22306

12526

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 answer 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 with neat sketch.

b) Define the following terms :–

i) Deformable body

ii) Hookes law.

c) Draw stress-strain diagram for Ductile Material and show different limits on it.

d) Define point of contra flexure of a loaded beam with neat sketch.

P.T.O.

Marks

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

f) What is core section? Draw the core section for circular column of diameter 'd'.

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

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

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

b) Define the following terms :–

i) Lateral strain

ii) Bulk modules

iii) Volumetric strain

iv) Tensile stress.

c) For a certain material, modules of elasticity is 170 MPa, if Poisson's ratio is 0.32. Calculate the values of –

i) Modules of rigidity

ii) Bulk modules.

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. Draw shear force and bending moment diagram.

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

a) i) Define moment of inertia.

ii) An isosceles triangle ABC has base width 80 mm and height 60 mm. Determine moment of inertia about centre of gravity and base BC.

b) Determine changes in length, width and thickness of a steel bar 4 m long, 30 mm wide and 20 mm thick and subjected to an axial pull of 30 kN. Take $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio = 0.3.

Marks

c) A cantilever beam is loaded as shown in Figure No. 1 Draw SFD and BMD.

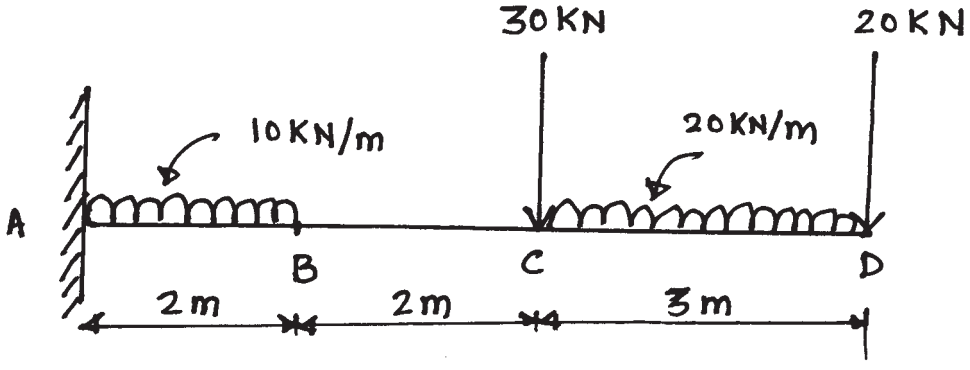

Fig. No. 1

d) A rectangular block of size 50 × 100 mm is made into 'C' shape and applying load of 40 kN at point. Calculate resultant stresses develop at section *x–x*, refer Figure No. 2.

