Sem III / Strength of materials. PROD 26-05-15

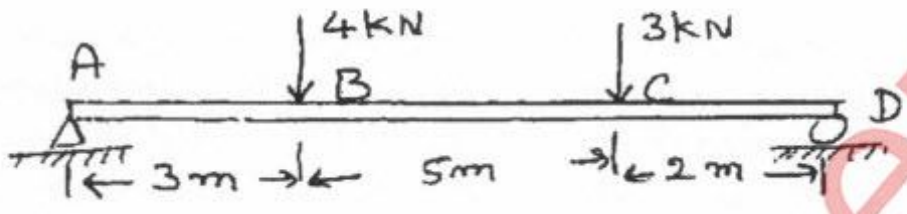
QP Code : 4806

(3 Hours) **[Total Marks :80**

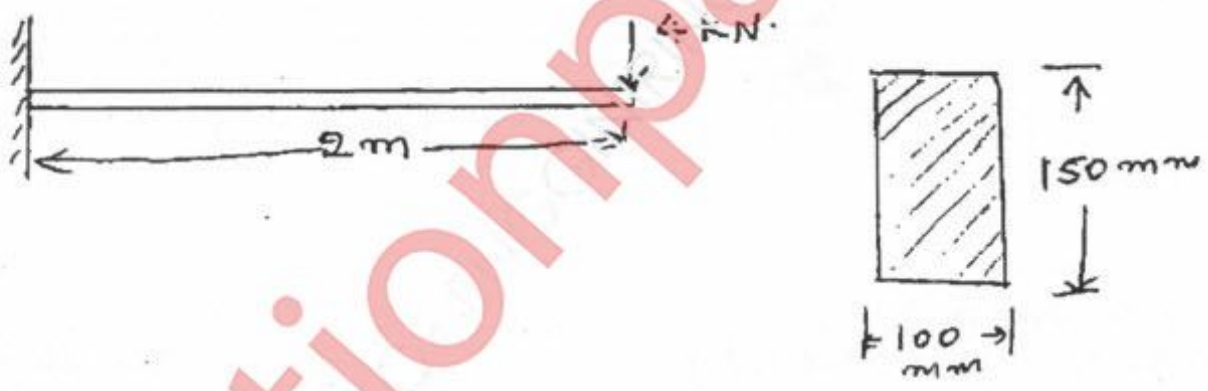
N.B. : (1) Questions No. **1** is **compulsory.**
(2) Attempt **any three** from the remaining **five** questions.
(3) Assume any suitable data if necessary.
(4) Figures to the **right** indicate **full** marks.

1. Answer any four of the following

(a). Draw the shear and moment diagram for the beam shown 5



(b) A 100mm x 150 wooden cantilever beam is 2 m long. It is loaded at its tip with a 4-KN load. Find the maximum bending stress in the beam shown in figure. 5



(c) Derive the torsion formula with usual notations. 5

$$\frac{T}{J} = \frac{\sigma}{R} = \frac{G\theta}{L}$$

(d) If a round bar of 37.5 mm diameter and 2.4 m length is stretched by 2.5 mm, find its bulk modulus and lateral contraction. Take, young's modulur= 110GN/m2 and shear modulus = 42 GN/m2 for the material of the bar. 5

(e) A uniformly tapering rod of length ℓ and diameters d_1 and d_2 is subjected to and axial pull P. Prove that the total extension of rod is 5

$$\delta\ell = \frac{4P\ell}{\pi E d_1 d_2}$$

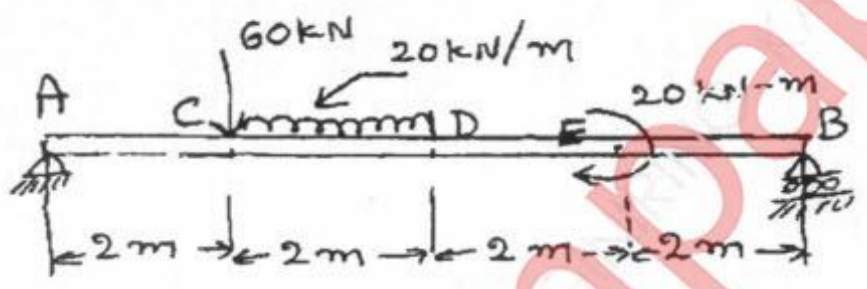
[TURN OVER]

2. (a) A composite bar is made with a copper flat of size 50x30mm and steel flat of 50x40mm of length 500mm each placed one over the other. Find the stresses induced in the materials, when the composite bar is subjected to and increase in temperature of 100°C, Take, $\alpha_s = 12x10\text{-}6 / {}^{0}_{C}$ $\alpha_c = 10x10^{-6}/{}^{0}_{C}$; Es= $2x10^5$ N/mm² Ec = $1x10^5$ N/ mm² **10**

