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

**B.Tech (Sem.-3<sup>rd</sup>)**  
**MECHANICS OF MATERIALS**  
**Subject Code: BTAE-301**  
**Paper ID: [A1112]**

Time: 3 Hrs.

Max. Marks: 60

**INSTRUCTIONS TO CANDIDATE:**

1. Section –A, is Compulsory.
2. Attempt any four questions from Section-B.
3. Attempt any two questions from Section-C.

**Section –A****(10x2=20)****Q.1.**

- (a) What do you mean by Longitudinal strain and Lateral strain ?
- (b) Define point of Contraflexure.
- (c) Calculate the ratio of maximum shear stress and average shear stress in rectangular section beam
- (d) What do you understand by Mohr's stress circle?
- (e) The young's modulus of elasticity of a material is 2.5 times its modulus of rigidity. Calculate the Poisson's ratio of material.
- (f) What do you mean by Section Modulus of a shaft ?
- (g) Differentiate between Column and Strut. Give examples.
- (h) What do you mean by Engineering Failure of a Material ?
- (i) State Mohr's Moment Area Theorems for slope and deflection.
- (j) A simply supported beam carries two equal concentrated loads  $W$  at distance  $l/3$  from either support Calculate the maximum bending moment.

**Section –B****(4x5=20)****Q.2.**

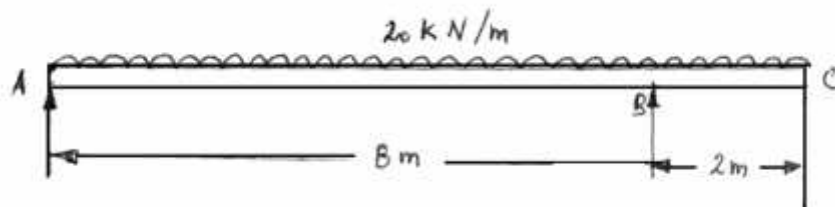
A thin cylinder 500 mm in diameter and length 2m has a thickness of 8mm. If it is subjected to internal pressure of 5 MPa, determine the increase in volume of cylinder. Take  $E=200\text{GPa}$  and Poisson's ratio as 0.33.

- Q.3.** A hollow pipe of 500mm outer diameter and 30mm wall thickness is full of water and is simply supported over a span of 12m. Calculate the maximum bending stress produced in the material of the pipe if the density of the pipe material is  $7200 \text{ kg/m}^3$  and that of water is  $1000 \text{ kg/m}^3$
- Q.4.** Briefly explain the Stress-Strain diagram for ductile materials and show all important Points on it. How it is different from stress-Strain diagram for brittle material?
- Q.5.** State the assumptions made in deriving the Torsion Formula. Also Derive the Torsion Formula for a solid circular shaft i. e.  $\tau = \frac{T \cdot r}{J}$ .
- Q.6.** Prove that the ratio of maximum value of shear stress and average value of shear stress in a Circular section beam is 1.33.

### SECTION-C

**(2x10=20)**

- Q.7.** Derive an expression for the buckling load for a pin end column. According to Euler's theory. State the assumptions made. Also explain the limitation of Euler's Formula ?
- Q.8.** A beam with overhang at one end and carrying a uniformly distributed load over the whole length is shown in Fig. No. 1 Draw the Shear Force Diagram and Bending Moment Diagram. Also find out the position of point of contraflexure.



- Q.9.** A circular shaft 100mm diameter is subjected to combined bending and twisting moments, the bending moment being three times the twisting moment. If the yield point stress of the material is 400 MPa and the factor of safety 4. Calculate the allowable twisting moment according to following theories of failure.
- Maximum Shear stress theory
  - Shear strain energy theory

\*\*\*\*\***END**\*\*\*\*\*