U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

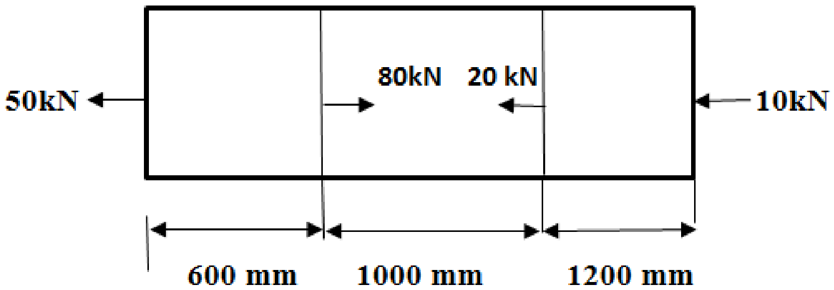
September / October 2024 Supplementary Examinations

Programme: B.E.
Branch: Mechanical Engineering
Course Code: 22ME3PCSOM
Course: Strength of Materials

Semester: III
Duration: 3 hrs.
Max Marks: 100

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	A bar of 20 mm diameter is tested in tension. It is observed that when a load of 37.7 kN is applied, the extension measured over a gauge length of 200 mm is 0.12 mm and contraction in diameter is 0.0036 mm. Determine the Poisson's ratio and elastic constants.	CO1 CO4	PO1 PO2	**10**
	b)	At a certain point in a strained material, the direct stresses acting in two mutually perpendicular directions are 280 N/mm^2 (compressive) and 500 N/mm^2 (tensile) together with complementary shear stress of 140 N/mm^2. Find (i) magnitude of principal stresses; (ii) direction of principal planes; (iii) magnitudes of maximum shear stress; (iv) direction of planes of maximum shear stress; and (v) normal stress on planes carrying maximum shear stress.	CO4	PO1 PO2	**10**
		OR			
2	a)	A bar having cross-sectional area 1000 mm^2 is subjected to axial forces as shown in the Figure 2a. Determine the elongation of the bar given E = 100 GN/m^2  Figure 2a	CO1 CO3	PO1 PO2	**10**
	b)	The state of stress in 2- D stressed body is as shown in Figure 2b. Determine (i) normal and tangential stress on plane AC, (ii) principal stresses, principal planes, maximum shear stress and its location. (iii) Verify answers by graphical method	CO4	PO1 PO2	**10**

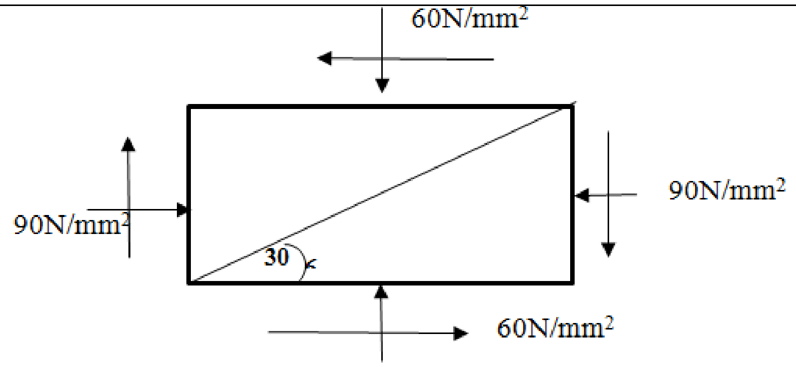


Figure 2b

			UNIT - II			
	3	a)	Draw the SFD and BMD of the Simply Supported Beam loaded as shown in the figure 3a.	*CO2* *CO3* *CO4*	*PO1* *PO2*	**10**

