

- N.B.:**
1. Question No 1 is **compulsory**
  2. Attempt any **Three** questions from the remaining five questions.
  3. Assume any **suitable data** if necessary with justification.
  4. Figures to the right indicate full marks.

**Q1.** Attempt any **four** of the following questions.

- (a) Draw the shear force and bending moment diagram for a simply supported beam carrying a concentrated load not at mid span. **05**
- (b) Write a short note on Macaulay's method **05**
- (c) Obtain the core of section for Rectangular Section. **05**
- (d) What is pure Torsion? State the assumption made in the theory of pure torsion. **05**
- (e) What do you mean by temperature stresses? Explain. **05**

**Q2.** (a) A 10 mm steel rod passes centrally through a copper tube of 25mm external diameter and 15 mm internal diameter and 2.5 m long. Tube is closed at each end by 25 mm thick steel plates secured by nuts. The nuts are tightened until the copper tube is reduced in length by 0.8 mm. The complete assembly then raised in temperature by 30 degree centigrade. Determine the stresses in steel and copper tubes before and after the rise in temperature. **12**

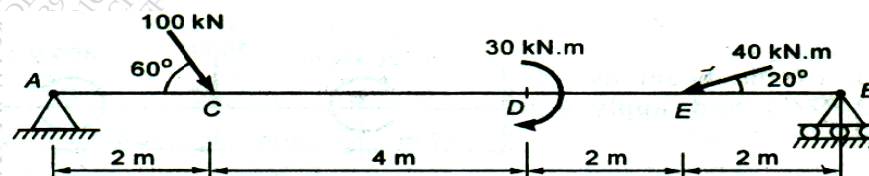
Take,  $E_s = 2 \times 10^5 \text{ N/mm}^2$ ,  $E_c = 1 \times 10^5 \text{ N/mm}^2$ ,  
Coefficient of thermal expansion of steel  $= 12 \times 10^{-6} / ^\circ \text{C}$   
Coefficient of thermal expansion of copper  $= 18 \times 10^{-6} / ^\circ \text{C}$ .

- (b) A 4 m long cast iron hollow column with both ends firmly fixed supports an axial load of 400 KN. The inside diameter of the column is 0.6 times the external diameter. Determine the section of the column. Assume factor of safety to be 5. **08**

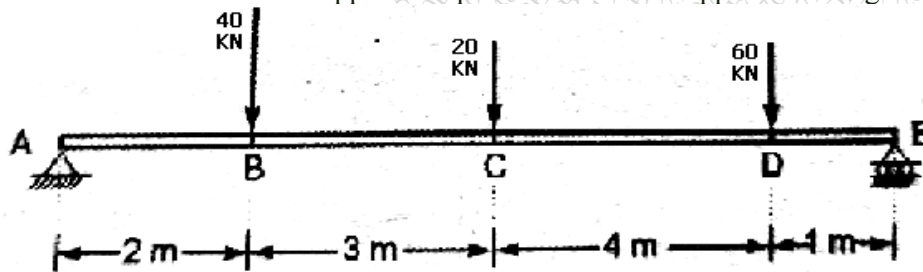
Take  $\sigma_c = 560 \text{ N/mm}^2$  and  $\alpha = 1/1600$ .

**Q3.** (a) A cantilever beam has a length of 2 m. It is of 'T' section with the flange of 100 mm x 15 mm, web 200 x 10 mm. Determine the maximum load per m run that can be applied if the maximum tensile stress is not to exceed  $25 \text{ N/mm}^2$ . **12**

- (b) Draw shear force and bending moment diagram for the beam loaded as shown in the figure. **08**



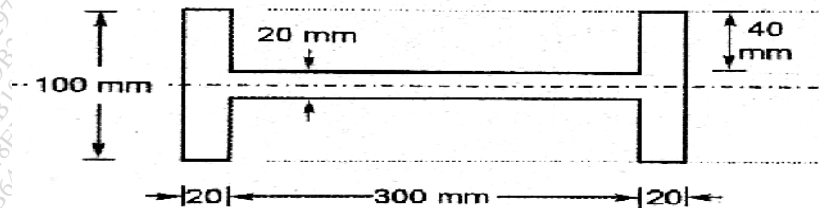
- Q4. (a) 4a)** A hollow circular shaft having 5 mm thickness is used for transmitting 250 kW power at 500 rpm. Determine the external and internal diameters of the shaft, if the permissible shear stress for the material of shaft is  $50 \text{ N/mm}^2$ . The maximum torque being 20% greater than mean torque. Take  $G = 8 \times 10^4 \text{ N/mm}^2$ . **10**
- (b)** A load of 75 kN is carried by a column made of cast iron. The external and internal diameters are 200 mm and 180 mm respectively. If the eccentricity of the load is 35 mm, find: 1. The maximum and minimum stress intensities. **10**
2. Upto what eccentricity there is no tensile stress in the column?
- Q5. (a)** Find the deflections of points B and C for the beam shown in figure. Assume  $EI = \text{constant}$ . Point A is a fixed support and point E is a roller support in the figure. **12**



- (b)** State the assumptions made in the theory of pure bending and prove: **08**

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

- Q6. (a)** A symmetrical I-section has flanges 100 mm x 20 mm and web 300 mm x 20 mm. Draw shear stress distribution diagram for the section when web is horizontal as shown in figure. Take  $SF = 100 \text{ kN}$ . **10**



- (b)** An unknown weight falls through 8 mm on to a collar rigidly connected to the lower end of the vertical bar 4 m long and  $800 \text{ mm}^2$  in section. If the maximum instantaneous extension is known to be 3 mm, what is the corresponding stress and the value of the unknown weight? Take  $E = 2 \times 10^5 \text{ N/mm}^2$ . **10**