Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐   **Total No. of Pages : 02**

Total No. of Questions : 09

B. Tech.(AE) (Sem.–3rd) (2011 Batch)
MECHANICS OF MATERIALS
Subject Code : BTAE-301
Paper ID : [A1112]

Time : 3 Hrs.   **Max. Marks : 60**

INSTRUCTION TO CANDIDATES :
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.**

SECTION-A

1. **Write briefly :**

    (a) What do you mean by Poisson's Ratio?

    (b) Define Hoop Stress and Longitudinal Stress.

    (c) Write down the formula of power transmitted by hollow shaft subjected to pure torsion.

    (d) What do you understand by Principle Stress?

    (e) Define Slenderness Ratio.

    (f) What do you mean by Temperature Stress?

    (g) What do you understand by Flitched beam?

    (h) State Maximum shear stress theory of failure.

    (i) Define shear stress. Write the formula of maximum shear stress in a circular section beam.

    (j) Calculate the maximum bending moment in a simply supported beam of length 5m and carrying a concentrated load of intensity 10 N at the center.

SECTION-B

2. Draw the shear force diagram and bending moment diagram for a simply supported beam having uniformly distributed load over its whole span.

3. A thin cylinder 2m long. 0.5 m in diameter and made out of 10 mm thick steel plate is subjected to an internal pressure of 2MPa. Calculate the change in diameter and change in length under pressure. Take Young's Modulus as 200GPa and Poisson's Ratio 0.25.

4. Show that the elongation of conical bar of length 'L' and base diameter 'D' under its own weight is given by $\rho g L^2/6E$. Where. E is Young's Modulus, density of material is ρ and g is acceleration due to gravity.

5. A hollow circular shaft is required to transmit 500 kW of power at 100 rpm. Determine, the diameters of shaft if the inside diameter is 0.8 times the outside diameter. Take allowable shear stress as 75 *MPa*.

6. Derive an expression for the crippling load for a both end fixed column, according to Euler's theory. State the assumptions made.

SECTION-C

7. A solid circular shaft is required to carry a torque of 40 kNm and a bending moment of 30 kNm. If yield stress in a simple tensile test on the material of the shaft was found to be 260 N/mm^2. Find the minimum required diameter of the shaft according to

   (a) shear stress theory

   (b) von-Mises Theory

   Take a factor of Safety = 2.5.

8. A beam simply supported over a span of 10 m carries concentrated loads of 40 kN. 20 kN and 60 kN at 2m. 5m and 9m from the left end support. Determine the position and amount of maximum deflection in the beam by using Macaulay's Method. Take $I = 695 \times 10^6$ mm^4 and $E = 200\ GPa$

9. What do you mean by pure Bending? Derive the Bending equation for a straight beam subjected to pure bending i.e. $\dfrac{\sigma_{max}}{y_{max}} = \dfrac{M}{I} = \dfrac{E}{R}$. Also write the assumptions made in the deriving the bending equation.