22303

11920

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

Instructions : (1) All Questions are *compulsory.*

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

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

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

(6) 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 Hook's law with expression.

(b) Write down formula of M-I of quarter circle about its centroidal axes.

(c) Define modulus of rigidity and bulk modulus.

(d) Define stress and strain.

(e) Write Euler's and Rankine's formula with meaning of each term.

(f) Define shear force & bending moment.

(g) Give relation between average and maximum shear stress for rectangular and circular cross-section.

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

(a) State parallel axis theorem and perpendicular axis theorem.

(b) Determine M-I about both axes for a Hollow rectangular section having 150 mm width and 90 mm depth.

(c) Calculate the moment of inertia of a L-section about the XX axis passing through the centre of gravity for a section as shown in fig. No. 1.

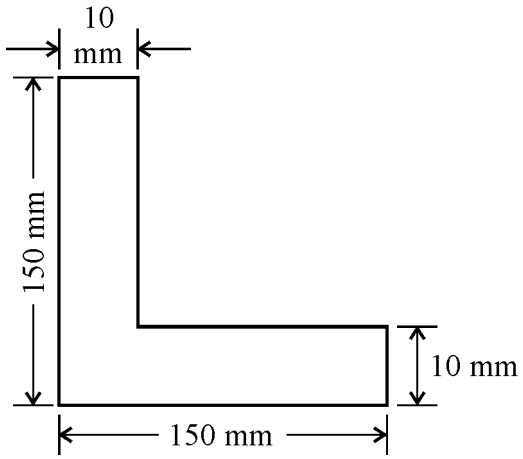

Fig. 1

(d) Calculate the M-I @ YY axis for following section.

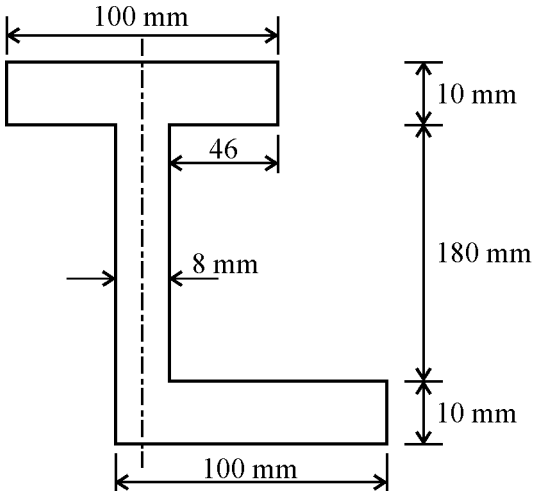

Fig. 2

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

(a) A steel rod 20 mm in diameter 1.2 m long is heated through 120°C and at the same time subjected to a pull 'P' if the total extension of the rod is 3 mm calculate the magnitude of 'P', take $\alpha = 12 \times 10^{-\sigma}/°C$ and E = 200 GPa.

(b) A bar having cross-section as given in fig. No.3 is subjected to a tensile load of 150 kN calculate the change in length of each part along with the total cahnge in length if $E = 2 \times 10^5$ N/mm^2.

Fig. 3

(c) A reinforced concrete column is 300 mm × 300 mm in section, reinforced with 8 bars of 20 mm diameter. The column carries a load of 360 kN. Find the stresses in concrete and steel bars.

Take Est = 2.1×10^5 N/mm^2

Econ. = 1.4×10^4 N/mm^2.

(d) A circular bar of 25 mm diameter and 3.5 m long is subjected to a tensile load of 40 kN. shows an elongation of 60 mm. Determine stress, strain & modulus of elasticity.

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

(a) For a given material E = 110 GPa, G = 43 GPa find K & μ.

(b) In a biaxial stress system, the stresses along the two directions are σ_x = 50N/mm^2 & σ_y = 30 N/mm^2 both tensile. Determine the strains along these two directions. E = 2×10^5 N/mm^2 & Poisson's ratio = 0.3.

(c) State relation between E, G & K with expressions.

