

B. Tech Degree III Semester Examination, November 2009**ME 303 MECHANICS OF SOLIDS**

(2006 Scheme)

Time : 3 Hours

Maximum Marks : 100

PART A(Answer ALL questions)

(8 x 5 = 40)

- I. (a) State and explain Hooke's law.
 (b) Explain the principle of superposition.
 (c) With neat sketches explain the different types of beams.
 (d) Derive relations between bending moment, shear force and rate of loading for beams.
 (e) What is neutral axis? Show that neutral axis always passes through the centroid of the section of the beam
 (f) Derive an expression for the intensity of shear stress at any point in the cross-section of a loaded beam.
 (g) Explain the failure of long columns and short columns.
 (h) Explain Ma Caulay's method of determining the deflections of a beam.

PART B

(4 x 15 = 60)

- II. A steel rod of 50 mm diameter and 1 m long is subjected to an axial pull of 60 kN.
 Find (i) stress induced
 (ii) strain
 (iii) change in length
 Take $E = 200 \text{ GPa}$.

OR

- III. A thin cylinder of 100 mm internal diameter and 5mm thick is subjected to an internal pressure of 10MPa and torque of 2000 N-m. Calculate the magnitudes of the principal stresses.

- IV. A torque transmitting solid steel shaft of 100 mm diameter is replaced by a hollow one of the same material having its outside diameter twice its inside diameter. The maximum shear stress in the hollow shaft remains the same as that in the solid shaft. Compare torsional rigidity of the two shafts.

OR

- V. Draw the shear force and bending moment diagrams for a continuous beam of four equal spans, each of length ' l ' and bearing a uniformly distributed load of ' w ' per unit length on each span.

- VI. At a particular section of a beam carrying transverse loads, the shear force is 40 kN. The section of the beam is circular of diameter 80 mm. Draw the shear stress distribution curve along the vertical axis passing through the centre of the section.

OR

- VII. A solid circular shaft of diameter ' d ' is subjected to a pure torque of 20 Nm. Determine the diameter of the shaft according to the maximum principal stress theory, taking the factor of safety as 2. Yield strength of the material is 310 N/mm^2 .

- VIII. A mild steel column of hollow circular section has 120 mm external diameter and 100 mm internal diameter. It is 4m long and hinged at both ends. What is the maximum permissible load with an eccentricity of 30 mm if the maximum compressive stress is limited to 100 N/mm^2 . Take $E = 2.05 \times 10^5 \text{ N/mm}^2$

OR

- IX. By using area moment method calculate the maximum slope and deflection of the cantilever beam which carries a uniformly distributed load from zero at the fixed end to 200 N/m at the free end. The length of the beam is 6m.

Take $E = 200 \text{ GPa}$ and $J = 20 \times 10^6 \text{ mm}^4$

