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Total No. of Questions : 09

B.Tech.(AE) (2011 Onwards)   (Sem.–3)

MECHANICS OF MATERIALS

Subject Code : BTAE-301

Paper ID : [A1112]

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

Q1) **Write briefly :**

a) Write down the relation between Young's Modulus, Poisson's ratio and Modulus of Rigidity.

b) Define Volumetric Strain.

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

d) What do you understand by Mohr Circle of stress?

e) Define Slenderness Ratio.

f) What do you mean by Flexural Rigidity?

g) What do you understand by composite beam?

h) State von-Mises theory of Failure.

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

j) Calculate the maximum bending moment in a simply supported beam of length 6*m* and carrying a uniformly distributed load of 15 *N/m* over whole span.

SECTION-B

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

3. The shell of boiler is 2*m* in diameter and the plates are 20*mm* thick. Calculate the safe working pressure in the boiler, if safe working stress for the plate material as 50 *MPa*. Also find by how much percentage the working pressure will be reduced if the efficiency of the joints is 80%.

4. Determine the elongation of a conical bar hanging under the action of its own weight. The diameter at the base is *D* and its length is *l* Assume weight per unit volume is ρ.

5. A bolt is subjected to an axial tensile force of 20*kN* along with a transverse shear force of 10*kN*. Determine the diameter of the bolt using von-Mises Theory. Assume yield point stress as 250*MPa*, Factor of safety 3.

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

SECTION-C

7. A circular shaft has to transmit 600*kW* of power at 150*rpm*.

   i) Determine the necessary diameter of a solid circular shaft,

   ii) Diameter of hollow shaft if the inside diameter is 0.85 times the outside diameter.

   iii) What is the saving in material when a hollow shaft is used?

   Take allowable shear stress of the shaft material as 80 *MPa*.

8. A beam simply supported over a span of 8 m carries concentrated loads of 50 *kN*, 30 *kN* and 60 *kN* at 2*m*, 4*m* and 7*m* 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 deriving the bending equation.