22306

23242

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) State parallel axis theorem of moment of Inertia.

b) State Hook's law.

c) State the relation between Young's modulus and Bulk modulus.

d) What are various types of beam? Draw neat sketches.

e) State two assumptions made in the theory of bending.

f) Define axial load and eccentric load.

g) State the condition for no tension at the base of column.

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

a) Calculate M.I. for a triangle of height 100 mm about an axis passing through vertex and parallel to base, If M.I. about the base of same triangle is 10^7 mm^4.

b) A bar 500 mm long and 22 mm in diameter is elongated by 1.2 mm under the effect of axial pull of 105 kN. Calculate the intensities of stress, strain and the modulus of elasticity of the bar.

P.T.O.

Marks

c) For a certain material, modulus of elasticity is 169 MPa. If Poisson's ratio is 0.32, calculate the values of modulus of rigidity and bulk modulus.

d) A simply supported beam of span 6 m carries a U.d.L. of 3 kN/m spread over 2 m from left support and a point load of 6 kN at 4 m from left support. Draw S.F.D. and B.M.D.

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

a) For the Lamina as shown in Fig. No. 01., determine it's M.I. about it's X - X axis.

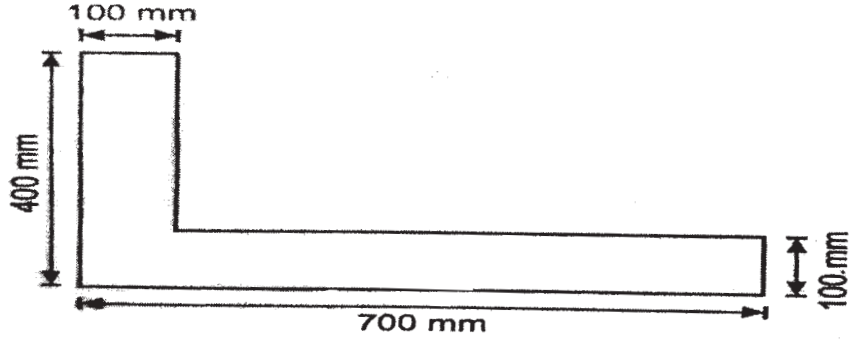

Fig. No. 01.

b) In a bi-axial stress system, the stresses along the two perpendicular directions are 70 N/mm^2 (tensile) and 40 N/mm^2 (compressive). Calculate the strains along these two directions. Take E = 2.1 × 10^5 N/mm^2 and Poisson's ratio = 0.28.

c) Draw B.M. and S.F. diagrams for the cantilever as shown in Fig. No. 02.

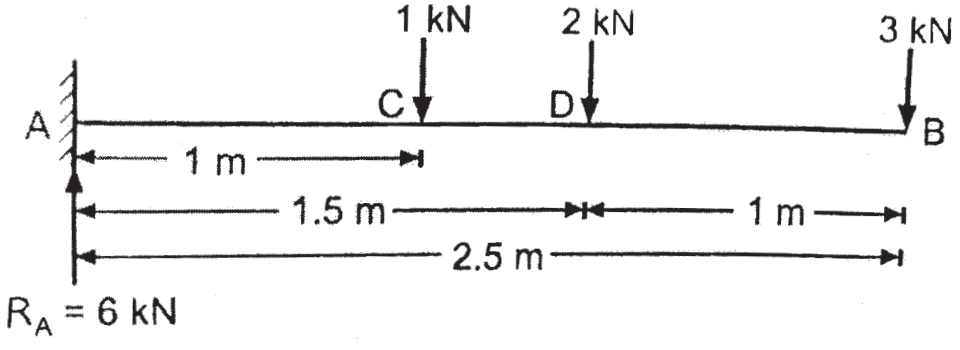

Fig. No. 02.

d) A steel flat 200 mm wide and 20 mm thick is subjected to a pull of 200 kN at an eccentricity of 10 mm in a plane bisecting the thickness. Find σ max and σ min.

Marks

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

a) A beam 6 m long rests on two supports 5 m apart. The right end is overhanged by 1 m. The beam carries a U.d.L. of 5 kN/m over the entire length of the beam. Draw S.F. and B.M. diagrams.

b) Sketch the shear stress distribution diagram for a rectangular beam of 600 × 200 mm (deep) subjected to a shear force of 20 kN.

c) A solid circular shaft of 30 mm diameter is subjected to torque of 0.28 kNm, causing angle of twist of 3.50° in a length of 2 m. Calculate modulus of rigidity for the material of shaft.

d) A steel rod of 12 mm diameter is subjected to a tensile force at 24 kN applied gradually. Calculate the strain energy stored in the rod, if length of the rod is 1 m. Take $E = 2 \times 10^5$ N/mm^2.

e) A shaft is required to transmit 25 kW power at 180 r.p.m. The maximum torque may exceed the mean torque by 30%. If shear stress is not to exceed 60 N/mm^2, determine the minimum diameter of the shaft.

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

a) A brass bar having a cross-sectional area of 1000 mm^2 is subjected to axial forces as shown in Fig. No. 03. Find the total change in length of the bar. Take $E = 1.05 \times 10^5$ N/mm^2.

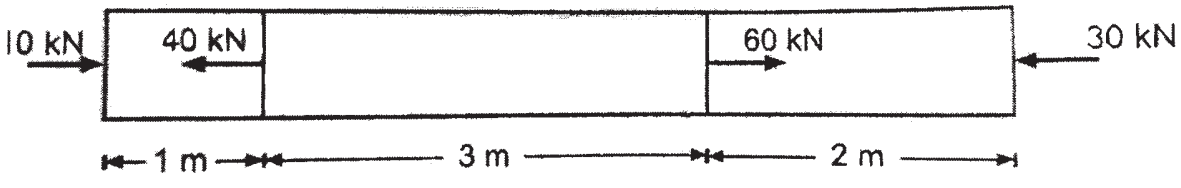

Fig. No. 03.

b) A simply supported beam of span 7 m carries a U.d.L. of 2 kN/m over 4 m length from the left support and a point load of 5 kN at 2 m from the right support. Draw S.F. and B.M. diagrams.

Marks

c) A 100 × 100 × 10 mm 'T' section is used as a simply supported beam with a flange at top. It carries a U.d.L. of 10 kN/m. If the maximum stress is not to exceed 150 N/mm^2, calculate the maximum span.

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

a) Determine the maximum bending stress developed in a beam of rectangular cross-section 50 mm × 150 mm when a bending moment of 600 N.M. is applied about X-X axis.

b) A solid shaft in the rolling mill transmits 20 kW at 2 revolutions per second. Determine the diameter of the shaft. If the shear stress is not to exceed 40 MN/m^2. The shaft is likely to have a maximum torque 40% more than mean torque.

c) A short mild steel column of external diameter 200 mm and internal diameter 150 mm carries an eccentric load. Find the greatest eccentricity which the load can have without producing tension in the section of the column.

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