22306

11819

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) Define moment of inertia. Write its unit.

b) Select any two parts subjected to tensile stresses and two parts subjected to compressive stresses of a bike, from the following: shock absorbers, spokes of wheels, foot rests, brake wires, clutch wire, chain drive, brake-padels.

c) Write the relationship between three moduli, with meaning of each term used.

d) Define shear force and bending moment, write their units.

e) State bending equation, with meaning of each term used.

f) Define eccentric loading. State two examples.

g) State twisting moment. Write the S.I. unit.

Marks

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

a) Find moment of inertia of angle
ISA : 100 mm × 75 mm × 6 mm about the centroidal XX and YY axis.

b) A mild steel specimen is tested on universal testing machine, axial tensile load is applied gradually upto fracture; draw the stress strain diagram with all important points on it. Also draw the variations in stress strain diagram for Cast Iron.

c) Determine the value of Young's modulus and Poisson's ratio of a metallic bar of length 30 cm, width 4 cm, and depth 4 cm, when the bar is subjected to an axial compressive load of 400 kN. The decrease in length is given as 0.075 cm and increase in width is 0.003 cm.

d) Draw shear force and bending moment diagrams for a simply supported beam of span L, carrying a UDL w/unit length over the entire span.

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

a) Find the moment of inertia of a solid rectangular section 40 mm wide and 60 mm deep about its smaller side.

b) Draw shear force and bending moment diagrams locating all important features for a cantilever 4 m long carries a load 4 kN at free end and a UDL of 2 kN/m over 2 m from the free end.

c) A solid shaft of diameter 110 mm transmits a torque of 12.5 kN.m. Calculate maximum shear stress in material of shaft and angle of twist in radians for a length of 2.5 m. Take G = 80 GPa.

Marks

d) A 30 mm diameter rod is bent to form an offset link as shown in Figure No. 1, if permissible tensile stress is 80 N/mm^2, find the maximum value of P.

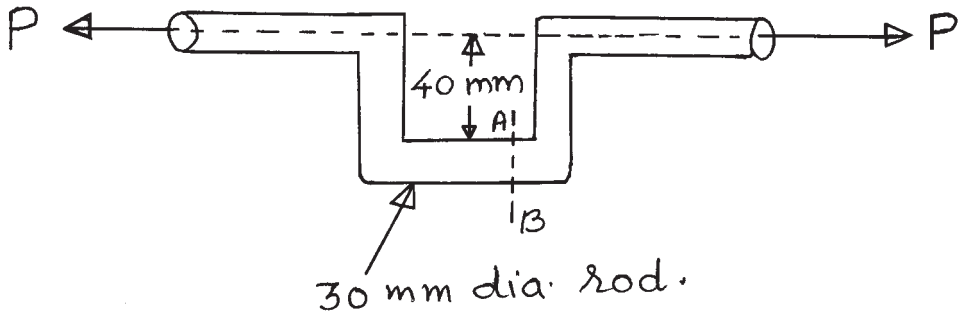

Fig. No. 1

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

a) A simply supported beam of 4 m length 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.

b) A timber beam 100 mm wide and 150 mm deep supports a UDL over a span of 2 m, if the safe stresses are 28 N/mm^2 in bending and 2 N/mm^2 in shear. Calculate the maximum UDL which can be supported by the beam.

c) Find the power that can be transmitted by a shaft of 40 mm dia. rotating at 200 RPM, if maximum shear stress is not to exceed 85 MPa.

d) A mild steel link as shown in Figure No. 2, by full lines transmits a pull of 80 kN; find the dimensions b and t if $b = 3t$. Assume the permissible stress as 70 N/mm^2.

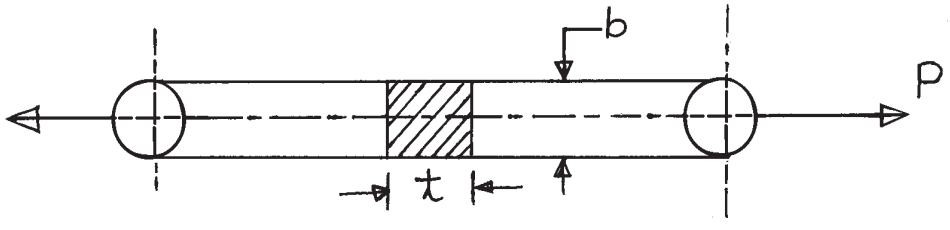

Fig. No. 2

e) A 'T' section is used for simply supported beam. Beam is subjected to UDL over entire span. Draw nature of bending stress distribution across the beam section. Also draw nature of shear stress distribution across the beam section.

Marks

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

a) A brass bar having cross sectional area of 1000 mm^2 is subjected to axial forces as shown in Figure No. 3, find the net deformation in the bar. Take E = 1.05×10^5 N/mm^2.

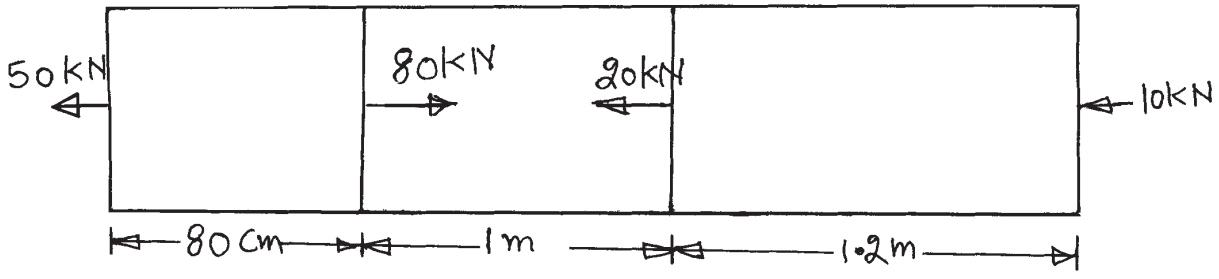

Fig. No. 3

b) Compare materials mild steel, leather, copper and wood on the basis of mechanical properties

(i) strength

(ii) hardness

(iii) ductility

c) A short column of external dia 40 cm and internal diameter 20 cm carries an eccentric load of 80 kN. Find the greatest eccentricity which the load can have without producing tension on the cross-section.

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

a) A simply supported wooden beam of span 1.3 m having a cross-section 150 mm wide and 250 mm deep carries a point load W at the centre. The permissible stresses are 7 N/mm^2 in bending and 1 N/mm^2 in shearing. Calculate the safe load W.

b) Determine the diameter of a solid steel shaft which will transmit 90 kW at 160 rpm. Also find the length of the shaft if the twist must not exceed 1° over the entire length. The maximum shear stress is limited to 60 N/mm^2.
Take the value of modulus of rigidity = 8×10^4 N/mm^2.

c) A rectangular column is 200 mm wide and 100 mm thick, it is subjected to a load of 180 kN at an eccentricity of 100 mm in the plane bisecting the thickness. Draw the combined stress distribution diagram showing their values.