(b) A short column of rectangular cross-section 80mmx60 mm carries a load of 40 KN at a point 20mm from longer side and 35mm from the shorter side. Determine the maximum compression and tensile stresses in the section. **10**

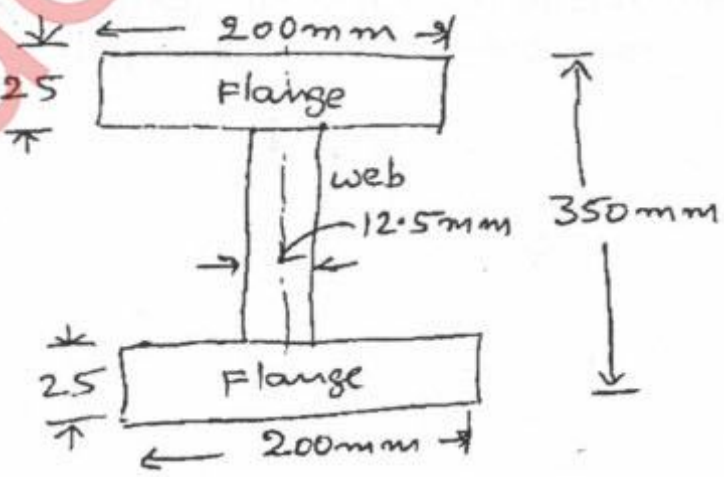
3. (a) Two mutually perpendicular planes of and element of material is subjected to tensile stress of 105 N/mm², Compressive stress of 35 N/mm² and shear stess of 70 N/mm². Find graphically magnitude and direction of principle stressor and also greatest shear stress. Verify the answers analytically. **10**

(b) For the beam loaded as shown in figure draw, shear force and Bending moment diagram. **10**



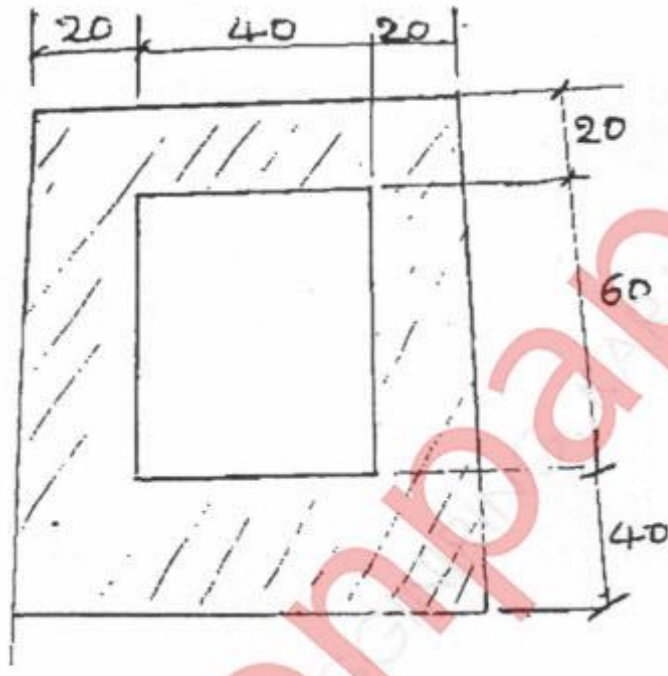
4. (a) A simply supported beam 4 m span with EI Constant throughout is subjected to a point load of 24 KN at 3 m from left hand support. Find the strain energy of the beam in bending. **10**

(b) An I- beam 350mmx200 mm has a web thickness of 12.5 mm and a flange thickness of 25mm. It carries a shearing force of 200 KN at a section. Sketch shear stress distribution across the section. **10**



5. (a) A cantilever of length 2 m carries a uniformly distributed load of 2 KN/m over a length of 1 m from the free end and a point load of 1 KN at the free end. Find slope and deflection at the free end. If E= 2.1 x 10^5 N/mm^2 and I= 6.667X10^7 mm^4. **10**

(b) The cross -section of a cost iron machine element used as beam is shown in figure. The permissible stresses in tension and compression are 25N/mm^2 and 30N/mm^2 respectively Determine the moment of resistance of the section for both positive and negative bending moment. **10**



6 (a) A 1.5 m/ long cost iron column has a circular cross-section of 5 cm diameter. One end of the column is fixed and the other end is free. Taking factor of safety as 3. Find safe load using **10**

(i) Rankine's Formula, taking Yield stress = 560 N/mm^2 and a = 1/1600

(ii) Euler's formula- take young's modulus for cast-iron = 120 GN/m^2.

(b) A hollow shaft of external diameter 120mm transmits 300 KW power at 200 rpm. Determine the maximum internal diameter, if maximum shear stress in the shaft is not to exceed 50N/mm^2. **10**
