Time -03 Hours **Total marks - 80**

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) State the physical significance of core of section. What is the limit of eccentricity of Section of solid rectangular column and hollow circular cylinder **05**

(b) Draw the relativity of stress with strain for ductile and brittle material **05**

(c) What are the limitations of Euler's theory? State the corrections made by Rankin Also state the different end conditions for column. **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, $E_s = 2x10^5 N/mm^2$,$E_c = 1x10^5 N/mm^2$,

Coefficient of thermal expansion of steel = $12x\ 10^{-6}/^0$ C

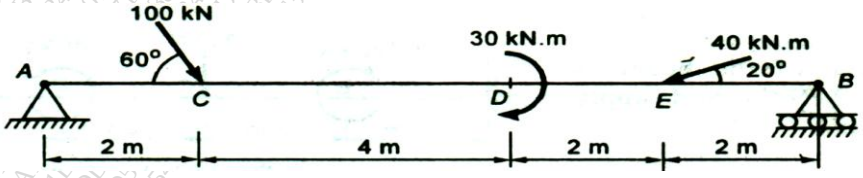
Coefficient of thermal expansion of copper = $18 \times 10^{-6}/^0$ C.

(b) A4 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 $\sigma_c = 560\ N/mm^2$ 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 N/mm^2. **12**

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

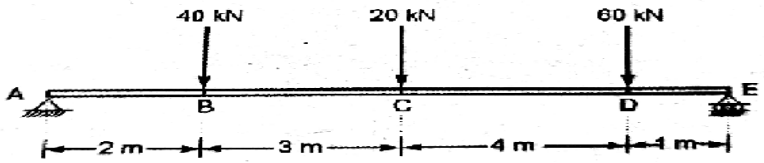


Q4. **(a)** A hollow circular shaft having 5 mm thickness is used for transmitting 250 kW power at 500 rpm. Determine the external and internal diameters of the shaft, if the permissible shear stress for the material of shaft is 50 N/mm^2.The maximum torque being 20% greater than mean torque. Take $G = 8 \times 10^4\ N/mm^2$. **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?

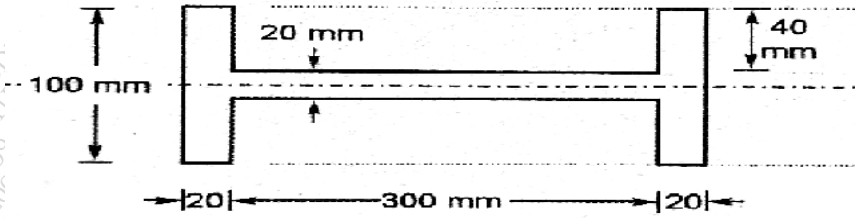
Q5. (a) Find the deflections of points B and C for the beam shown in figure. Assume EI = constant. Point A is a fixed support and point E is a roller support in the figure. **12**



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

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

6. (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 a the section when web is horizontal as shown in figure. Take SF=100KN. **10**



(b) An unknown weight falls though 8 mm on to a collar rigidly connected to the lower end of the vertical bar 4m long and 800 mm^2in 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 x 10^5 N/mm^2. **10**