22303

22223

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.

(8) Keep safe social distance > 1.0 m.

Marks

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

a) State Hook's law with formula and meaning of each term.

b) Define proof resilience and modulus of resilience.

c) Define Poisson's ratio and Volumetric strain.

d) For a certain material modulus of elasticity is 169 GPa. If Poisson's ratio is 0.32, calculate modulus of rigidity.

e) Determine maximum shear force and maximum bending moment for a cantilever beam having 3.0 m span carrying point of 20 kN at free end.

f) State shear stress equation and meaning of each term.

g) Define short column and long column.

Marks

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

a) State parallel axis theorem and perpendicular axis theorem.

b) For a rectangular lamina 200 × 400 mm. Calculate the moment of inertia at bottom axis.

c) Determine the I_{XX} and I_{YY} of the T-section having dimensions. Top fange 80 × 20 mm and web 20 mm × 80 mm.

d) Calculate moment of inertia and radius of gyration about XX and YY axis for a semicircular lumina of diameter 100 mm.

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

a) Draw standard stress-strain curve for mild steel bar tested under tension test. Also show sailent points and state significance of curve.

b) An R.C.C. circular column has a diameter of 300 mm and it is reinforced with 8 steel bars. The total area of steel bars is 2513.27 mm^2. The column carries a load of 250 kN. If the modulus of elasticity for steel is 18 times that of concrete. Find the stresses in concrete and steel.

c) A straight bar 450 mm long is 20 mm in diameter for the first 250 mm length and 10 mm in diameter for the remaining length. If the bar subjected to an axial pull for 10 kN. Find the deformation of the bar. E = 200 GPa.

d) A steel rod of 60 mm in diameter is 3 m long. Find the maximum instantaneous stress induced when pull of 100 kN. is applied suddenly. Also calculate elongation, strain energy and modulus of resilience. E = 2 × 10^3 N/mm^2.

Marks

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

a) For a given material young modulus is 110 GPa and shear modulus 42 GPa. Find the bulk modulus and Laterial contraction of a round bar of 37.5 mm diameter and 2.4 m length when stretched 2.5 mm when subjected to an axial load.

b) In a biaxial stress system, the loads along two directions are 40 N/mm^2 tensile (x-direction) and 50 N/mm^2 compressive (y-direction). Find the strains along the two directions. Take E = 200 kN/mm^2 and m = $\frac{1}{4}$.

c) A cantilever beam of length 5 m carries a udl of 2 kN/m over the whole length and a point load of 4 kN at free end. Draw Shear Force Diagram (SFD) and Bending Moment Diagram (BMD).

d) Find the maximum length of a solid mild steel rod having diameter 40 mm used as a column with both ends fixed to carry a crippling load of 60 kN. Take E = 2×10^5 N/mm^2. (Use Euler's equation)

e) An ISMB 250 rolled steel joint is to be used as column 4.0 m long with both ends fixed. Find the safe load on the column allowing. (Use Rankine formula) a factor of safety 3. Take σ_C = 320 N/mm^2, α = 1/7500, A = 4755 mm^2, $I_{XX} = 5.1316 \times 10^7$ mm^4, $I_{YY} = 3.345 \times 10^6$ mm^4.

Marks

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

a) A 6 m long cantilever beam carries loads of 2 kN and 3 kN at 2 m and 5 m respectively from fixed end and a udl of 10 kN/m over its entire length. Draw SFD and BMD.

b) Draw SFD and BMD for SSB of span 4 m subjected a point loads of 2 kN, 4 kN and 2kN at 1m, 2m and 3m from Left Hand Support (LHS).

c) Draw shear force and bending moment diagram for the loaded beam as shown in Fig. No. 1. Locate the point of contraflexor if any.

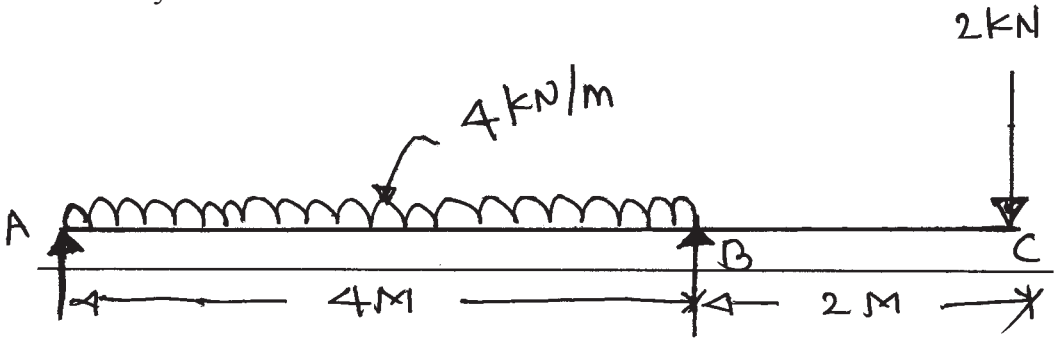

Fig. No. 1.

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

a) A rectangular beam of cross section 100 mm × 200 mm is simply supported over a span of 10 m and carries a udl of 2 kN/m. Find the maximum bending stress and shearing stress and draw stress distribution diagram.

b) A rectangular beam 300 mm deep is simply supported over a span of 4 m. What uniformly distributed load per meter the beam may carry. If the bending stress is not to exceed 120 N/mm^2? Take $I = 8 \times 10^6$ mm^4.

c) The shear force acting on beam of I-section is 100 kN. The dimension of I-Section are

Top flange = 250 mm × 50 mm

Web = 50 mm × 250 mm

Bottom flange = 250 mm × 50 mm

Draw the shear stress distribution over the depth of the section.