17311

15162

3 Hours / 100 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. a) Solve **any six** of the following : **(6×2=12)**

i) Define moment of inertia. State its value for a semicircle about its centroid.

ii) Find the MI of a solid circular lamina of diameter 'd' about its tangent.

iii) Draw stress strain curve for HYSD bar.

iv) Define proof stress and ultimate stress.

v) Draw a bending stress distribution diagram for a 'T' section used as cantilever beam.

vi) Draw a shear stress distribution diagram for a 'T' section used as SSB.

vii) Define radius of Gyration and slenderness ratio.

viii) State assumptions made in Euler's theory of long columns.

b) Solve **any two** of the following : **(2×4=8)**

i) A cantilever beam of rectangular section supports udl of 5 kN/m. The span of the beam is 3 m. If the maximum bending stress is 100 N/mm^2 and the depth of the beam is 1.5 times the width, determine the size of the beam.

ii) For applying Euler's formula, find the minimum value of stenderness ratio for mild steel strut with both ends fixed. Take yield stress as 315 MPa and E as 210 GPa.

iii) Differentiate gradual load and sudden load. Write four points of difference.

P.T.O.

Marks

2. Solve **any two** of the following : **(2×8=16)**

a) A hollow circular section of external diameter 100 mm has a uniform thickness of 10 mm, calculate its moment of inertia with respect to

i) Diameter

ii) Tangent to the bottom of circle

iii) The axis parallel to and 20 mm below the tangent.

b) A steel stanchion is built up of 100 mm × 150 mm RSJ with one 120 mm × 12 mm plate revetted to each flange. The overall depth of stanchion is 174 mm. Calculate MI about the centroidal axes. Properties of RSJ are : Area = 2167 mm^2, $I_{XX} = 8.39 \times 10^6$ mm^4 $I_{YY} = 0.98 \times 10^6$ mm^4.

c) i) For an equilateral triangle of side 400 mm show that MI about the horizontal and vertical centroidal axes are equal.

ii) A bar of cross sectional area 200 mm^2 is axially pulled by a force 'P' kN. If the maximum stress induced in the bar is 30 MPa, determine 'P'. If elongation of 1.2 mm is observed over a gauge length 3 m, determine Young's modulus.

3. Solve **any two** of the following : **(2×8=16)**

a) Determine load P and total elongation in the bar shown in Fig. 1 having 12 mm diameter $E = 2 \times 10^5$ N/mm^2 .

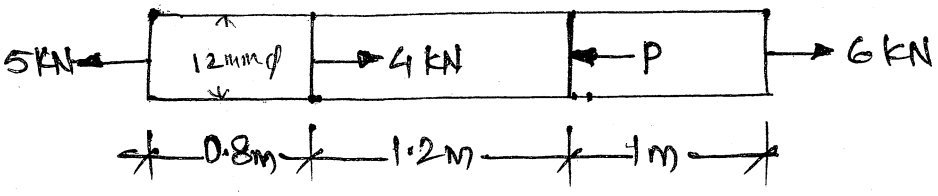

Fig. 1

b) A reinforced concrete column is 300 mm × 300 mm in section, reinforced with 8 bars of 20 mm dia. The column carries a load of 360 kN. Find the stresses in concrete and steel bars. Take $E_S = 2.1 \times 10^5$ N/mm^2 and $E_C = 1.4 \times 10^4$ N/mm^2.

c) A steel rod 4 m long and 20 mm diameter is subjected to an axial tensile load of 45 kN. Find the change in length and diameter of the rod. $E_S = 2 \times 10^5$ N/mm^2, Poisson's ratio = $\frac{1}{4}$.

