22303

24225

03 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) State the formula for M.I. of a semi-circle about its horizontal centroidal axis and about its base.

b) Define:

i) Yield stress

ii) Ultimate stress

c) Draw stress-strain curve for mild steel bar showing all points on it.

d) State the relation between E, G and μ.

e) State the relation between S.F., B.M. and rate of loading.

f) Define bending moment and state its sign convention.

g) State flexural formula with meaning of each term involved in it.

Marks

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

a) Find the M.I. of a circle about its tangent having diameter 250 mm.

b) Calculate the M.I. of a T-section about its horizontal centroidal axis. Assume flange size = 200 × 10 mm, vertical web = 180 × 12 mm.

c) Calculate the moment of inertia about both centroidal axis for an equal angle section 180 × 180 × 10 mm size.

d) Define radius of gyration and polar moment of inertia along with their expressions.

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

a) A bar of uniform cross sectional area 120 mm^2 is subjected to axial forces as shown in Fig. No. 1. Calculate the unknown force 'P' and the total change in length of the bar. Take E = 200 GPa.

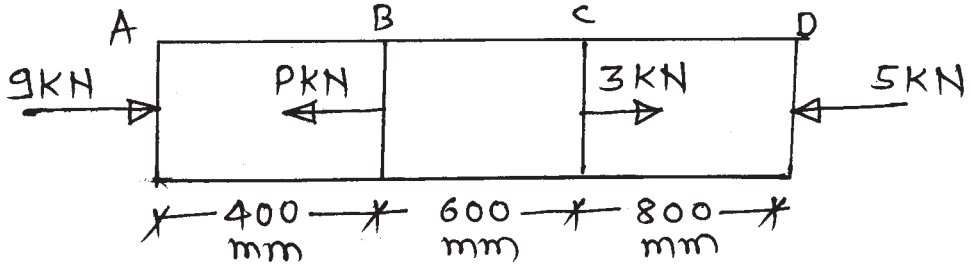

Fig. No. 1

b) A R.C.C. column 400 mm × 400 mm is reinforced with 8 bars of 20 mm diameter. The column carries a load of 350 KN. Find the stresses induced in steel and concrete. Take Esteel = 2.1×10^5 N/mm^2, Econ = 1.4×10^4 N/mm^2.

c) A rod 400 mm long and 25 mm in diameter is heated through 120°C and at the same time pulled by a force 'P'. If the total extension is 0.6 mm, what is the magnitude of force 'P'? Take E = 2×10^5 N/mm^2, $\alpha = 12 \times 10^{-6}$/°C.

d) Define:

i) Temperature stress

ii) Strain Energy

iii) Modulus of resilience

iv) Linear strain

Marks

4. Attempt any THREE of the following: 12

a) A steel bar 20 mm wide, 40 mm thick and 4 m long is subjected to an axial pull of 50 KN. IF E = 200 GPa and $\mu = 0.30$, Calculate change in length, change in width, change in thickness and change in volume of the bar.

b) A cube of 150 mm side is acted upon by stresses along the three directions 20 N/mm^2 (Tensile), 10 N/mm^2 (Compressive) and 20 N/mm^2 (Tensile). Calculate the strains in all these three directions and change in volume of the cube. Take $E = 2 \times 10^5$ N/mm^2, $\mu = 0.25$.

c) Draw SFD and BMD indicating all the values at important points. Refer Fig. No. 2.

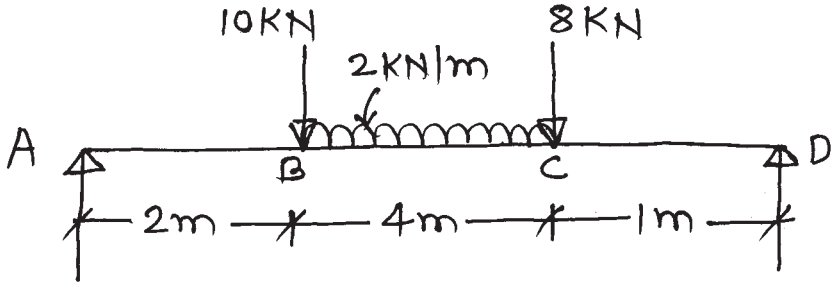

Fig. No. 2

d) A hollow circular section of 250 mm as external diameter and 25 mm thickness is 4 m long and used as a column. One end of the column is fixed and other end is hinged. Calculate the safe load the column can carry. Use Euler's formula, Take $E = 2 \times 10^5$ N/mm^2, Factory of safety = 2.5.

e) A cast iron column 200 mm external diameter and 180 mm internal diameter is 4 m long. It is fixed at one end and hinged at other end. Calculate the safe axial load by Rankine's formula taking factor of safety 3. Assume 6c = 550 N/mm^2 and $a = \frac{1}{1600}$.

