QP Code: S253A037 | Reg. No | | | | | | | | | | | AY 23

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Third Semester – Regular & Supplementary) Examinations, November 2025

23BMEPC23002 – Mechanics of Solids

(Mechanical Engineering)

Time: 3 hrs | Maximum: 60 Marks

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

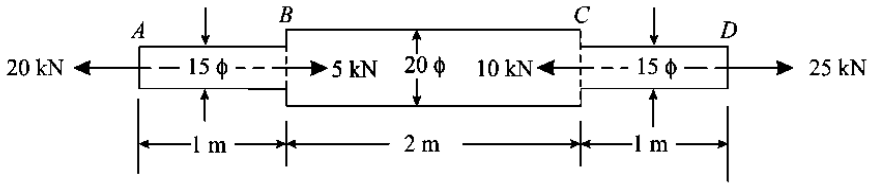
Q.1. Answer ***ALL*** questions

		CO #	Blooms Level
a.	Define the term Poisson's ratio. Write the expressions for strains in the three principal directions.	CO1	K1
b.	What is the significance of Mohr's circle for stress and strain?	CO2	K1
c.	What are types of stress in a thin cylindrical vessel subjected to internal pressure?	CO3	K1
d.	What are the main type of supports? Distinguish between roller and hinged support.	CO4	K1
e.	What do you mean by Equivalent Torque?	CO6	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions

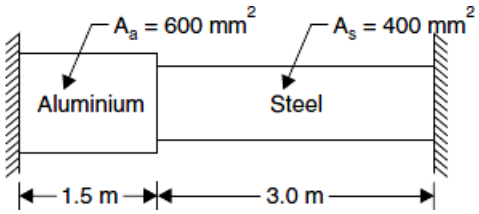
		Marks	CO #	Blooms Level
2. a.	A steel bar ABCD 4 m long is subjected to forces as shown in Fig. Find the elongation of the bar. Take E for the steel as 200 GPa.	5	CO1	K3



b.	A circular rod of 25 mm diameter and 500 mm long is subjected to a tensile force of 60 kN. Determine modulus of rigidity, bulk modulus and change in volume if Poisson's ratio =0.3 and Young's modulus E = 2×10^5 N/mm^2.	5	CO1	K3

(OR)

c.	The composite bar shown in figure is rigidly fixed at the ends A and B. Determine the reaction developed at ends when the temperature is raised by 18°C. Given E_{Al} = 70 kN/mm^2, E_s = 200 kN/mm^2 , $\alpha_{Al} = 11 \times 10^{-6}$/°C , $\alpha_s = 12 \times 10^{-6}$/°C	10	CO1	K3

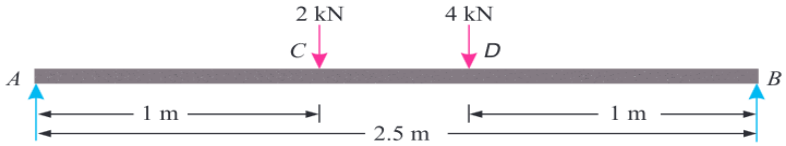
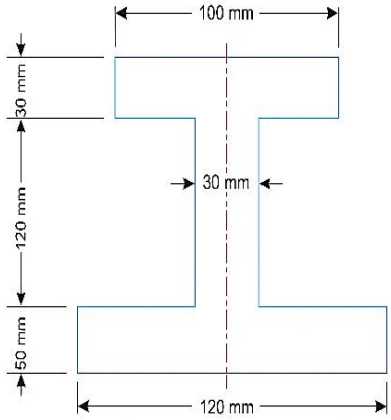
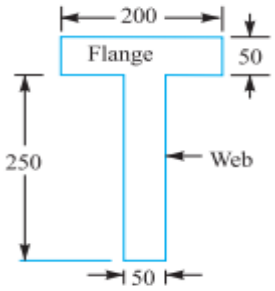


3.a.	A piece of material is subjected to tensile stresses of 100 MPa and 60 MPa. Determine normal and tangential stresses on a plane inclined at 300 to the plane of 100 MPa stress. Also find the resultant and its inclination with the normal stress. (Using Mohr's circle)	6	CO2	K4
b.	A thin cylindrical shell, 3m long, 1m in diameter is subjected to an internal pressure of 1 N/mm^2. If the thickness of the shell is 12 mm, find the circumferential and longitudinal stresses. Also find the maximum shear stress.	4	CO3	K3

(OR)

c.	A cast iron cylinder of 200 mm inner diameter and 12.5 mm thick is closely	6	CO3	K3

wound with a layer of 4 mm diameter steel wire under a tensile stress of 55 MN/mm^2. Determine the stresses setup in the cylinder and steel wire, if water under a pressure of $3MN/mm^2$ is admitted in the cylinder. Take E_{CI}= 100 GN/m^2; E_S= 200 GN/m^2; μ= 0.25.

d.	The principal stresses at a point in the section of a boiler shell are 120 MPa & 30 MPa, both tensile. Find normal, tangential & resultant stresses across a plane inclined at 50^0 to the plane carrying 120 MPa stress.	4	CO2	K3
4.a.	A cantilever of 14 m span carries loads of 6kN, 4 kN, 6 kN and 4kN at 2m, 4m, 7m, and 14m respectively from the fixed end. It also has a uniformly distributed load of 2 kN/m run for the length between 4m and 10m from the fixed end. Draw the shear force and bending moment diagrams.	10	CO4	K4
	(OR)			
b.	A simply supported beam AB of span 2.5 m is carrying two-point loads as shown in Fig. Draw the shear force and bending moment diagrams for the beam. 	10	CO4	K4
5.a.	A beam simply supported at the ends and having cross section as shown in figure is loaded with a UDL over whole of its span. If the beam is 8m long, find the UDL. If maximum permissible bending stress in tension is limited to $30MN/m^2$ and in compression to $45MN/m^2$. What are the actual maximum bending stresses set up in the section? 	10	CO5	K4
	(OR)			
b.	A T-shaped cross section of a beam having web and flange dimension of 200*50 is subjected to a vertical shear force of 100kN. Calculate the shear stress at the neutral axis and at the junction of the web and flange. All the dimensions in figure are mm. 	10	CO5	K4
6.a.	A solid circular shaft of 100 mm diameter is transmitting 120 kW at 150 rpm. Find the intensity of shear stress in the shaft.	5	CO6	K3
b.	Design the diameter of solid circular shaft to transmit 50kW power at 100 rpm. Maximum torque is likely to exceed mean torque by 25%. Maximum permissible shear stress is 60MPa. Also calculate angle of twist for a length of 2m. Take G=80 GPa	5	CO6	K4
	(OR)			
c.	Write the assumptions made in the theory of Torsion.	5	CO6	K2
d.	A hollow shaft of external and internal diameters as 100mm and 40mm is transmitting power at 120 rpm. Find the power of the shaft can transmit, if the shearing stress is not to exceed 50 MPa.	5	CO6	K3

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