U.S.N.										

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

Autonomous Institute Affiliated to VTU

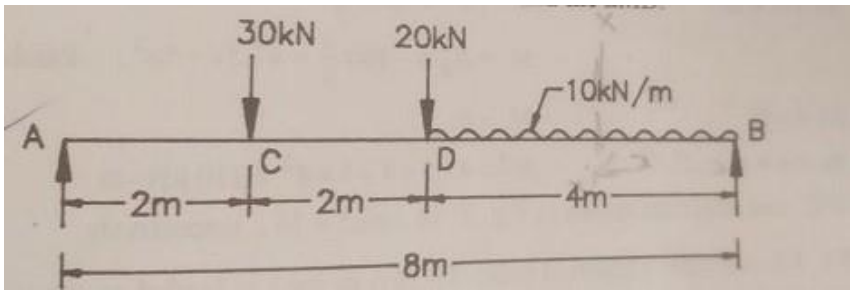
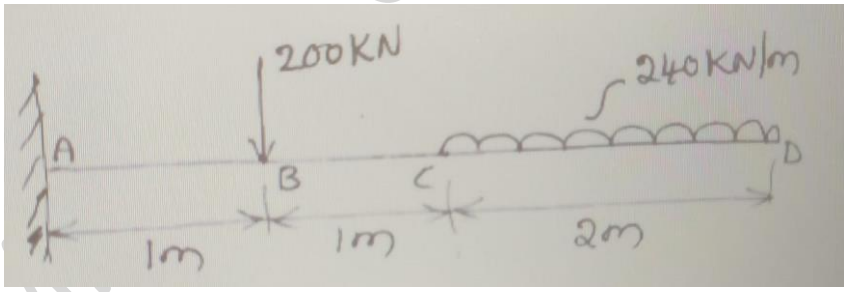
April 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 23ME3PCSOM / 22ME3PCSOM **Max Marks: 100**
Course: Strength of Materials

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)	Define the following terms: (i) Normal stress (ii) Volumetric strain (iii) Poisson's ratio	*CO1*	*PO1*	**06**
	b)	Derive an expression for deformation of tapering bar of rectangular section.	*CO1*	*PO1*	**07**
	c)	A load of 270 kN is carried by a short concreate column 250 mm x 250 mm in cross section. The column is reinforced with 8 steel bars of 16 mm diameter. Find the stresses in concreate and steel, if the modulus of elasticity for the steel is 18 times that of concrete .If the stress in concrete is not to exceed 5 MPa. Find the area of steel required, so that the column may carry of load 500 kN.	*CO1*	*PO2*	**07**
		OR			
2	a)	For a plane element subjected to a general two dimensional stress system, derive the expression for normal and tangential stress on a plane inclined at an angle to the X-plane.	*CO1*	*PO1*	**08**
	b)	At a point in a body, the stress system has a tensile stress of 250 MPa in the horizontal direction and another tensile stress of 100 MPa in the vertical direction. The point is also subjected to a simple shear stress of 25 MPa, such that when it is associated with the major tensile stress, it tends to rotate the element in the clockwise direction. What is the magnitude of the normal and shear stresses on an inclined section at an angle of 20° with the major tensile stress? Use Mohr's circle method.	*CO4*	*PO2*	**12**
		UNIT – II			
3	a)	Draw SFD and BMD for a simply supported beam subjected to a uniformly distributed load of intensity w per unit length over the entire span L. What is the maximum value of shear force and bending moment?	*CO4*	*PO2*	**08**

		b)	Draw the shear force and bending moment diagrams for a simply supported beam subjected to two concentrated load and a uniformly distributed load as shown in Figure 3b.  Figure 3b	*CO4*	*PO2*	**12**
			UNIT - III			
	4	a)	Derive the bending equation for a beam subjected to pure bending and list out its assumptions.	*CO1* *CO2*	*PO1*	**08**
		b)	An I-section of a beam has equal flanges each of 120 x 20 mm and web of size 200 x 10 mm. Draw the shear stress distribution curve when the section is subjected to a shearing force of 100 kN.	*CO1* *CO2*	*PO2*	**12**
			OR			
	5	a)	A cantilever beam is subjected to a point load at its free-end. Using double integration method, derive expressions for slope and maximum deflection at the free-end.	*CO1* *CO2*	*PO1*	**08**
		b)	A cantilever beam is loaded as shown in Figure 5b. Determine the deflections at B and D. Take E = 10^8 kN/m^2 and I = 10^{-4} m^4.  Figure 5b	*CO1* *CO2*	*PO2*	**12**
			UNIT - IV			
	6	a)	Derive the torsion equation; $T/J = \tau/R = G\theta/L$ and list out its assumptions.	*CO1* *CO3*	*PO1*	**10**
		b)	A hollow shaft having internal diameter 40% of its external diameter transmit 562.5 kW power at 100 rpm. Determine the internal and external diameter if the shear stress is not to exceed 60 N/mm^2 and the twist in length of 2.5 m should not exceed 1.3 degree, the maximum torque being 25% greater than mean. Take G = 9x10^4 N/mm^2 .	*CO1* *CO3*	*PO2*	**10**

			UNIT - V			
	7	a)	A pipe of 500 mm internal diameter and 75 mm thick is filled with a fluid at a pressure of 6 N/mm^2. Find the maximum and minimum hoop stress across the section of the cylinder. Also sketch the radial pressure and hoop stress distribution across the section.	*CO1* *CO3*	*PO2*	**12**
		b)	Derive expression for Euler's crippling load for a column whose both ends are fixed.	*CO1* *CO3*	*PO1*	**08**

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