SE | MTRX | sem-IV / CBSGS | SH-2018 **Q.P. Code: 50218**

10/12/2018

Duration: 3 Hours **Marks: 80**

Q.1 Attempt any Four [20]

(a) Draw the Shear force and bending moment diagram for cantilever beam carrying point load at free end.

(b) Evaluate the extension of rectangular rod under self-weight.

(c) Explain the theory of pure bending with assumption made.

(d) A bar of 12 mm diameter, is acted by an axial load of 20 kN. The change in diameter is measured as 0.003 mm. Determine;

(i) the Poisson ratio

(ii) the modulus of elasticity and bulk modulus .Take G= 80 MPa.

(e) Define the principle of superposition. What is its utility?

Q.2 **(a)** A 10 m long simply supported beam carries a point load of 4 KN at 8 m from the left end along with a uniformly distributed loads of 4 kN/m intensity for 3 m length starting from the left end. The beam is also acted by clockwise couple of 10 kN-m at mid-point of the span. Draw the shear force and bending moment diagram. **[10]**

(b) A hollow shaft of diameter ratio 3/8 (internal diameterto external diameter) is to transmit 375 kW power at 100 r.p.m.The maximum torque being 20 % greater than the mean. The Stress is not exceed 60 N/mm^2 and twist in length of 4 m not exceed 2°.Calculate its external and internal diameters which would satisfy both the above conditions. Assume modulus of rigidity $G = 0.85 \times 10^5$ N/mm^2 **[10]**

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Q.3 **(a)** A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectably from the left support. Find:

(i) Deflection under each load,

(ii) Maximum deflection, and

(iii) The point at which the maximum deflection occurs.

Take E= 2×10^5 N/mm^2 and I = 85×10^6 mm^4 **[10]**

(b) A tension bar 5 m long is made up of two parts, 3 metre of its length has a cross-sectional area of 10 cm^2 while remaining 2 metre has a cross-sectional area of 20 cm^2. An axial load of 80kN is gradually applied. Find the total strain energy produced in bar and compare this value with that obtained in a uniform bar of the same length and having the same volume when under the same load. E =2×10^5 N/mm^2 **[10]**

Q.4 **(a)** A steel tube of 30 mm external diameter and 20mm internal diameter enclose a copper rod of 15 mm diameter to which it is rigidly joined at each end. If at a temperature of 10 °C there is no longitudinal stress, calculate the stress in rod and the tube when temperature is raised to 200 °C .Take E for steel and copper as 2×10^5 N/mm^2 and 1×10^5 N/mm^2 respectively. The value of co-efficient of linear expansion for steel and copper is given as 11×10^{-6}per °C and 18×10^{-6}per °C respectively. **[10]**

(b) Two mutually perpendicular planes of an element of, material are subjected to direct stresses of 10.5 MN/m^2 (tensile) and 3.5 MN/m^2 (compressive) and shear of 7 MN/m^2.Find graphically or otherwise:

(i) The magnitude and direction of principle stress and

(ii) The magnitude of the normal and shear stress on a plane on which the shear stress is maximum. **[10]**

Q.5 **(a)** A timber beam of rectangular section is to support a load of 20 kN uniformly distributed over a span of 3.6 m, when beam is simply supported. If the depth of section is to be twice the breadth, and the stress in beam is not exceed 7 N/mm^2, find the dimension of the cross-section. How would you modify the cross-section of the beam, if it carries a concentrated load of 20 kN placed at the Centre with the same ratio of breadth to depth. **[10]**

(b) A shaft transmit 280 kW of power at 160 r.p.m. Determine: (i) The diameter of solid shaft to transmit the required power (ii) the inner and outer diameter of hollow shaft if the ratio of the inner to the outer diameter is 2/3 and (iii) percentage saving the material on using hollow shaft instead of solid shaft. Take allowable shear stress as 80MPa and the density of material 70 kN/m^3 **[10]**

Q.6 **(a)** Define the terms: **[10]**

(i) Modular ratio

(ii) Section modulus

(b) What do you meant by principal plane and principal stress? **[05]**

(c) Write short note on flitched beams. **[05]**

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