U.S.N.										

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

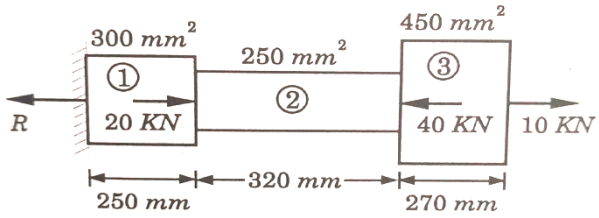
Autonomous Institute Affiliated to VTU

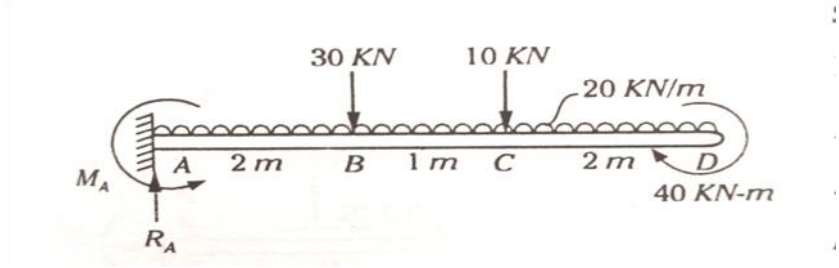
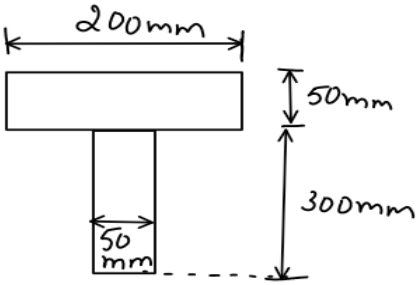
August 2024 Supplementary Examinations

Programme: B.E. **Semester: III**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 19CV3PCSOM **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)		A stepped bar with 3 different portions has a fixed support at one of its ends. The stepped bar is subjected to forces as shown in Fig.1. Determine the stresses and deformations induced in each portion. Also find the net deformation induced in the stepped bar. Take E = 200 GPa.  Fig-1	CO 1	PO1	**10**
	b)		Derive an expression for change in length in case of uniformly varying circular cross section whose diameter varies from d1 to d2 over a length "L" subjected to an axial force F.	CO 1	PO1	**10**
			OR			
	a)		The following data refer to a mild steel specimen tested in a laboratory: Diameter of bar = 25mm, Gauge length = 300mm, extension under a load of 15kN is 0.045mm, load at yield point is 127kN, ultimate load is 208kN, length after failure is 375mm and diameter at failure is 17.75mm. Determine Young's modulus, ultimate stress, yield stress, percentage elongation and percentage reduction in area.	CO 1	PO1	**10**
	b)		A brass tube 12 mm inside diameter and 18mm outside diameter encloses a steel bolt 10mm in diameter. The assembly is 30 mm long. To hold the assembly rigid, the steel bolt is loaded to an initial tension of 5 KN. The complete assembly is then heated from 150 C to 320 0 C. Evaluate the final stresses in steel bolt and brass tube. E_{steel}= 200 GPa, α_s=1.2 x 10^{-5}/ ^{0}C, E_{brass}=105 GPa, α_b =1.90 x10^{-5}/ ^{0}C.	CO1	P01,2	**10**

			UNIT - II			
	3	a)	Draw SFD and BMD for the cantilever beam shown in Fig 2, showing the salient features.  Fig-2	*CO* 2	*PO2*	**10**
		b)	Derive an expression for simply supported beam carrying uniformly distributed load throughout the span of L. Draw bending moment and shear force diagram	*CO* 2	*PO1,2*	**10**
			UNIT - III			
	4	a)	Derive the simple bending equation M/I = f/y = E/R with usual notations	*CO* 2	*PO1*	**10**
		b)	A beam with an I section consists of 180mm x 15mm flanges and a web of 280mm depth x 15mm thickness. It is subjected to a sagging bending moment of 120 kN-m. Draw the bending stress distribution along the depth of the section.	*CO* 2	*PO2*	**10**
			OR			
	5	a)	A simple supported beam of span 6 m is of T-section as shown in fig 3, carries two point loads of 50kN at a distance of 2m from either supports. Draw the shear stress distribution along the depth of the section.  Fig-3	*CO* 2	*PO2*	**10**
		b)	A 1m long cantilever with T section is subjected to a point load 10kN at its free end .The size of flange is (140mmx10mm) and the overall depth of the section is 150mm.Thickness of web is 10mm. Determine the maximum tensile stress and maximum compressive stress induced in the section and draw the bending stress distrbution. Assume the self weight of beam to be negligible.	*CO* 2	*PO1,2*	**10**
			UNIT - IV			
	6	a)	Derive the Euler's equation for buckling load for column with whose both ends are hinged.	*CO* 2	*PO1*	**10**

		b)	A hollow cast iron column has an outer diameter of 180 mm and thickness of 20 mm. It is 8 m long with one end fixed and the other end hinged. Calculate the ratio of Rankine's critical load to Euler's critical load. Take E= 80 GPa, α = 1/1600, fc =550 MPa and factor of safety of 3.	*CO* 2	*PO2*	**10**
			UNIT – V			
	7	a)	Derive the following relation for torsion of circular shaft (τ/R) = (T/J) = (GΘ/L) with usual notation.	*CO* 2	*PO1*	**10**
		b)	A solid shaft rotating at 500 rpm transmits 30 KW. Maximum torque is 20% more than the mean torque. Material of shaft has the allowable shear stress of 65 MPa and modulus of rigidity of 81 GPa. Angle of twist in the shaft should not exceed 1˚ in 1 meter length. Determine the diameter of shaft.	*CO* 2	*PO2*	**10**

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