22306

21222

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

15 minutes extra for each hour

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 : Polar Moment of inertia, radius of gyration.

b) Define : Temperature stress and give one field example where temp stress produced.

c) Define : Creep, Toughness.

d) State relation between shear force and bending moment.

e) State flexural formula with meaning of each term used.

f) Define : Axial load and Eccentric load.

g) Define core of section and show it for solid circular section of dia. 'D'.

Marks

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

a) A symmetrical I-section of overall depth of 300 mm has its flanges 150 mm × 10 mm and web 10 mm thick. Calculate moment of inertia @ XX and YY centroidal axes.

b) With neat sketches show the failure of rivet in single shear and double shear. Also write the formulae to calculate shear stress for each case. Assume diameter of rivet = d.

c) A steel tube of external diameter 20 mm and internal diameter 15 mm was subjected to a tensile load of 1.5 kN. It produced an elongation of 0.004 mm in a length of 80 mm while the outer diameter suffered a compression of 0.00028 mm. Calculate the value of Poissons ratio, Modulus of Elasticity and Modulus of rigidity.

d) A simply supported beam is loaded as shown in Fig. No. 1. Draw shear force diagram and locate the position from support 'A' where B.M. is maximum. Also calculate value of Maximum B.M.

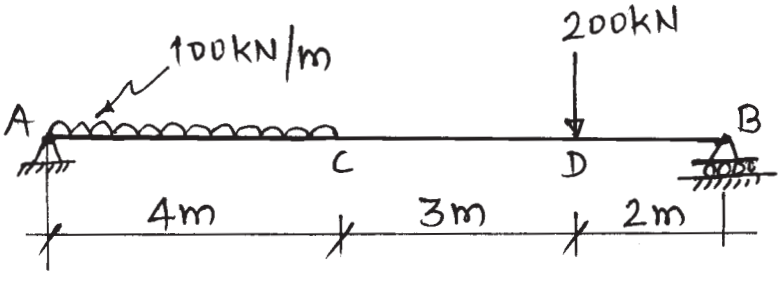


Fig. No. 1

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

a) A hollow circular section has external diameter 50 mm and wall thickness of 10 mm. Calculate moment of inertia about the tangent to the exernal diameter.

b) A metal bar 200 mm long, 40 mm × 30 mm in cross section is subjected to stress of 110 MPa along the length and 50 MPa on other two faces. All stresses are tensile. Calculate strains along the three direction and also the volumetric strain. Assume E = 120 MPa and μ = 0.30.

Marks

c) Draw S.F. and B.M. diagrams with all important values for the beam loaded as shown in Fig. No. 2.

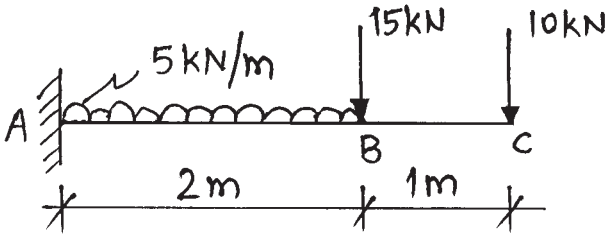


Fig. No. 2

d) A mild steel tube 50 mm external dia and 10 mm thickness is bent in the form of hook as shown in Fig. No. 3. What maximum load 'P' the hook can lift, if the stresses on the cross section 'AB' shall not exceed 90 MPa in tension and 40 MPa in compression?

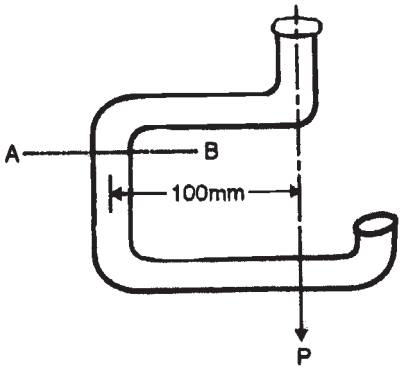


Fig. No. 3

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

a) Draw S.F. and B.M. diagrams for the beam as shown in Fig. No. 4.