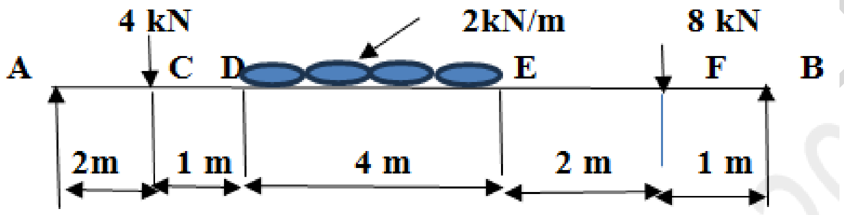
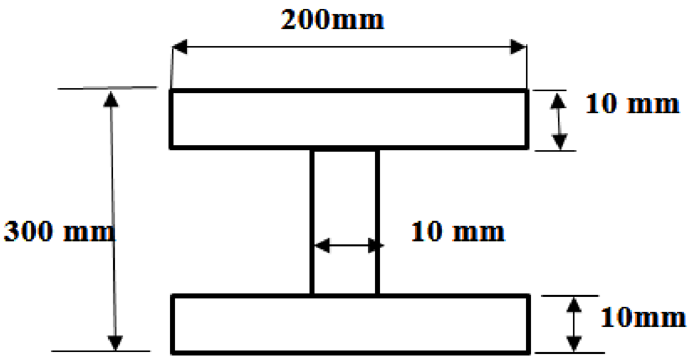


Figure 3a

		b)	Derive the relation between rate of loading, shear force and bending moment in a beam.	*CO2* *CO3* *CO4*	*PO1* *PO2*	**10**
			UNIT - III			
	4	a)	With usual notations, derive the bending equation.	*CO4*	*PO1* *PO2*	**10**
		b)	A steel girder of uniform section, 14 meters long is simply supported at its ends. It carries a concentrated load of 90 kN and 60 kN at two points 3 meters and 4.5 meters from the left and right ends respectively. Calculate using Macaulay's method (i) deflection of the girder at the points under the two loads, and (ii) the maximum deflection. Take $I = 64 \times 10^{-4}$ m^4; $E = 210 \times 10^6$ kN/m^2.	*CO4*	*PO1* *PO2*	**10**
			OR			
	5	a)	A beam of I-section (Figure 5a) 200 mm x 300 mm has thickness 10 mm and flange thickness 10 mm. It carries a shearing force of 10 kN at a section. Sketch the shear stress distribution across the section.	*CO3*	*PO1* *PO2*	**10**

			 Figure 5a			
	b)		A steel girder of 6 m length acting as a beam carries a UDL of 'w' N/m running throughout its length. If I= 30 x10^{-6} m^4 and depth 270 mm, calculate using double integration method (i) the magnitude of 'w' so that the maximum stress developed in the beam does not exceed 72 MN/m^2, and (ii) slope and deflection (under this load) in the beam at a distance of 1.8 m from one end. Take E =200 GN/m^2.	*CO4*	*PO1* *PO2*	**10**
			UNIT - IV			
	6	a)	Derive the torsion formula for a circular shaft subjected to torsion.	*CO2* *CO3*	*PO1* *PO2*	**10**
		b)	A solid circular shaft is required to transmit 80 kW at 160 rpm. The permissible shear stress in the shaft material is 60 N/mm^2. The maximum torque transmitted exceeds the mean torque by 20%. The angle of twist is not to exceed 1^0 in a length of 20 times the diameter of shaft. The value of rigidity modulus is 0.8x10^5 N/mm^2. Find the diameter of the shaft.	*CO2* *CO3*	*PO1* *PO2*	**10**
			UNIT - V			
	7	a)	A 1.5 m long column has a circular cross section of 50 mm diameter. One end of the column is fixed in direction and position and the other end is free. Taking the Factor of Safety as 3, calculate the safe load using (i) Rankine's formula taking yield stress = 560 N/mm^2 and α = 1/1600; (ii) Euler's formula taking E= 1.2x10^5 N/mm^2.	*CO2* *CO3*	*PO1* *PO2*	**10**
		b)	A thick cylindrical pipe of outer diameter 300 mm and inner diameter 200 mm is subjected to an internal fluid pressure of 20 N/mm^2 and external fluid pressure of 5 N/mm^2. Determine the maximum hoop stress developed. Draw the variation of hoop and radial stress across the thickness indicating the values at every 25 mm interval.	*CO2* *CO4*	*PO1* *PO2*	**10**

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