21314

12043

3 Hours/100 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 ten** : **(10×2=20)**

a) Define elasticity and elastic limit.

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

c) State the types of loading on beams with sketches.

d) Define point of contraflexure and contrashear.

e) State the perpendicular axis theorem of M.I.

f) State the value of M.I. of triangle about its base.

MARKS

g) Define section modulus and its unit.

h) State shear stress formula and its meaning of each symbols.

i) Define eccentric load and one example of it.

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

k) State any 4 assumptions made in theory of pure tension.

l) Define torsional rigidity and write unit.

2. Attempt **any four** : **(4×4=16)**

a) Draw stress strain curve for M.S. and explain terms.

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

c) A circular bar having 200 mm^2 area is subjected to the axial loads as shown in Fig. 1. Find the value of 'P' and the total elongation. Take E = 2×10^5 N/mm^2.

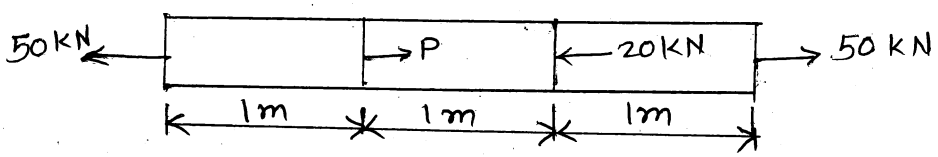

Fig. 1

d) Explain Tri-axial stress system with total volumetric strain of cube.

MARKS

e) Calculate M.I. of a T section about the centroidal axis XX. Top flange is 1200 × 200 mm and web is 1800 mm × 200 mm. Total height is 2000 mm.

f) A steel bar of 30 mm dia. is heated to 80°C and then clamped at ends. It is then allowed to cool down to 30°C. During cooling only 1 mm contraction was allowed. Calculate temp. stress developed and reactions at the clamps. Take length of the bar = 10 m, $\alpha = 12 \times 10^{-6}$/°C, $E = 2 \times 10^5$ N/mm^2.

3. Attempt **any four** : **(4×4=16)**

a) 2 vertical rods are of steel and copper are each rigidly fixed at the top as shown in Fig. 2. A horizontal cross bar of copper fixed to the rods at the lower end carries a load of 6000 N such that the cross bar remains horizontal even after loading. Calculate the load shared by each rod. Take $E_s = 2 \times 10^5$ N/mm^2, $E_c = 1 \times 10^5$ N/mm^2.

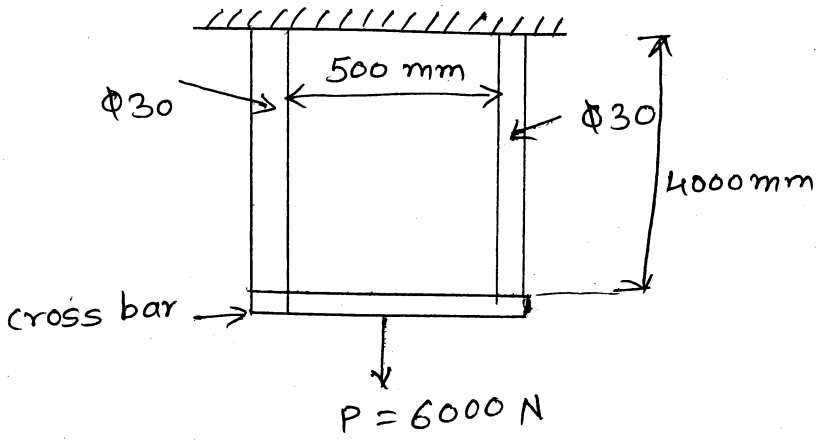

Fig. 2

MARKS

b) Draw S.F.D. and BMD for cantilever loaded as shown in Fig. 3.

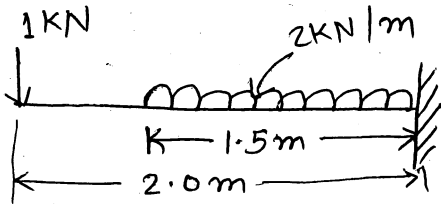

Fig. 3

c) Draw S.F. and B.M. diagram for a simply supported beam of a span 'L' carrying a central point load 'W'. State the values of max. S.F. and B.M.

d) A simply supported beam of span 5 m carries two point loads of 5 kN and 7 kN at 1.5 m and 3.5 m from the left hand support respectively. Draw SFD and BMD showing the important value.

e) Draw SFD and BMD for a beam shown in Fig. 4.

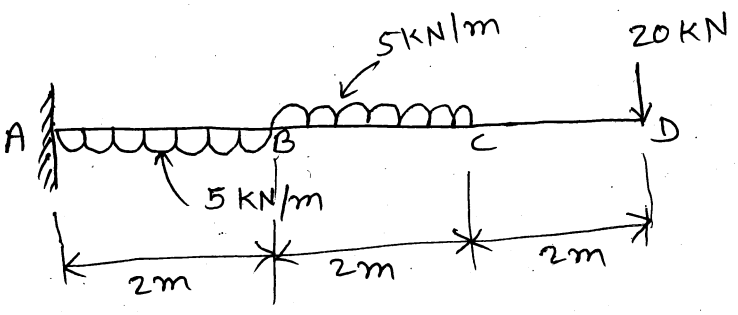

Fig. 4

f) A symmetrical I-Section of overall depth of 300 mm has its flanges 150 mm × 10 mm and web 10 mm thick. Find the moment of inertia about its centroidal axis parallel to the flanges.