Marks

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

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

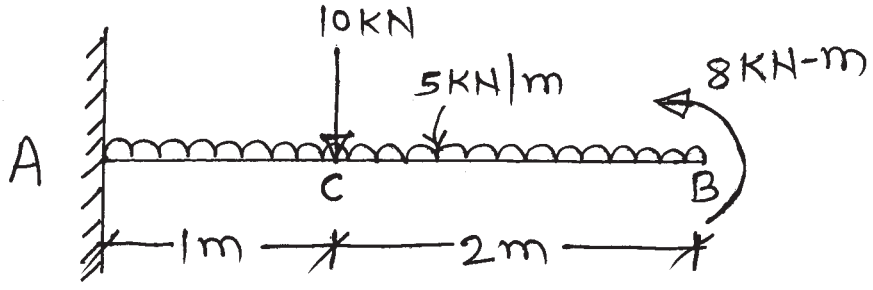

Fig. No. 3

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

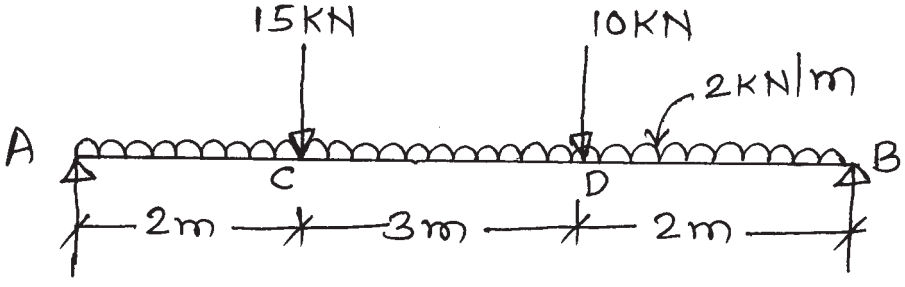

Fig. No. 4

c) Draw SF and BM diagrams for an overhanging beam as shown in Fig. No. 5. Locate point of contra flexure if any.

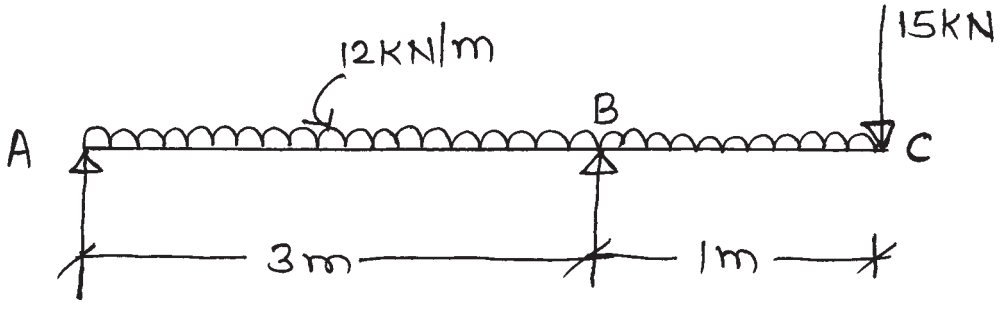

Fig. No. 5

Marks

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

a) Draw shear stress distribution along cross-section of a circular beam for 300 mm diameter carrying 500 KN shear force. Also determine the ratio of maximum shear stress to average shear stress.

b) A simply supported beam of span 6 m carries two point loads 20 KN with 2 m spacing and symmetrical to span. Design square beam for bending if maximum bending stresses in beam is 15 N/mm^2.

c) Draw shear stress distribution along of beam for symmetrical I-section with flanges 140×20 mm and web 10×160 mm carrying shear force of 260 KN.