Marks

4. Solve **any two** of the following : **(2×8=16)**

a) A steel bar 200 mm long, 40 mm × 40 mm in cross section is subjected to stress of 120 MPa along length and 40 MPa on other two faces all tensile and change in volume was observed to be 140 mm^3. Determine Poisson's ratio. E = 200 GPa.

b) In a tension test on a certain specimen 20 mm diameter, 200 mm long an axial pull of 100 kN produce an elongation 0.32 mm and reduction in diameter is observed to be 0.0085 mm. Find the value of Poisson's ratio and the three moduli.

c) Draw SFD and BMD for the cantilever beam loaded as shown in Fig. 2.

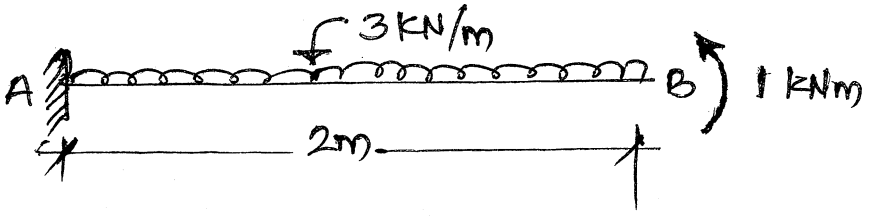

Fig. 2

5. Solve **any two** of the following : **(2×8=16)**

a) Draw SFD and BMD for the simply supported beam shown in Fig. 3. Show all important values.

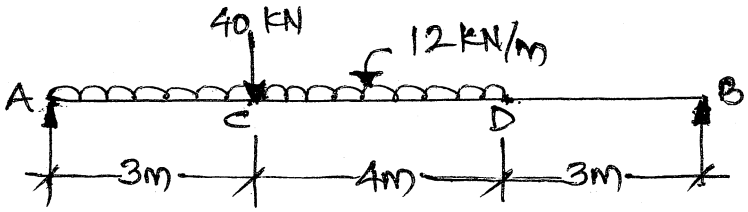

Fig. 3

b) An overhanging beam ABC, such that AB = 4 m and BC = 1 m. It is supported at 'A' and 'B'. The beam ABC is subjected to udl of 30 kN/m over entire length, it is subjected to point load of 50 kN at the free end C. Draw SFD and BMD. Locate point of contraflexure if any.

c) A T-section with flange 120 mm × 10 mm and web 10 mm × 120 mm is used as a simply supported beam with flange at top. If the permissible bending stress in tension and compression are 160 MPa and 100 MPa respectively, determine the moment of resistance. E = 210 GPa.

Marks

6. Solve **any two** of the following : **(2×8=16)**

a) A channel section is shown in Fig. 4. It carries a shearing force of 150 kN at a particular section. Calculate the ratio of average shear stress to maximum shear stress.

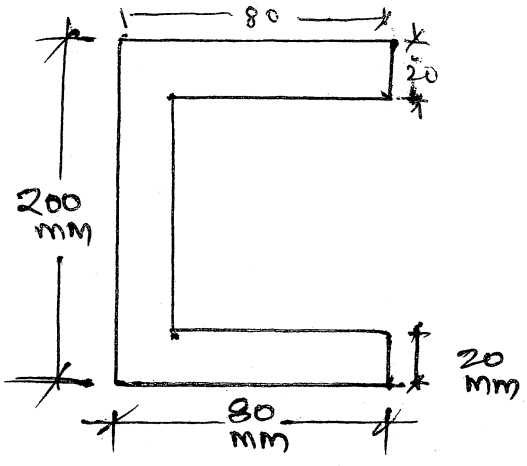

Fig. 4

b) Compare the crippling loads given by Euler's and Rankine's formula for a strut with both ends hinged, 2.5 m long, 40 mm external and 30 mm internal diameters, Take E = 200 GPa, $\alpha = \frac{1}{7500}$, σ_c = 320 MPa.

c) A weight of 1000 N falls on to a collar, at the lower end of the bar 5 m long, through a height of 200 mm. Determine the diameter of the bar if the stress induced is 80 MPa.
Take E = 210 GPa.