22303

21819

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.

Marks

1. Attempt any FIVE of the following : **5 × 2 = 10**

(a) Define ductility and plasticity.

(b) Write mathematical expression of temperature stresses with meaning of each term.

(c) Calculate longitudinal stress developed in 2 cm diameter bar undergo tensile force of 120 kN.

(d) Define and explain Bulk Modulus.

(e) State any four types of beam.

(f) State the position of maximum shear stress and bending stress in S/S rectangular beam section carrying udl.

(g) Define effective length in column with its application.

2. Attempt any THREE of the following : 3 × 4 = 12

(a) Define 'Moment of inertia' and write mathematical expression of square and quarter circle with both axes.

(b) Define 'radius of gyration' and state its application. Calculate radius of gyration for circular lamina of diameter 500 mm.

(c) Calculate moment of inertia about the base of composite lamina made up of a semicircle of 120 mm base diameter is removed from base of rectangle 120 mm × 500 mm such that lamina is symmetrical to Y-axis.

(d) Find centroidal moment of inertia about X-X axis of 'symmetrical I' section with flanges 200 mm × 12 mm and web 10 mm × 300 mm.

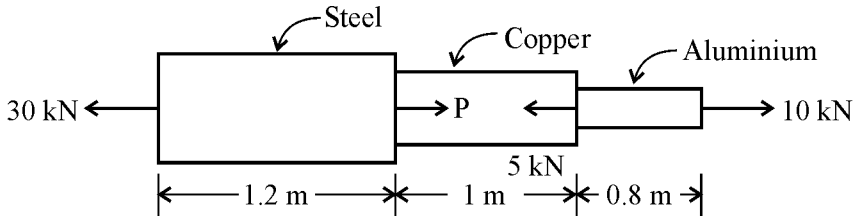
3. Attempt any THREE of the following : 3 × 4 = 12

(a) Sketch the standard stress-strain curve for mild steel and tor steel bar under axial tension and show important points on it.

(b) A steel rod is subjected to an axial pull of 25 kN. Find minimum diameter if the stress is not exceed 100 N/mm^2. The length of rod is 2000 mm and take E = 2.1 × 10^5 N/mm^2.

(c) A square R.C.C. column of 300 mm × 300 mm in section with 8 steel bars of 20 mm diameter carries a load of 360 kN. Find the stresses induced in steel and concrete. Take modular ratio = 15.

(d) A compound bar having steel rod of dia. 35 mm and solid copper rod of dia. 20 mm and aluminium square rod of 10 mm is as shown in following figure. Find change in length of bar. Take modulus of elasticity Es = 210 kN/mm^2, E_c = 110 GPa and E_{al} = 70 GPa.



4. Attempt any THREE of the following : **3 × 4 = 12**

(a) A bar of 20 mm diameter is subjected to a pull of 45 kN. The measured extension on gauge length of 200 mm is 0.05 mm and change in diameter is 0.0025 mm. Calculate the Poisson's ratio and the value of the modulus of rigidity.

(b) A steel flat 30 mm × 15 mm and 2.8 m long is subjected to an axial pull of 58 kN, if E = 2.1 × 10^5 N/mm^2 and μ = 0.30. Calculate volumetric strain and change in Volume.

(c) Draw shear force and bending moment diagram for cantilever beam of 5 m span subjected to udl of 15 N/m up to midspan from fixity.

(d) Calculate the Euler's limiting value of slenderness ratio for which it is not valid for long columns.

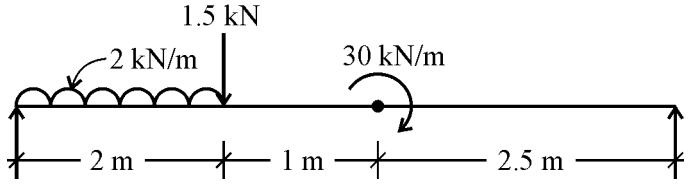
Take E = 2 × 10^5 MPa & σ_c = 320 N/mm^2

(e) Calculate the crippling load by Rankine's formula for a hollow circular column of 300 mm external diameter and 200 mm internal diameter. Unsupported length of the column is 4.2 m. If (a) both ends are fixed and (b) both ends are hinged.

Take σ_c = 550 N/mm^2, a = (1/1600).

5. Attempt any TWO of the following : **2 × 6 = 12**

(a) Draw shear force and bending moment for simply supported beam as shown in Fig.



(b) Draw shear force and bending moment diagram for cantilever beam of 5 m span. Beam is loaded with udl of 15 N/m over entire span. Vertically downward point load of 100 N at its free end and clockwise moment of 50 Nm at its mid span.

(c) A simply supported beam of span 6 m carries udl of 10 kN/m upto 2 m and couple of 5 kNm (clockwise) at 3 m respectively from left side support. Draw SFD and BMD with appropriate calculation.

6. Attempt any TWO of the following : 2 × 6 = 12

(a) A simply supported beam of span 6 m carries two point loads 18 kN with 2 m spacing and symmetrical to span. Design square beam for bending if maximum bending stresses in beam is 10 N/mm^2.

(b) Draw shear stress distribution along cross-section of circular beam for 300 mm diameter carrying 400 kN shear force. Also determine the ratio of maximum shear stress to average shear stress.

(c) Draw shear stress distribution along of beam for L section with 75 × 12 mm in flange and 100 × 15 mm in web carrying 60 kN shear force.
