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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: III**

Branch: Industrial Engineering and Management **Duration: 3 hrs.**

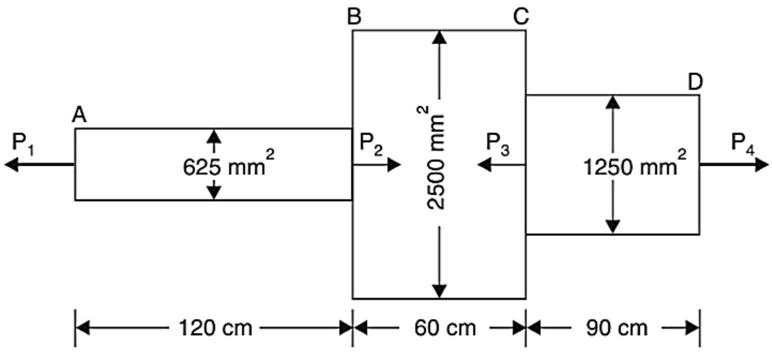
Course Code: 23IM3PCEMM **Max Marks: 100**

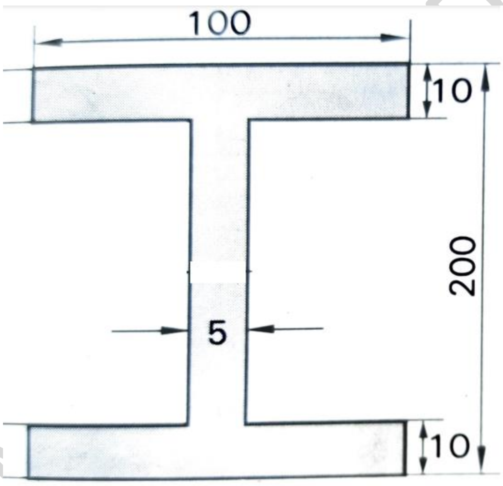
Course: Engineering Materials and Mechanics

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.

			CO	PO	Marks
		UNIT - I			
1	a)	Define a solid solution. Illustrate its types with diagrams and provide a detailed explanation	*CO1*	*PO1*	**10**
	b)	Define phase and phase diagram. Draw the iron-iron carbide phase diagram and mark on it all salient temperatures and composition fields.	*CO1*	*PO1*	**10**
		OR			
2	a)	Explain the Gibbs phase rule and the Lever rule, highlighting their significance in the context of phase diagrams.	*CO1*	*PO1*	**10**
	b)	A binary alloy having 28 wt % Cu & balance Ag solidifies at 779^{o}C. The solid consists of two phases α & β. Phase α has 9% Cu whereas phase β has 8% Ag at 779^{0}C. At room temperature these are pure Ag & Cu respectively. Sketch the phase diagram. Label all fields & lines. Melting points of Cu & Ag are 1083^0 & 960^{0}C respectively. Estimate the amount of α & β in the above alloy at 779^{0}C & at room temperature.	*CO1*	*PO1*	**10**
		UNIT - II			
3	a)	Define heat treatment process. Give the classification of heat treatment processes. Also, differentiate Annealing and normalizing	*CO2*	*PO2*	**10**
	b)	What is metallography? Describe the steps involved in preparing a metallographic specimen for microscopic examination.	*CO2*	*PO2*	**10**
		OR			
4	a)	Illustrate the key steps involved in the Pultrusion process for producing composite materials with the help of a neat sketch. Also highlight its advantages.	*CO1*	*PO1*	**10**
	b)	What are Nanomaterials? List the applications, advantages and disadvantages of Nanotechnology.	*CO1*	*PO1*	**10**

			UNIT - III			
	5	a)	Differentiate between: i)Young’s modulus and rigidity modulus ii) Proportionality limit and elastic limit iii) True stress and engineering stress iv) Elasticity and plasticity v) Stiffness and resilience	*CO4*	*PO4*	**10**
		b)	A member ABCD is subjected to point loads P_1, P_2, P_3 and P_4 as shown in Fig. 5(b). Calculate the force P_2 necessary for equilibrium, if P_1 = 45 kN, P_3 = 450 kN and P_4 = 130 kN. Determine the total elongation of the member, assuming the modulus of elasticity to be 2.1×10^5 N/mm^2.  Fig. 5(b).	*CO4*	*PO4*	**10**
			OR			
	6	a)	Define Principle of Superposition. Obtain an expression for total elongation of a uniformly tapering circular bar when it is subjected to an axial load P.	*CO3*	*PO3*	**10**
		b)	A compound tube consists of a steel tube 140 mm internal diameter and 160 mm external diameter and an outer brass tube 160 mm internal diameter and 180 mm external diameter. The two tubes are of the same length. The compound tube carries an axial load of 900 kN. Find the stresses and the load carried by each tube. Length of each tube is 140 mm. Take E for steel as 2×10^5 N/mm^2 and for brass as 1×10^5 N/mm^2.	*CO4*	*PO4*	**10**
			UNIT - IV			
	7	a)	Define: Shear Force and Bending Moment. Illustrate with figures: i. Different types of beams ii. Different types of loads acting on a beam.	*CO3*	*PO3*	**10**
		b)	Draw the S.F. and B.M. diagrams for a simply supported beam carrying a uniformly distributed load of ‘w’ per unit length over the entire span. Also calculate the maximum B.M.	*CO3*	*PO3*	**10**
			OR			

	8	a)	What do you mean by point of Contraflexure? Derive the relationship between: a) Shear force and bending moment. b) Intensity of load and shear force	*CO3*	*PO3*	**10**
		b)	Draw the shear force and bending moment diagram for a simply supported beam of length 9 m and carrying a uniformly distributed load of 10 kN/m for a distance of 6 m from the left end.	*CO3*	*PO3*	**10**
			UNIT - V			
	9	a)	Derive bending equation $\frac{M}{I}=\frac{\sigma_b}{Y}=\frac{E}{R}$ with usual notations. State the assumptions made.	*CO3*	*PO3*	**10**
		b)	A rectangular beam 200 mm deep and 300 mm wide is simply supported over a span of 8 m. What uniformly distributed load per metre the beam may carry, if the bending stress is not to exceed 120 N/mm^2.	*CO3*	*PO3*	**10**
			OR			
	10	a)	A cast iron bracket of I-section with equal flanges is as shown in the figure below. The beam carries an *udl* of 10 kN/m on a span of 10m length. Determine the positon of neutral axis, Moment of Inertia about the neutral axis and the maximum stress distribution. 	*CO4*	*PO4*	**10**
		b)	A beam of ‘I’ section 200mm x 300 mm has web thickness of 10mm and flange thickness 10mm. It carries a shearing force of 10 kN at a section. Sketch the shear stress distribution across the section.	*CO4*	*PO4*	**10**

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