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Total No. of Questions: 09 **Total No. of Pages: 02**

B. Tech. (CE) (Sem. 3)
STRENGTH OF MATERIALS
Subject Code: BTCE-303
Paper ID: A1133

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

INSTRUCTIONS 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 have to attempt any FOUR questions.**
3. **Section C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION A

1. Write briefly:

a) Define Hook's law.

b) A simply supported beam of uniform cross-section is subjected to a maximum bending moment of 30KN.m. If its cross-section is a hollow tube with outer diameter 40mm and inner diameter 30mm. find the values of maximum bending stress.

c) Write the relationship between E, G and K.

d) If $\sigma_x = \sigma_y$ and $\lambda_{xy} = 0$, then what is the center and radius of the Mohr's circle?

e) Briefly explain the maximum principal stress theory of failure.

f) If an element is subjected to pure shearing stress of 30MPa, then find the value of maximum principal stress.

g) What is the maximum bending moment in a simply supported beam of span L and carrying uniformly distributed load of intensity w per unit length?

h) If outside diameter of a hollow shaft is double the inside diameter, then for the same maximum shear stress and weight, the ratio of torque transmitted by hollow to solid shaft will be.....

i) What is the slenderness ratio of a column having one end fixed and the other hinged if its length is lm and diameter 20mm?

j) Write the formula for the change in volume of a thin cylindrical pressure vessel subjected to internal pressure.

SECTION B

2. Derive expression for total elongation of a conical bar due to its own weight, when the bar is fixed at its upper end and is hanging freely at its lower end.

3. A simply supported beam of length 9 meters rests on supports 7 meter apart, with an overhang of 1 meter on each side. The beam carries a u.d.l. of 2kN/meter over the entire length. Draw S.F. and B.M. diagrams and find the points of contra-flexure, if any

4. A simply supported beam of span 3.6m has to resist a shear force of 120KN. The cross section of the beam is a T-section with flange width of 120mm, web and flange thicknesses of 16mm each and overall depth of 160mm. Determine the maximum shear stress induced in the beam and draws the shear stress distribution for the beam section.

5. A hollow steel circular shaft transmits 200KW of power at 150rpm. The angle of twist in a length of 5m of shaft is 4degree. Find the inner and outer diameters of the shaft if the permissible shear stress is 60MPa and modulus of rigidity is 80GPa.

6. An aluminum tube of length 8m is used as a column with hinged ends carrying a 1.2 KN axial compressive load. If the outer diameter of the tube is 50mm, compute the limiting value of the inner diameter that would be safe against bucking use E = 70 GPa for aluminium.

SECTION C

7. A steel bolt 20mm in diameter and 0.25m long passes centrally through a brass tube of 0.25m length, having an outside diameter of 35mm and inside diameter of 25mm.The screw has 4 threads per cm and the nut is initially just tight on one end of the brass tube. Find the change in stress in the bolt and the tube due to tightening of nut by turning it through 45°

8. A thin cylindrical pressure vessel is 3m long, 0.75m in diameter and 12mm thick. Calculate its dimensions when subjected to an internal pressure of 1.5 MPa. What is then the maximum shear stress in the vessel?

9. Drive a relationship for maximum bending moment and maximum stress in case of column carrying eccentric load W at an eccentricity e.