SE/ Sem-III/ PROD/ Strength of Materials / 04-12-13

2nd Half-13(10)-PKL-27

Con. 8610-13.

PROD (CBGS)

GX-12107

(3 Hours)

[Total Marks : 80

N. B. : (1) Question No. **1** is **compulsory**.
(2) Answer any **three** from the **remaining** questions.
(3) Assume **suitable** data if **necessary.**

1. Answer any **four** from the following:– **20**

(a) Derive the torsion equation $\frac{T}{J} = \frac{\sigma}{R} = \frac{G\theta}{L}$

(b) Draw SFD and BMD for a cantilever beam of span L carrying a udl of intensity w per unit length.

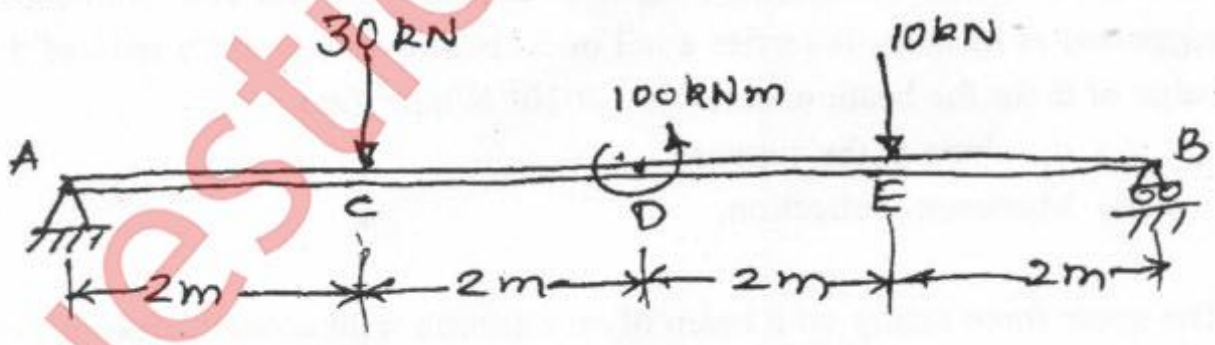
(c) In a tensile test on MS bar of 20 mm diameter the elongation in gauge length of 100 mm was 0.072 mm when the load was 45 kN. The reduction in diameter was 0·0036 mm. Find E,G and K.

(d) Determine the strain energy stored in a simply supported beam of span L carrying a central point load W.

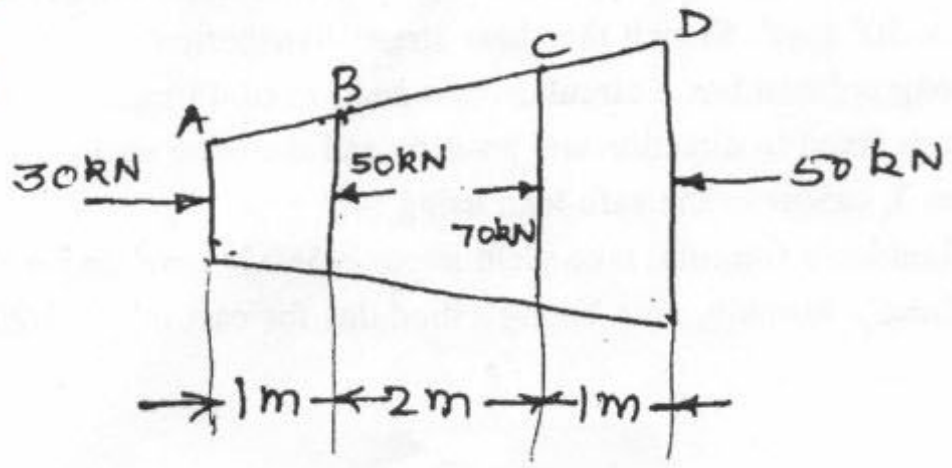
(e) Calculate MI of a T-section about the centroidal axis XX. The top flange is 1200 × 200 mm and web is 1800 × 200 mm. The total depth of the section is 2000 mm.

2. (a) A brass rod 300 mm long and 25 mm indiameter is fixed inside a steel tube having 45 mm as external and 25 mm as internal diameter of same length. Calculate the load shared by each metal if the assembly is loaded with an axial pull of 120 kN. Use E_{steel} = 200 kN/mm². E_{brass} = 110 kN/mm². **10**

(b) Draw SFD and BMD for the simply supported beam of span 8 m with all salient features. **10**



3. (a) Find the change in length of the bar. Bigger diameter is 40 mm and smaller diameter is 20 mm. Take E = 120 GPa. **10**



[TURN OVER

(b) A short column of rectangular section 80 mm × 60 mm carries a load at a point 20 mm from longer sider and 35 mm from the shorter side. Determine the maximum compression and tensile stresses in the section. **10**

4. (a) A point in a strained material is subjected to mutually perpendicular stresses of 80 MPa tensile and 50 MPa compressive. It is also subjected to a shear stress of 15 MPa find the principal stresses and maximum shear. Also find the angle made by the planer carrying principal stresses and maximum shear with respect to 80 MPa stress plane. **10**

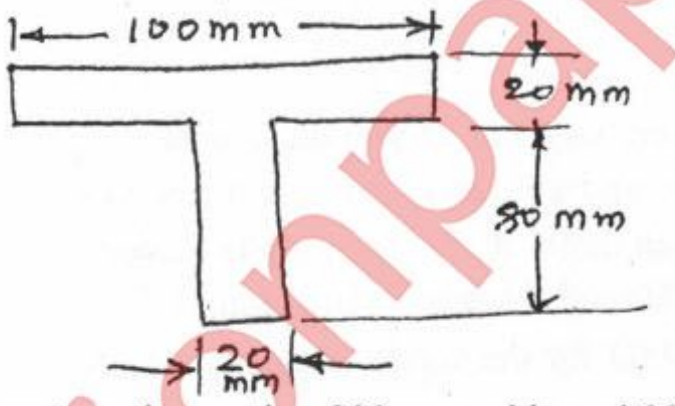
(b) For a hollow circular shaft having internal diameter 0.5 times the external diameter, is to be designed to transmit 50 kW at 450 rpm and shear stress is not to exceed 85 MPa. Calculate– **10**

(i) External diameter of the hollow shaft

(ii) The angle of twist in degrees between a length of 1.5 m apart.

Take G = 80 GPa.

5. (a) A cast iron beam is of T section as shown in **figure.** The beam is simply supported on a span of 8 m. The beam carries a uniformly distributed of 1.5 kN/m on the entire span. Determine the maximum tensile and maximum compressive stresses. **10**



(b) A beam of uniform rectangular section 200 mm wide and 300 mm deep is simply supported at its ends. It carries a udl of 9 kN/m over the entire span of 5 m. If the value of E for the beam material is 1×10^4 N/mm^2 find :– **10**

(i) the slope at the supports

(ii) Maximum deflection.

6. (a) The shear force acting on a beam of an I section with equal flanges is 50 kN. Top flange and bottom flanges dimensions are 200 × 50 mm each. The web dimensions are 50 × 200 mm. Overall depth is 300 mm. The moment of inertia about neutral axis is 37×10^7 mm^4. Sketch the shear stress distribution across the section. **10**

(b) A 1.2 m long column has a circular cross section of 45 mm diameter. One end of the column is fixed in direction and position and the other end is free. Taking factor of safety as 3, calculate the safe load using :– **10**

(i) Rankine's formula, take yield stress = 560 N/mm^2 and $\alpha = 1/1600$.

(ii) Euler's formula, take Young's modulus for cast iron = 1.20×10^5 N/mm^2.
