U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

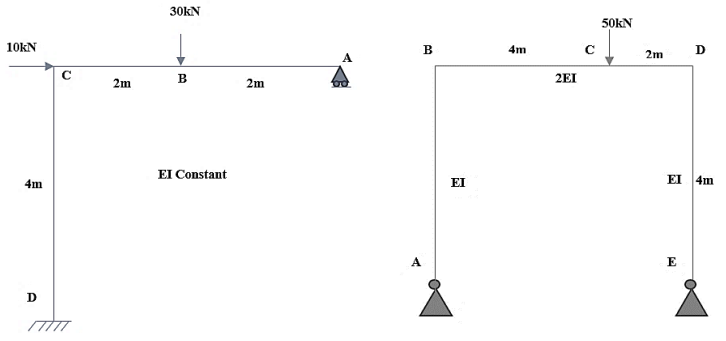
Programme: B.E. **Semester: IV**

Branch: CIVIL ENGG. **Duration: 3 hrs.**

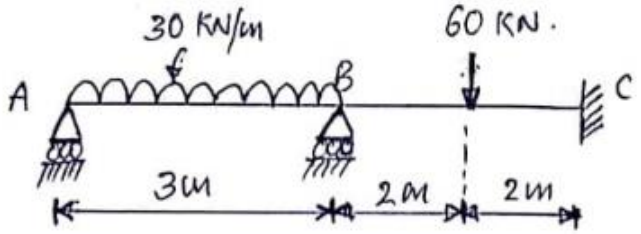
Course Code: 23CV4PCSTA / 22CV4PCSTA **Max Marks: 100**

Course: Structural Analysis

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

		UNIT - I	CO	PO	Marks
1	a)	Define degree of static and kinematic indeterminacy with three examples each.	*CO1*	*PO1, PO2*	**10**
	b)	A simply supported beam of span 6 m carries a point load of 12 kN at mid-span. Using Macaulay's method, calculate: (i) Maximum deflection (ii) Slope at supports Take $E=200\times10^6$ kN/m^2, $I=8\times10^{-6}$ m^4	*CO1*	*PO1, PO2*	**10**
		OR			
2	a)	Find the static and kinematic indeterminacy of the portal frames shown in fig. 2a  (i) (ii) Fig. 2a	*CO1*	*PO1, PO2*	**10**
	b)	Derive the governing differential equation of the elastic curve for a simply supported beam subjected to a point load at mid-span.	*CO1*	*PO1, PO2*	**10**

			UNIT - II			
	3	a)	A simply supported beam of 5 m span is subjected to a UDL of 10 kN/m over the entire span. Using the Moment Area Method, calculate slope at supports and maximum deflection.	*CO1*	*PO1, PO2*	**10**
		b)	Derive expressions for the slope and deflection of a cantilever beam with a point load at its free end using conjugate beam method.	*CO1*	*PO1, PO2*	**10**
			OR			
	4	a)	A cantilever of 3 m length carries a point load of 8 kN at free end. Using conjugate beam method, determine: (i) Slope at free end (ii) Deflection at free end E=200GPa, I = 4 x 10^{-6} m^4	*CO1*	*PO1, PO2*	**10**
		b)	Determine the slope and deflection at the free end of a cantilever beam subjected to a uniformly distributed load using the Moment Area Method.	*CO1*	*PO1, PO2*	**10**
			UNIT - III			
	5	a)	Distinguish between arch action and beam action. How does the internal force distribution differ between an arch and a straight beam?	*CO1*	*PO1, PO2*	**10**
		b)	A cable of span 12 m is subjected to three-point loads 5 kN, 8 kN, and 7 kN placed at spaced 3 m, 6 m and 9 m respectively from left support. The vertical deflection under 5 kN load is 1 m and if supports are at the same level, Find the maximum tension in the cable.	*CO1*	*PO1, PO2*	**10**
			OR			
	6	a)	Explain the terms: bending moment, radial shear, and normal thrust in the context of three-hinged arches. Derive expressions for them.	*CO1*	*PO1, PO2*	**10**
		b)	A three-hinged parabolic arch of span 30 m and rise 6 m carries a UDL of 10 kN/m over the entire span. Find the bending moment, Normal thrust and radial shear at quarter span from left support.	*CO1*	*PO1, PO2*	**10**
			UNIT - IV			
	7	a)	Analyze a fixed beam carrying a central point load using the Theorem of Three Moments. Sketch the bending moment diagram.	*CO2*	*PO1, PO2*	**10**
		b)	Using Clayperon's theorem of three moments, determine the moments at supports for a two-span continuous simply supported	*CO2*	*PO1, PO2*	**10**

			beam (each span 5 m) carrying UDL of 8 kN/m. Assume supports are at same level. Take EI Constant.			
			OR			
	8	a)	Analyse the continuous beam as shown in the Figure Q7(b) below using Clapeyrons three moment equation. Take EI Constant.  **Figure Q7(b)**	*CO2*	*PO1, PO2*	**10**
		b)	Using Consistent Deformation Method, find the support reactions of a propped cantilever beam having a span of 3 m and carrying a point load of 15 kN at mid-span.	*CO2*	*PO1, PO2*	**10**
			UNIT - V			
	9	a)	Using Castigliano's theorem, find the deflection at mid-span of a simply supported beam of 6 m span carrying a central point load of 10 kN.	*CO2*	*PO1, PO2*	**10**
		b)	Explain the concept of strain energy due to axial load and bending. Derive expressions for strain energy stored in a member under axial load.	*CO2*	*PO1, PO2*	**10**
			OR			
	10	a)	Explain the principle of virtual work. Using unit load method, determine the deflection at the free end of a cantilever beam subjected to a point load at the free end.	*CO2*	*PO1, PO2*	**10**
		b)	Using Unit Load Method, determine the vertical deflection at the free end of a cantilever beam of 4 m carrying a UDL of 5 kN/m. Take EI = 12 x 10^6 kNm^2	*CO2*	*PO1, PO2*	**10**

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