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

Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

Programme: B.E. **Semester: IV**

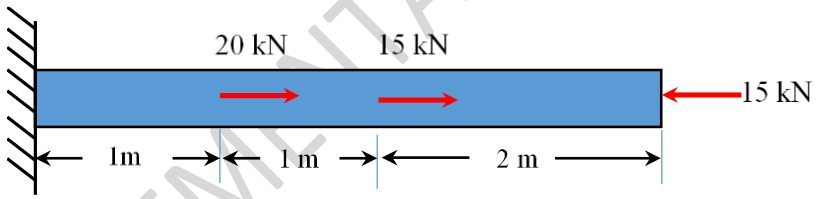
Branch: Aerospace Engineering **Duration: 3 hrs.**

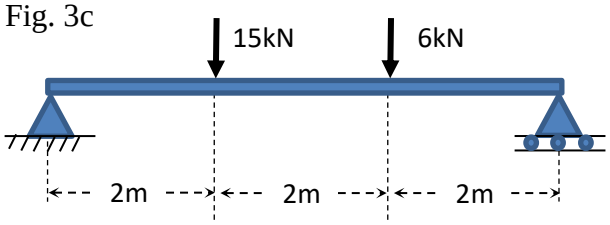
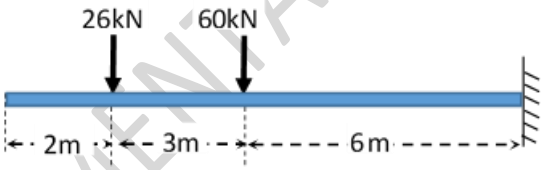
Course Code: 23AS4PCSDM **Max Marks: 100**

Course: Solid Mechanics

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)	Explain the stress-strain curves for different materials with a neat sketch.	CO1	PO1	6
	b)	Derive the tip extension expression for a uniformly tapering circular bar under a load its tip.	CO2	PO1	7
	c)	A prismatic steel bar having cross sectional area of A=300 mm^2 is subjected to axial load as shown in figure 1c. Find the net increase in the length of the bar. Assume E = $2 \cdot 10^5$MPa.  Fig 1c.	CO3	PO1 PO2	7
		OR			
2	a)	Derive the relationship between modulus of elasticity, modulus of rigidity and bulk modulus.	CO2	PO2	10
	b)	A bar of brass 20 mm is enclosed in a steel tube of 40 mm external diameter and 20 mm internal diameter. The bar and the tubes are initially 1.2 m long and are rigidly fastened at both ends. If the temperature is raised by 60 °C, find the stresses induced in the bar and tube. Take E_{steel} = 2×10^5 N/mm^2 and E_{brass}= 1×10^5 N/mm^2. αsteel =12×10-6/°C and αbrass =18.7×10-6/°C	CO3	PO1 PO2	10
		UNIT - II			
3	a)	Explain briefly different types of beams and loads.	CO1	PO1	6
	b)	Derive the relation between distributed load, shear force and bending moment in beam.	CO2	PO1	7

		c)	Draw the SFD and BMD for the following simply supported beam shown in Fig. 3c  Fig. 3c	*CO3*	*PO1* *PO2*	**7**
	4	a)	Derive the flexural formula for beam $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ with usual notation. State the assumptions made.	*CO2*	*PO1*	**8**
		b)	A T-section of simply supported beam has the following dimensions. Width of the flange =100 mm, overall depth =100 mm, and thickness of stem and flange =20 mm. (i) Determine the maximum stress in the beam when a bending moment at 1,200 N·m is acting on the section. (ii) Calculate the shear stress at the neutral axis and at the junction of web and the flange when a shear force of 50kN acting on the beam. (iii) Drawn bending stress, and shear stress diagrams along the section.	*CO3*	*PO1* *PO2*	**12**
			UNIT - III			
	5	a)	Derive the deflection equation $EI\frac{d^2y}{dx^2} = M$. State the assumptions made.	*CO2*	*PO1*	**8**
		b)	Determine the deflection and slope at the free end as shown in Fig 5b.  Fig.5b	*CO3*	*PO1* *PO2*	**12**
			UNIT - IV			
	6	a)	Derive the torsional formula $\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{L}$ with usual notation for the circular shaft.	*CO2*	*PO1*	**7**
		b)	Derive Euler's formula for long columns with both ends hinged.	*CO2*	*PO1*	**6**
		c)	A motor at a dam construction site is rotating at 100 rpm lifts concrete of 50kN at each cycle. The rope carrying the bucket is wound round the pulley which is attached at the end of the shaft. Diameter of the pully is 0.8m. Determine i) shaft diameter so that the induced shear stress does not exceed 100 MPa and ii) Power generated by the motor. Take G=80 GPa.	*CO3*	*PO1* *PO2*	**7**
			UNIT - V			
	7	a)	It has been determined that a point in a load-carrying member is subjected to the following stress condition: σ_x=400MPa (Tensile), σ_y=300MPa (Compressive) and τ_{xy}=200MPa(CW). Perform the following.	*CO33*	*PO1* *PO2*	**12**

			i. Draw the initial stress element. ii. Draw the complete Mohr's circle, labeling critical points. iii. Draw the complete principal stress element. iv. Draw the maximum shear stress element.			
		b)	A machine element is subjected to the following stresses σ_x=60MPa, σ_y=45MPa and τ_{xy}=30MPa. Find the factor of safety if the element is made of C45 steel having yield stress as 353 MPa using following theories of failure. i. Maximum principal stress theory ii. Maximum shear stress theory	*CO3*	*PO1* *PO2*	**8**

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