MARKS

4. Attempt **any four** : **(4×4=16)**

a) Calculate the strain induced in a cube of 400 mm side in X, Y and Z if it is subjected to 300 N/mm^2 tensile stress in X dir^n., 500 N/mm^2 tensile stress in Y dir^n. and 200 N/mm^2 comp. stress in Z-dir^n.

b) Explain the theorem of mutually perpendicular axis for M.I.

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

d) A simply supported beam ABC with supported at A and B. 6 m apart with an overhang BC 2 m long, carries a udl of 15 kN/m over AB and a point load of 30 kN at C. Draw SF and BM diagram.

e) For a certain material the modulus of elasticity is 189 MPa. If Poisson's ratio = 0.35. Calculate the values of modulus of rigidity and bulk modulus.

f) Calculate moment of inertia about its axis for an angle section 200 × 200 × 20 mm size.

5. Attempt **any four** : **(4×4=16)**

a) Find the bending stress induced in the steel flat 40 mm wide and 5 mm thick if it is required to bend an arc of a circle of radius 2.5 m. Also calculate the moment required to bend the flat. Take E = 2×10^5 MPa.

b) Draw the stress distribution diagram of a rectangular section is subjected to direct and bending stresses.

c) A short column of hollow cylindrical section 250 mm outside dia. and 150 mm inside dia. carries a vertical load of 390 kN along one of the dia. planes 95 mm away from the axis of the column. Find the extreme intensities of stresses and their nature.

MARKS

d) A pier of 2 m × 2 m in section and having its weight 385 kN and carries a compressive load P which is acting at 75 mm from its edge bisecting one of its axis. What is the value of 'P' for no tension conditions ?

e) A 30 mm dia. rod is bent up to form an offset link as shown in Fig. 5 if the allowable tensile stress in the bar is 80 N/mm^2. Determine the max. value of force 'P'.

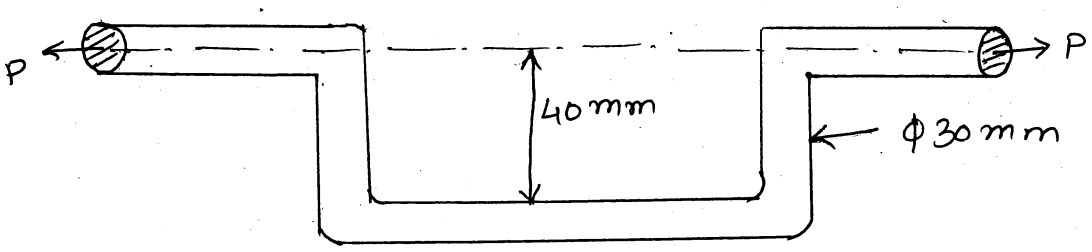

Fig. 5

f) A C-clamp as shown in Fig. 6 carries a load P = 25 kN. The CIS of the clamp at X-X is rectangular having width equal to twice thickness. Assuming that the C-clamp is made of steel casting with an allowable stress of 100 N/mm^2. Find its dimension.

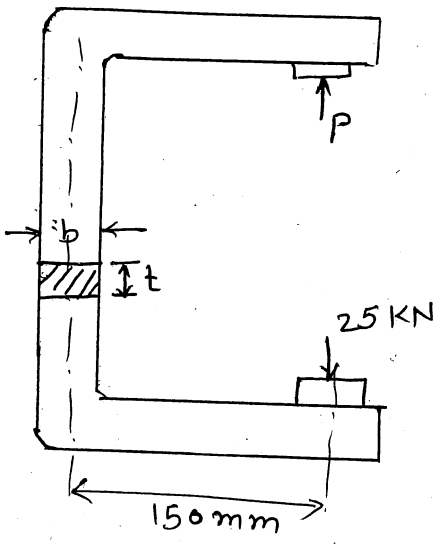

Fig. 6

MARKS

6. Attempt **any four** : **(4×4=16)**

a) A beam having a overall depth of 300 mm is used as a cantilever for a span of 1.2 m. Calculate the intensity of udl it can carry, including the self weight if the bending stress is not to exceed 8 N/mm^2 M.I. of the beam about NA is 4.05×10^8 mm^4.

b) Two string are to be used in lifting a newly cast reinforced concrete pole of length 2 m. The pole remains horizontal during its lift. Determine most suitable position for the string if the pole damage would be due to bending under its own weight of 8 kN/m.

c) Distinguish bet^n solid shaft and hollow shaft.

d) Explain torque or twisting moment. State its S.I. unit.

e) A shaft of hollow circular CIS has outer dia. 120 mm, inner 90 mm. It is subjected to a torsional moment of 18 kN/m. For this shaft compute shear stress at the outer surface.

f) Find power transmitted by a shaft having 50 mm dia. rotating at 120 rpm. If max. permissible shear stress = 80 MPa.