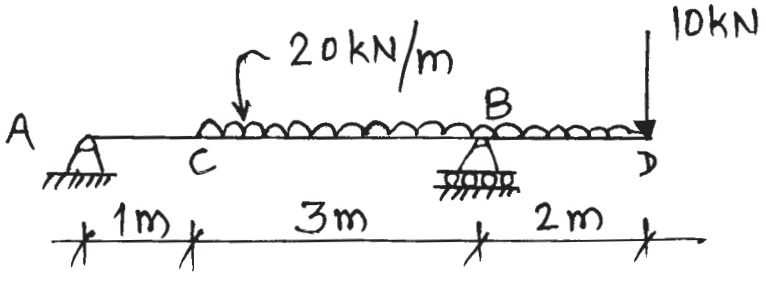


Fig. No. 4

Marks

b) A cantilever rectangular metal section is 4 m in length. It is subjected to all inclussive UDL of 5 kN/m. If permissible bending stress in the material is 5 N/mm^2, determine the size of the section. Assume depth to width ratio = 2.

c) Calculate the power transmitted by a solid shaft of 60 mm diameter running at 240 RPM. Permissible shear stress is 70 N/mm^2 and the maximum torque is likely to exceed the mean torque by 30%.

d) Calculate the strain energy stored in a bar 4 m long and 5 cm in diameter when it is subjected to suddenly applied tensile load of 200 kN. Also determine the instantaneous elongation produced. Assume E = 210 GPa.

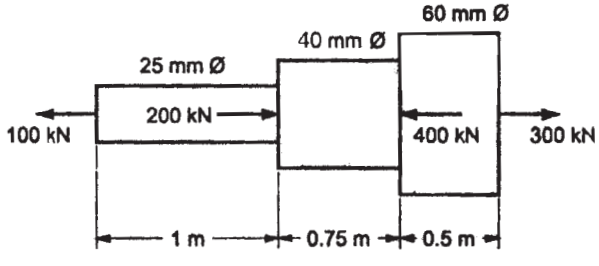
e) A solid aluminium shaft 1 m long and 50 mm diameter is to be replaced by hollow steel shaft of same length and outside diameter. Determine the inner diameter of hollow steel shaft for the same torque.

Take, For aluminium Shaft, $G_A = 2.8 \times 10^4$ N/mm^2

for steel shaft, $G_s = 8.5 \times 10^4$ N/mm^2

5. Attempt any <u>TWO</u> of the following: **12**

a) A steel bar is subjected to axial loads as shown in Fig. No. 5. Calculate deformation of the bar. Take E = 210 GPa.



<u>Fig. No. 5</u>

b) A simply supported beam of 6 m span is subjected to two point loads of 40 kN and 60 kN at 2 m and 4 m from left had support respectively. Draw S.F., B.M. diagrams. Also draw the nature of deflected curve of the beam.

Marks

c) A rectangular beam 200 mm wide × 300 mm deep is subjected to shear force of 40 kN. Calculate the shear stresses at top layer and at distances of 50 mm, 100 mm and 150 mm from the top layer. Sketch the shear stress distribution.

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

a) A circular beam has simply supported span of 5 m and subjected to a point load of 30 kN at a distance 3 m from left hand support. The shear stress across the beam is limited to 2 N/mm^2. Design the minimum section for the beam and hence determine the magnitude of average shear stress.

b) A propeller shaft, 400 mm external and 200 mm internal diameters is subjected to twisting moment of 4650 N.m. Calculate maximum shear stress developed in shaft. Also calculate angle of twist in degrees in a length 20 times the external diameter. Take G = 82 GPa.

c) A short mild steel column of external diameter 200 mm and internal diameter 150 mm carries an deccentric load. Determine the gretest eccentricity which the load can have so as to avoid reversal of stresses in the section of column.

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