22303

12223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define elastic limit and modulus of elasticity.

b) Define proof resilience and resilience.

c) Calculate modulus of elasticity for a member having $G = 70.37\ kN/mm^2$ and $\mu = 0.35$.

d) Give the relation between Bulk Modulus and Young's Modulus.

e) Determine maximum shear force and maximum bending moment for a simply supported beam having 5m span and carrying a central point load of 30 kN.

f) Give the relation between average and maximum shear stress for a triangular and a circular section.

g) Along with expression, define radius of gyration.

Marks

2. Attempt any THREE of the following: **12**

a) Along with expression state parallel axis theorem and perpendicular axis theorem.

b) A triangle ABC has base BC = 90 mm and vertical side AB = 115 mm such that ∠B = 90°. Calculate MI of the triangle about sides AB and BC.

c) Calculate polar MI of semi circle having 80 mm diameter. Also calculate minimum radius of gyration. Diameter is parallel to yy axis.

d) Find the least MI of a symmetrical section having the following details. Flanges 120 mm × 12 mm, overall depth = 280 mm, thickness of web = 10 mm.

3. Attempt any THREE of the following: **12**

a) A steel rod of 32 mm diameter and 2m long is subjected to an axial pull of 60 kN. Find

i) Stress

ii) Strain and

iii) Elongation.

Take E = 200 GPa.

b) A circular bar having 300 mm^2 area is subjected to axial loads as shown in the Fig. No. 1. Find the value of P and the total elongation. Take E = 2×10^5 N/mm^2.

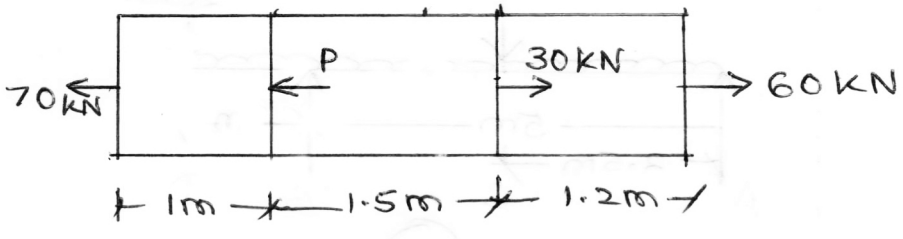


Fig. No. 1.

c) A steel rod 15m long is at a temp of 20°C. Find the free expansion of rod when temp is raised to 80°C. If 40% of free expansion is permitted, calculate the temperature stress produced. Take $\alpha = 12 \times 10^{-6}$/°C and E = 200 GPa.

Marks

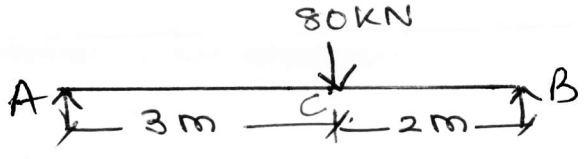
d) A RCC column 500 mm diameter is reinforced with 6 bars of 20 mm diameter. Find the safe load that the column can carry. If permissible stress in concrete and steel are 5 N/mm^2 and 130 N/mm^2 respectively. Take $E_c = 0.14 \times 10^5$ N/mm^2 and $Es = 2.1 \times 10^5$ N/mm^2.

4. Attempt any <u>THREE</u> of the following: **12**

a) A steel bar, 40 mm × 40 mm in section and 4m long is subjected to an axial pull of 130 kN. If the change in length is 1.5 mm (increase) and change in width is 0.0060 mm (decrease). Calculate modulus of elasticity and poisson's ratio.

b) A cube of 400 mm side is subjected to tensile forces of 60 kN, 70 kN and 80 kN in three principle direction, E = 200 GPa and Poisson's ratio = 0.28. Calculate the change in volume.

c) Draw SFD and BMD for a simply supported beam as shown in the Fig. No. 2.



<u>Fig. No. 2.</u>

d) A column having diameter 300 mm is 5m long. Determine Euler's crippling load if both ends of the column are fixed. Take $E = 2 \times 10^5$ N/mm^2.

e) Determine Rankine's crippling load for a hollow circular CI column of external diameter 100 mm and 20 mm thick. It is 3m long with both ends fixed. Take $\sigma_c = 500$ N/mm^2 and $\alpha = 1/1600$.

Marks

5. Attempt any TWO of the following: **12**

a) Draw SF and BM diagram for the cantilever beam as shown in Fig. No. 3.

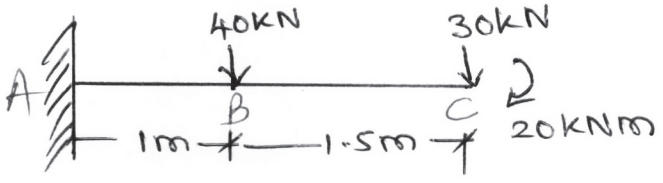


Fig. No. 3.

b) Draw SF and BM diagram for the simply supported beam as shown in Fig. No. 4.

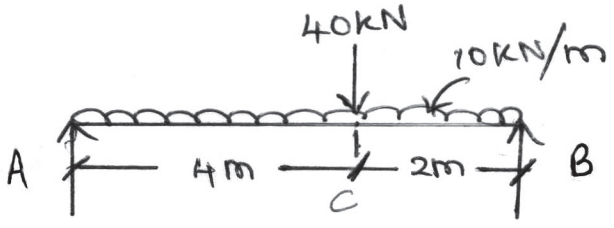


Fig. No. 4.

c) Draw SF and BM diagram for the overhanging beam as shown in the Fig. No. 5.

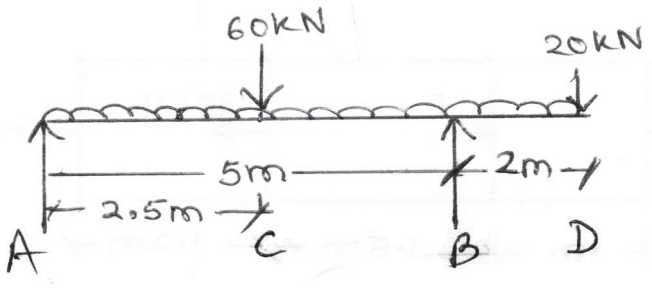


Fig. No. 5.

Marks

6. Attempt any TWO of the following: **12**

a) i) A rectangular beam section is used as a simply supported beam over a span of 5m. Calculate the downward point load at mid-span the beam can carry, if the maximum bending tensile stress is not to exceed 10 N/mm^2, width = 120 mm, depth = 250 mm.

ii) A beam carries an udl of 25 kN/m over the entire span of 7m. Beam has rectangular section of width 230 mm and depth 350 mm. Determine max shear stress at a section 1m from the support.

b) A tee section having flange 180 mm wide and 20 mm thick and web 150 mm long and 20 mm thick carries a udl of 90 kN/m over an effective span of 8m. Determine the maximum bending tensile and bending compressive stress developed and their position, showing stress distribution diagram.

c) A beam has hollow rectangular section with external dimensions 80 mm × 160 mm and uniform thickness of section is 10 mm. Draw shear stress variation diagram if section is subjected to a shear force of 80 kN. Also determine the ratio of maximum shear stress and average shear stress.

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