



(3 Hours)

[Total Marks : 80

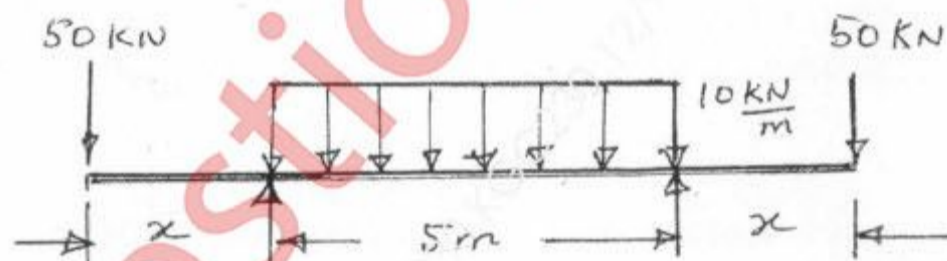
- N.B. :** (1) Question No. 1 is Compulsory.
 (2) Answer **any three** questions out of remaining **five** questions.
 (3) Assumption suitable data if necessary.

1. Explain briefly the following

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- Core of hollow rectangular section
- Expression for volumetric strain in uni axial loading in terms of linear strain and Poisson's ratio.
- Expression for strain energy stored in a bar due to suddenly applied load with impact.
- Expression for Cantilear beam deflection subjected to UDL over the entire span.

- 2 (a) A double overhand beam carries loads as shown in fig. What is the overhang length on each side, that makes the bending moment to be zero at the centre of the beam. Sketch SFD and BMD. 10

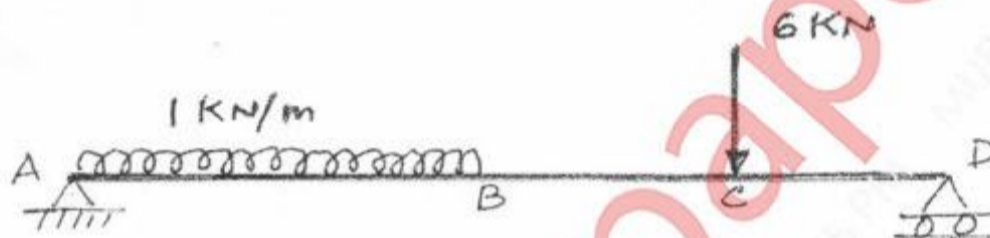


- Find the section modulus of hollow square section and hollow circular section. 10/05
- An aluminium rod 2 m long is secured between two walls. If the stress in the rod is Zero at temperature 10°C , what will be its stress at temperature -10°C ? Given $\alpha = 23 \times 10^{-6}/^{\circ}\text{C}$ and $E = 60 \text{ GPa}$. Solve assuming. 10/05
 - the walls are rigid
 - that walls yield by 0.5 mm together as temperature drops.

[TURN OVER]

3. A C I beam of span 5m is made of I -section with upper flange (80mmx20mm), bottom flange (160mmx40mm) and web 160mm(deep)x20mm (thick). The beam is simply supported and carries UDL throughout. If the tensile stress in the beam is not to exceed 20N/mm^2 , find the value of UDL which the beam carry. Find also the maximum compressive stress. Also draw the variation of shear stress diagram considering maximum shear force in the section. 20

4. (a) For the beam loaded as shown in fig find slopes at points A and D and deflection at point B and C. 10
 Take $E=2 \times 10^5 \text{ N/mm}^2$ and $I = 10^8 \text{ mm}^4$
 Take $AB = 5\text{m}$, $BC=3\text{m}$ and $CD = 2\text{m}$.

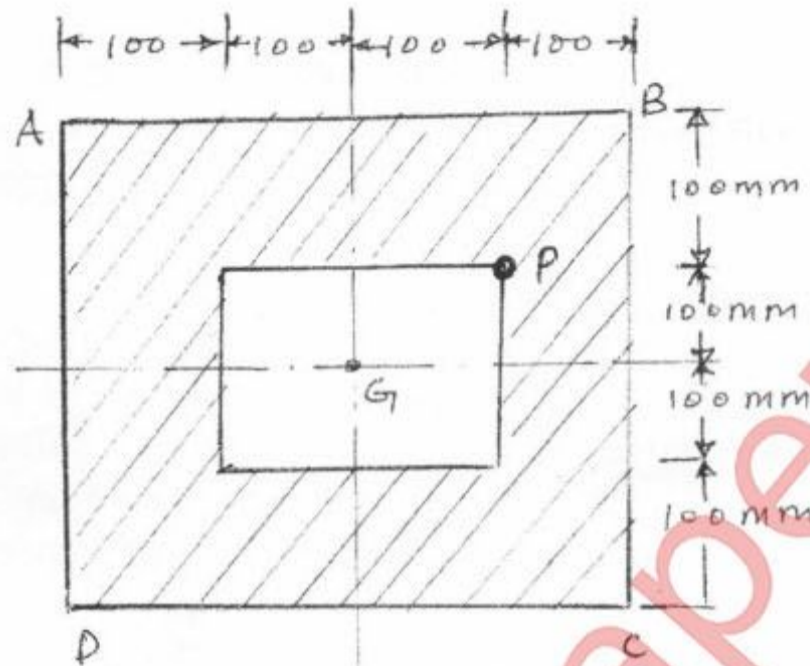


(b) Calculate the moment of Inertia of T section about its centroidal axes. The top flange is (150mmx50mm) and web is (50mmx150mm). Overall depth of T section is 200 mm. 5

(c) Sketch the deflected shape of the columns under different end conditions under buckling. Also write the expression for equivalent length of the column in terms of actual length. 5

5. (a) A shaft of 100mm diameter, 2m long is subjected to a torque of 8 KN.m 10
 Calculate the maximum Shear stress and angle of twist.
 If the central 1m length of shaft was reduced to 60mm diameter and same torque is applied, what would be the change in Shear Stress and angle of twist? Take $G = 80 \text{ GPa}$.

(b) A hollow square section is subjected to a compressive load of 50 KN 10
 acting at point P Determine the stresses at Points A, B, C, D and G. Also indicate the nature of the stress.



6. (a) Find the Eulers crushing load for a hollow column 200 mm external diameter and 25 mm thick, if it is 6m long and hinged at both ends. Take $E=1.2 \times 10^6 \text{ N/mm}^2$. Compare this load with crushing load given by Rankine's formula. Take $\sigma_c = 550 \text{ N/mm}^2$ and $\alpha = 1/1600$. 10
- (b) A plane element is subjected to stresses as shown in fig. Determine. 10
- The principal stresses and their orient action.
 - The maximum shear stress and the planes on which it occurs.
 - Normal and Shear Stress on an inclined plane BE.