(d) Draw SF & BM diagram for the cantilever beam as shown in fig. No. 4

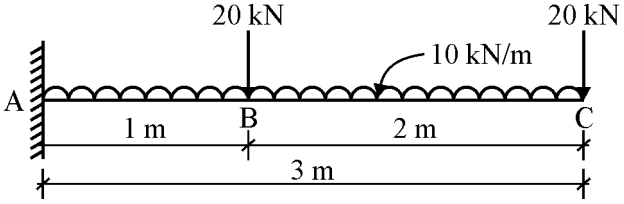

Fig. 4

(e) State four assumptions made in Euler's theory.

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

(a) Draw the shear force & bending moment diagrams for the beam as shown in fig. No. 5

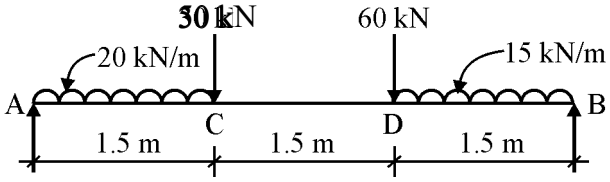

Fig. 5

P.T.O.

(b) Draw S.F. & B.M. diagram for overhanging beam as shown in fig. No.6

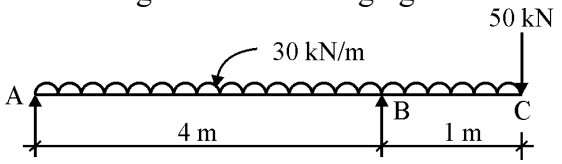

Fig. 6

(c) Draw SF & B.M. diagram for the beam as shown in fig. No. 7

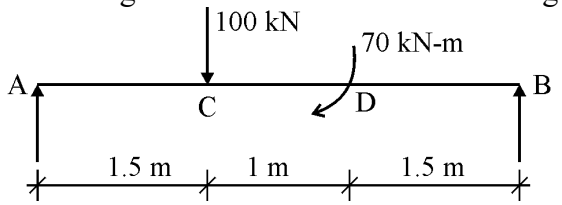

Fig. 7

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

(a) Solve the following :

(i) Determine by Rankine's formula the safe load on the colomn of 5.5 m length, with both ends fixed, can carry with a factor of safety 4. The properties of section are A = 1777 mm^2.

$I_{XX} = 11.6 \times 10^{\sigma}$ mm^4. $I_{YY} = 0.84 \times 10^{\sigma}$ mm^4. σC 320 N/mm^2 $\alpha = \frac{1}{7500}$

(ii) A simply supported beam has span 7 m carries a point load of 50 kN at the centre of the beam. Calculate the modulus of section if bending stress is not to exceed 140 MPa. With distribution diagram of stress.

(b) A cantilever is 2 m long and is subjected to a udl of 5 kN/m. The c/s of a cantilever is a I-section as shown in Fig. No. 8. Determine the maximum tensile and compressive stress developed and their position, showing stress distribution diagram.

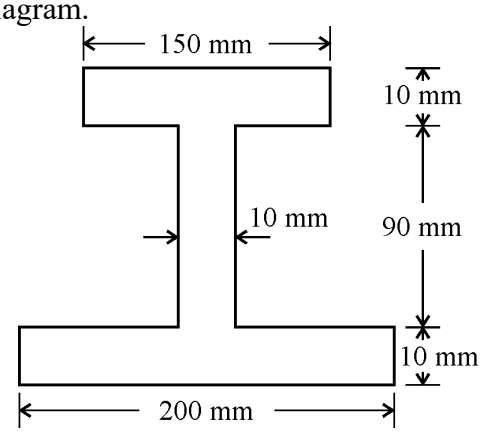

Fig. 8

(c) A T-Section beam having flange 180 mm wide and 20 mm thick and web 150 mm long & 20 mm thick carries a udl of 80 kN/m over an effective span of 8 m. Calculate the maximum bending stress.