Q.P. Code: 39027

DURATION: 3Hours **MAX MARKS: 80**

Note:

1. Question no.1 is compulsory.
2. Attempt any three questions out of the remaining six questions.
3. Assume suitable data wherever required.

Q1 Answer any four **20**

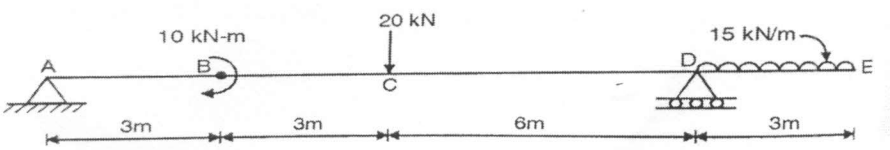
1. A round bar of 37.5mm diameter and 2.4m length is stretched by 2.5mm, find its bulk modulus and lateral contraction. Take E = 110GN/m^2 and G = 42GN/m^2 for the material of the bar.
2. A short column of external diameter 400mm and internal diameter 200mm carries an eccentric load of 80 kN. Find the greatest eccentricity, which the load can have without producing tension on the cross section.
3. Prove that for a beam of rectangular section maximum shear stress is 1.5 times the average shear stress.
4. A steel rod 3m long and of 50mm diameter is used as a column with both ends are hinged. Find crippling load by Eulers formula. Take E= $2x10^5$ N/mm^2.
5. A rod 13mm in diameter is stretched by 3.5mm under a steady load of 12kN. What stress would be induced in the bar by a 800 N weight falling through 80mm before causing to stretch the rod if it is originally unstretched? Take E= $2.15x10^5$ N/mm^2.
6. Draw a Mohr's circle diagram for two mutually perpendicular direct stresses.
7. State the assumptions made in the theory of pure bending.

Q2 a) A compound bar consists of a copper rod 20mm in diameter and a steel tube of 60mm in external diameter, with thickness 5mm. The copper rod and steel tube are assembled coaxially and their ends are rigidly fixed at 30°C. If the compound bar is heated to 130°C, determine the stress induced in each metal. Take Es= 200kN/mm^2 , Ecu = 120kN/mm^2, α_s = $12x\ 10^{-6}$/°C , α_{cu} = $18x\ 10^{-6}$/°C. **10**

b) Evaluate the power that can be transmitted at 300rpm by a hollow steel shaft of 75mm external and 50mm internal diameter when permissible shear stress for the steel is 70 MN/mm^2 and maximum torque is 1.3 times the mean? Compare the strength of this hollow shaft with that of solid shaft of same material and length. **10**

Q3 a) A cantilever beam of span 2m has inverted T cross section. The flange at bottom is 150mm wide and 12mm thick and the overall depth of the section is 150mm. if the permissible tensile stress is 125 MPa, find the maximum intensity of udl that may be applied all over the span. Also calculate the force resisted by the flange. **10**

b) Construct shear force and bending moment diagrams for a beam loaded as shown in fig 1 and locate point of contraflexure. **10**



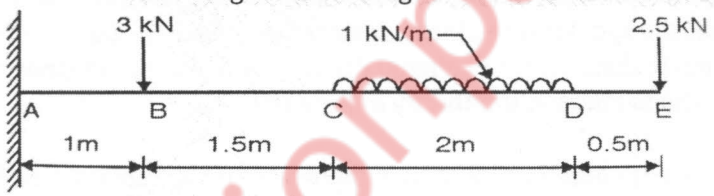
Q4 a) An I-section beam 350mm x 150mm has a web thickness of 10mm and flange thickness 20mm. If the shear force acting on the section is 40kN, find **10**
   a. Maximum shear stress developed in the section.
   b. Sketch the shear stress distribution diagram.
   c. The total shear force carried by the web.

b) At a cross section of a beam, there is a longitudinal bending stress of 110 N/mm^2 tensile and a transverse shear stress of 45 N/mm^2. Find the resultant stress in magnitude and direction on a plane inclined at 30° to the longitudinal axis. (There is no normal stress on longitudinal plane.) Also determine principal stresses and strains. **10**

Q5 a) A cantilever of length 2m carries a uniformly distributed load of 25 N/m for a length of 1.25m from the fixed end and a point load of 1000N at the free end. If the section is rectangular with 120mm side and 240mm deep, find the deflection at the free end. Take E= 10 kN/mm^2. **10**

b) The cross section of a column is hollow rectangular section, having external dimensions 120 mm x 80mm, internal dimensions 100mm x 60mm, with uniform thickness of 10mm. It is 5m long having one end fixed, other end hinged. Find the safe load it can carry by Euler's formula and Rankine's formula. Take E= 200 GPa, σ_c = 3200 N/mm^2, α = 1/7500, Factor of safety = 3. **10**

Q6 a) Draw shear force and bending moment diagrams for the beam shown in fig 2. **10**



b) Make the core of the section and calculate the area of the core section, for I-section. Take flange and web thickness as 10mm, width of flanges 100mm, depth of web 130mm with overall depth 150mm. **10**

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