S.E (MECHANICAL ENGG) (SEM III) (CBGS)
Strength of Materials

28th May, 2014
3.00 pm to 6.00 pm

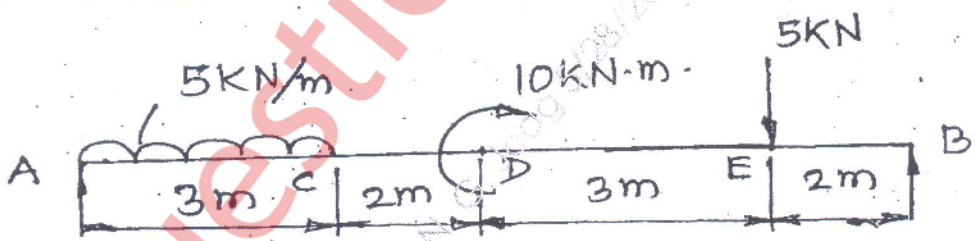
QP Code : **NP-18669**

(3 Hours) **[Total Marks : 80**

**N.B.:** (1) Question No.**1** is **compulsory.** Answer any **three** from the remaining **five** questions.
(2) **All** questions carry **equal** marks.
(3) Assume **suitable** data wherever **necessary.**
(4) **Use** of non-programmable calculator is **permitted.**
(5) **Figures** to **right** indicate **full** marks.

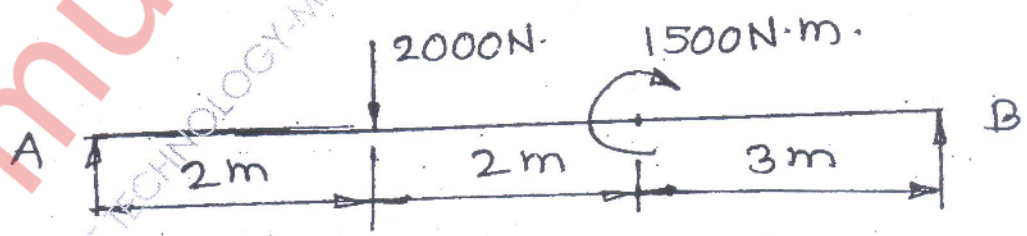
1. Attempt any **four** :— **20**
   (a) What is sagging and hogging in bending moments give its sign conventions.
   (b) Draw stress strain curve for ductile material and explain salient points on it.
   (c) What are the assumptions made in simple bending, derive flexural formula.
   (d) Calculate the strain energy stored in a bar 2m long, 50mm wide and 40mm thick when it is subjected to a tensile load of 60 kN. Take, E = 200 GPa.
   (e) What are the assumptions made in the analysis of struts and column by Eular's buckling theory ? What are its limitations ?
   (f) A steel spherical shell of radius 600 mm has a wall thickness of 6mm. Determine maximum stress caused due to internal pressure of a 0·8N/mm$^2$. Take, E = 210 GPa and Poisson's Ratio = 0·3

2. (a) A beam of 10m length is acted upon by forces and couple as shown in fig. Draw SFD and BMD. **14**