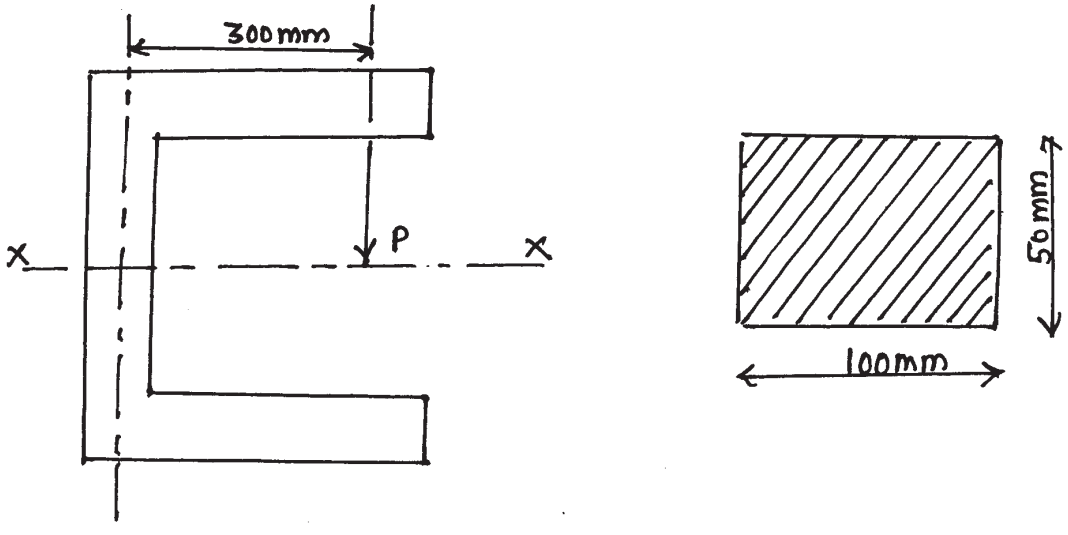

Fig. No. 2

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

a) A beam of span 6 m carries a udl of 1.5 kN/m run over entire span and two point load of 4 kN and 5 kN at 2 m and 4 m from the left support. Draw SFD and BMD.

b) Rectangular beam section 30 mm wide and 500 mm deep is simply supported over a span of 4 m carries a full span udl of 10 kN/m. Find maximum bending stress.

c) State assumptions made while analysis of circular shaft subjected to pure torsion.

Marks

d) i) Define

1) Resilience

2) Modules of resilience

ii) A steel rod of 20 mm diameter is subjected to a tensile load of 30 kN applied gradually. Calculate strain energy and elongation in rod. If length of rod is 1 m, E = 200 GPa.

e) Find the power transmitted by a solid shaft of 60 mm diameter running at 220 rpm if the permissible shear stress is 68 Mpa, the maximum torque is likely to exceed the mean torque by 25%.

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

a) A block is shown in Figure No. 3 weighing 35 kN supported by three wires. The outer two wires are of steel and have an area of 100 mm^2 each, while middle wire of aluminium has an area of 200 mm^2. Calculate stresses in aluminium and steel wires, take Es = 200 GPa and EA = 80 GPa.

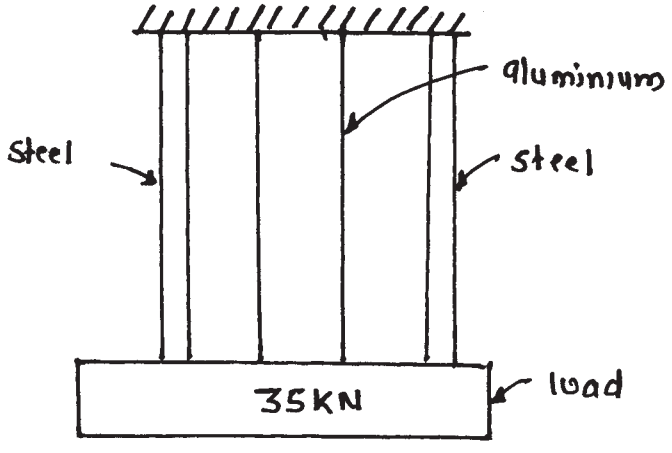

Fig. No. 3

b) A beam is simply supported over a span of 10 m. It carries a udl of 1 kN/m run over 2 m from left hand support also for 4 m from right hand support. Also carries two point load of 2 kN and 4 kN at a distance of 2 m and 8 m from left hand support. Draw shear force and bending moment diagram.

Marks

c) i) State assumptions made in theory of pure bending.

ii) 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 load which can be supported by beam.

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

a) A cantilever is 2 m long and is subjected to a udl of 2 kN/m. The cross section of the cantilever is Tee section with flange 80 mm × 10 mm and web of 10 mm × 120 mm such that its total depth is 130 mm. The flange is at the top and web is vertical. Determine maximum tensile stress and compressive stress developed and their position.

b) Select a suitable diameter for a solid circular shaft to transmit 200 HP at 180 rpm. the allowable shear stress is 90 N/mm^2 and allowable angle of twist is 1° in a length of 5 m. Take G or C = 0.85×10^5 N/mm^2.

c) i) Define eccentric load.

ii) A rectangular strut is 150 mm and 120 mm thick it carries a load of 180 kN at an eccentricity of 10 mm in a plane bisecting the thickness. Find maximum and minimum intensities of stress in the section.