4N/mm^2. Take value E=2*105 N/mm^2 and poison ratio=1/3	5	CO2	K3
d.	A cylindrical shell 3 m long, 1 m internal diameter and 10 mm thick is subjected to an internal pressure of 1.5 N/mm2. Calculate the changes in length, diameter and volume of the cylinder. E = 200 kN/mm2, Poisson's ratio = 0.3.	5	CO2	K3
4.a.	A SSB of length 6m, carries point load of 3KN and 6KN at a distance of 2m and 4m from left end. Draw SFD & BMD	5	CO3	K3
b.	Explain Different Types of Beams Loadings.	5	CO3	K3

(OR)

c.	Explain Shear force and Bending moment.	5	CO3	K3
d.	A SSB of 5m carries UVL having 800N/m at one end and 1600N/m at other end which runs for the entire length. Draw SFD & BMD for the beam. Also find the location and magnitude of maximum bending moment.	5	CO3	K3
5.a.	Derive the expression for bending stress.	5	CO4	K2
b.	Find the dimension of a timber beam of span 4.38m to carry uniformly distributed load of 20 kN/m. If the width of the joist is half the depth and permissible bending stress is limited to 9 MPa.	5	CO4	K3

(OR)

c.	A steel plate of width 120 mm and of thickness 20 mm is bent into a circular arc of radius 10 m. Determine the maximum stress induced and the bending moment which will produce the maximum stress. Take $E=2\times10^5$ N/mm^2.	5	CO4	K2
d.	Explain the bending stress distribution in beams with different cross sections	5	CO4	K2
6.a.	A solid circular shaft of diameter 50mm is subjected to a torque of 120 Nm. Calculate the shear stress and angle of twist if the length of the shaft is 2m and the modulus of rigidity is 80 GPa.	5	CO5	K3
b.	Analyse the strain energy developed in a hollow circular shaft under torsion.	5	CO5	K4

(OR)

c.	A hollow shaft is to transmit 300 kW power at 80 r.p.m. If the shear stress is not to exceed 60 N/mm² and the internal diameter is 0.6 of the external diameter, find the external and internal diameters assuming that the maximum torque is 1.4 times the mean.	5	CO5	K4
d.	Find the maximum shear stress induced in a solid circular shaft of diameter 15 cm when the shaft transmits 150 kW power at 180 r.p.m.	5	CO5	K3

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