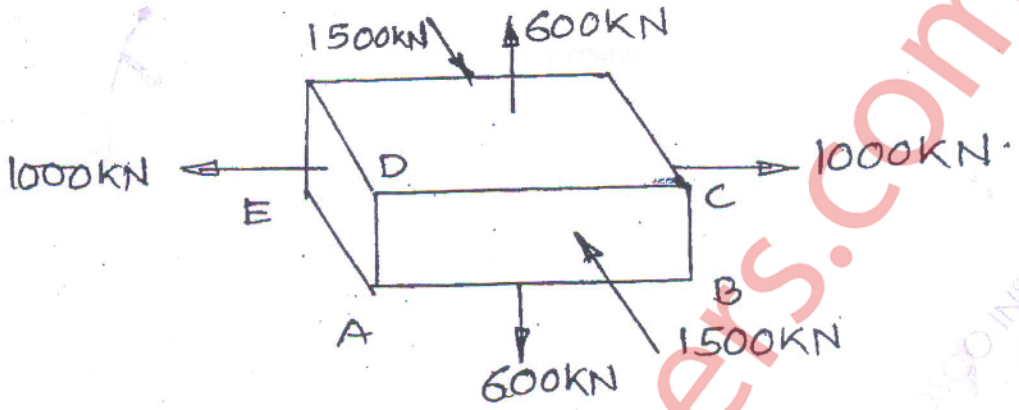



   (b) Derive the relation between Elastic constants i.e. E, K and G. **6**

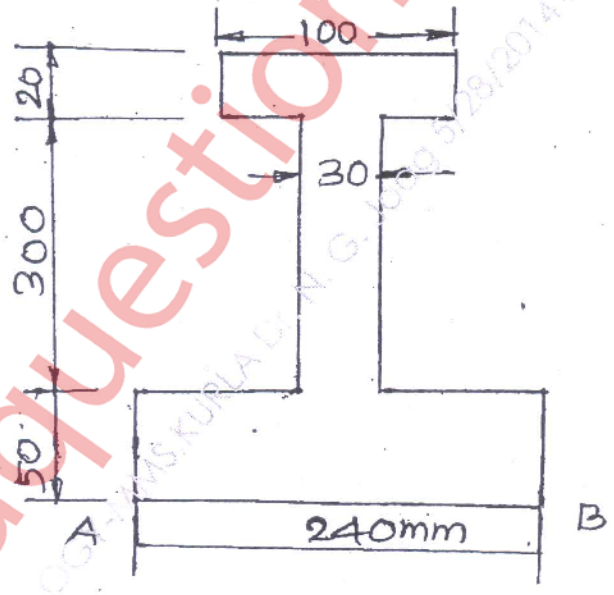
3. (a) Find deflection of point B for the beam as shown in figure. **10**



(b) A rectangular black is loaded as shown in figure. Find the change in dimensions and also change in volume. Take, Poisson's Ratio as 0·3 and E = 210 GPa AB = 500 mm, BC = 200 mm and AE = 400 mm. 1




4. (a) The tension flange of cost iron I-section beam is 240mm wide and 50mm deep. The compression flange is 100 mm wide and 20 mm deep where as the web is 300 mm ×30 mm. Find the load per meter run which can be carried over a 4 m span by a simply supported beam if the maximum permissible stresses are 90 MPa in compression and 24 MPa in tension. 1




(b) A solid shaft of 200 mm diameter has the same cross sectional area as hollow shaft of the same material with inside diameter of 150 mm. Find the ratio of – 10

(i) Power transmitted by both the shaft at the same angular velocity

(ii) Angle of twist in equal length of these shaft when stressed to same intensities.

5. (a) A 4 m long steel bar of square cross section of 40 mm side, is heated through 75°C with its ends clamped before heating. Calculate the thrust exerted by the bar on clamps : 10

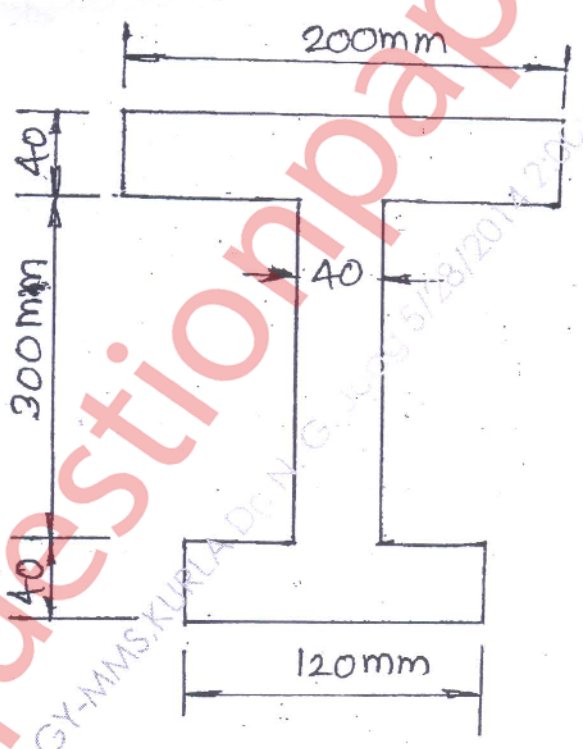
(i) if the clamps do not yield

(ii) if the clamps yield by 0·6 mm.

Take, E = 210 GPa and $\alpha = 11{\cdot}5 \times 10^{-6}/°C$

(b) A shaft is to transmit 40 kW at 200 rpm calculate the diameter of the shaft if the angle of twist is not to exceed 1° in a length of 20 times the diameter of the shaft and the maximum shear stress is limited to 100 N/mm$^2$. Take, G = 84 GPa. If the shaft is replaced by hollow shaft with the ratio of diameters as 2. Find the inside and outside diameter of the shaft. 10

6. (a) Figure shows a C.I. bracket subjected to bending if the maximum tensile stress in the top flange is not to exceed 15 MPa, determine the bending moment the section can take. If the beam is subjected to shear force of 150 kN. Sketch the stress distribution over the depth of the section. 10




(b) Determine deflection at free end 'C' for the beam as shown in figure. 10

Take, E = 210 GPa and I = $15 \times 10^{-6}$ m$^4$.