Shirpur Education Society's
R. C. PATEL INSTITUTE OF TECHNOLOGY, SHIRPUR
An Autonomous Institute
(Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere)
आर. सी. पटेल इन्स्टिट्यूट ऑफ टेक्नॉलॉजी, शिरपूर
(स्वायत्त महाविद्यालय)

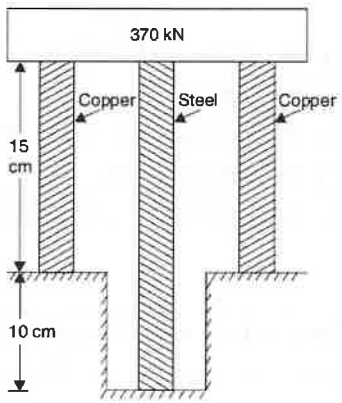
Academic Year (2024-25)
Year: Second Semester: III

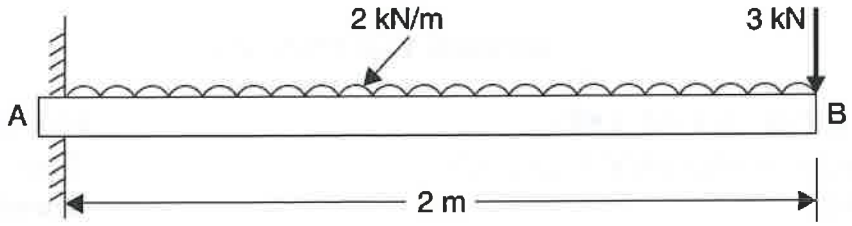
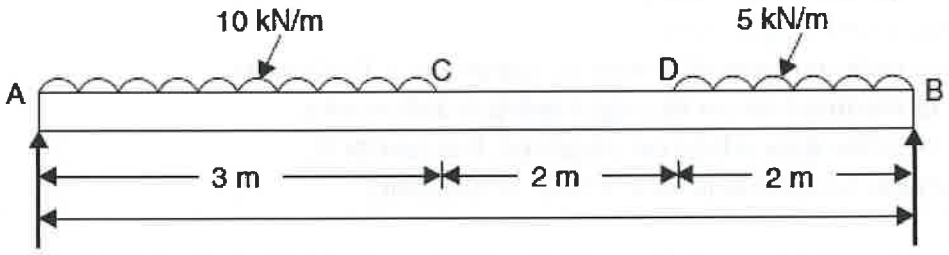
Program: SY B.Tech. (CIVIL ENGG.) **Max. Marks: 60**
Subject: Mechanics of Solids (RCP23VCPC302) **Time: 2.30 To 4.30 pm**
Date: 22/03/2025 **Duration: 2 Hours**

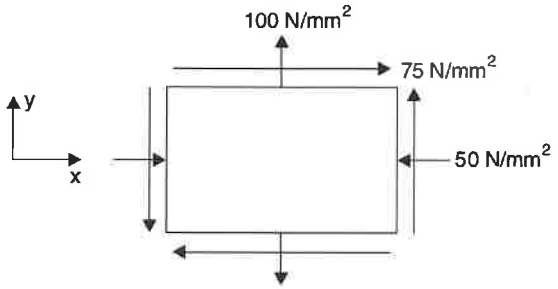
RE END SEM EXAMINATION –ODD SEM- III (MARCH 2025)

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover page of the Answer Book, which is provided for their use.

(1) This question paper contains 03 pages.
(2) All Questions are Compulsory.
(3) All questions carry equal marks.
(4) Answer to each new question is to be started on a fresh page.
(5) Figures in the brackets on the right indicate full marks.
(6) Assume suitable data wherever required, but justify it.
(7) Draw the neat, labelled diagrams, wherever necessary.

Question No.		Max. Marks
Q1 (a)	A steel rod and two copper rods together support a load of 370 kN as shown in Fig. 1. The cross-sectional area of steel rod is 2500 mm^2 and of each copper rod is 1600 mm^2. Find the stresses in the rods. Take E for steel = 2×10^5 N/mm^2 and for copper = 1×10^5 N/mm^2.  Fig. 1 **OR** A rod is 2 m long at a temperature of 10°C. Find the expansion of the rod, when the temperature is raised to 80°C. If this expansion is prevented, find the stress induced in the material of the rod. Take E = 1.0×10^5 MN/m^2 and $\alpha = 0.000012$ per degree centigrade.	[07] [07]
Q1 (b)	Define the following terms: (i) Modulus of Elasticity (ii) Modulus of Rigidity	[05]
Q2 (a)	A cantilever of length 2.0 m carries a uniformly distributed load of 2 kN/m length over the whole length and a point load of 3 kN at the free end. Draw the S.F. and B.M. diagrams for the cantilever. Refer Fig. 2.	[08] [08]

	 Fig. 2 **OR** Draw the S.F. and B.M. diagrams of a simply supported beam of length 7 m carrying uniformly distributed loads as shown in Fig. 3.  Fig. 3	
Q2 (b)	Draw SFD & BMD for cantilever beam with a uniformly distributed load over the entire span.	[04]
Q3 (a)	A cantilever of length 2 metre fails when a load of 2 kN is applied at the free end. If the section of the beam is 40 mm × 60 mm, find the bending stress at the failure. **OR** A rectangular beam 100 mm wide and 250 mm deep is subjected to a maximum shear force of 50 kN. Determine : (i) Average shear stress, (ii) Maximum shear stress, and (iii) Shear stress at a distance of 25 mm above the neutral axis.	[07] [07]
Q3 (b)	Prove that the maximum shear stress in a circular section of a beam is 4/3 times the average shear stress.	[05]
Q4 (a)	A hollow circular shaft of 6 m length and inner and outer diameters of 75 mm and 100 mm is subjected to a torque of 10kN-m. If G=80GPa, determine the maximum shear stress produced and the total angle of twist. **OR** A load of 100 N falls through a height of 2 cm onto a collar rigidly attached to the lower end of a vertical bar 1.5 m long and of 1.5 cm2 cross-sectional area. The upper end of the vertical bar is fixed. Determine : (i) maximum instantaneous stress induced in the vertical bar, (ii) maximum instantaneous elongation, and (iii) strain energy stored in the vertical rod. Take $E = 2 \times 10^5$ N/mm^2.	[07] [07]
Q4 (b)	Explain: (i) Resilience (ii) Proof Resilience	[05]
Q5 (a)	State of stress at a point in a material is as shown in the Fig. 4. Determine (i) principal stresses (ii) maximum shear stress	[07] [07]

	(iii) plane of maximum shear stress  **OR** A column section 200 mm wide and 150 mm thick is subjected to a load of 200 kN at an eccentricity of 20 mm in a plane bisecting the thickness. Find the maximum and minimum intensities of stress in the section.	
Q5 (b)	Explain in detailed Middle Third Rule (Limit of Eccentricity) for Rectangular section.	[05]