MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

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MANIPAL INSTITUTE OF TECHNOLOGY

FOURTH SEMESTER B. TECH (CIVIL ENGINEERING)

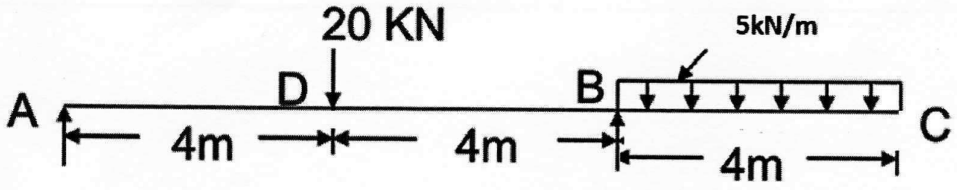
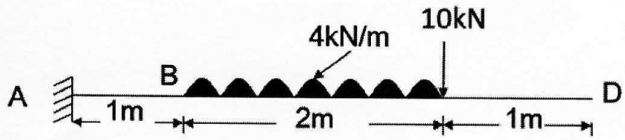
END SEMESTER EXAMINATION, MAY 2023

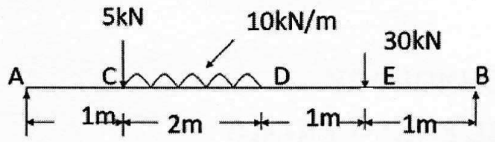
STRENGTH OF MATERIALS (CIE 4306)

(– 06 - 2023)

TIME: 3 HRS. **MAX. MARKS: 50**

Note: 1. Answer all questions.
2. Any missing data may be suitably assumed.

Q. NO	QUESTION	MARKS	CO	BL
1A	Draw SFD and BMD for the single overhanging beam supported at A and B is subjected to loading as shown in figure. Mark all salient points and inflection point. 	6	1	3
1B	Derive the relationship between load, shear force and bending moment.	4	5	2
2A	A simply supported beam of span 8m carries a UDL of 20 kN/m over its entire span. The c / s of the beam is a rectangle 150 mm x 200 mm deep. Draw the shear stress distribution at 1m from the left support, by considering horizontal fibres 50 mm apart from top to bottom in the cross section.	6	2	3
2B	Define pure bending and list the assumption made in pure bending theory.	4	2	2
3A	Determine the deflection and slope at free end for loaded beam shown in figure. Take EI constant. 	5	3	3

3B	Determine the deflections at points C and D for the beam loaded as shown in figure. Take E=2x10^5 MPa; I= 60x10^8 mm^4. 	**5**	**3**	**3**
4A	Show that a hollow shaft is stiffer than a solid shaft of same material, length, and weight subjected to pure torsion.	**5**	**4**	**2**
4B	A solid shaft is required to transmit 245 kW power at 240 rpm. The maximum torque is 50% more than the mean torque. The shear stress in the shaft is not to exceed 40 N/mm^2 and the twist 1° per meter length. Determine the minimum diameter required. Take G = 80 kN/mm^2,	**5**	**4**	**3**
5A	Determine the Euler's crippling load for a column of 4m long with hinged at both ends. The section details of column as follows: (T-section) flange of 150 mm (wide) x 20 mm (deep) and web of 20 mm (wide) x 100 mm (deep), overall depth of section is 120 mm. Take E =200 GPa.	**5**	**5**	**3**
5B	A hollow cylindrical cast iron column is 4m long with both ends fixed. Determine the minimum diameter of the column using Rankine's formula, if it has to carry a safe load of 250 kN with a factor of safety of 2. Take the internal diameter as 0.8 times the external diameter. Take Rankine's constant as σ_C =550 MN /m ^{2}, a= 1/1600.	**5**	**5**	**3**