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**PRESIDENCY UNIVERSITY  
BENGALURU**

**SET B**

**SCHOOL OF ENGINEERING  
END TERM EXAMINATION - JAN 2024**

**Semester :** Semester III - 2022

**Course Code :** MEC2011

**Course Name :** Mechanics of Solids

**Program :** B.Tech.

**Date :** 05-JAN-2024

**Time :** 9:30AM - 12:30 PM

**Max Marks :** 100

**Weightage :** 50%

**Instructions:**

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.

**PART A**

**ANSWER ALL THE QUESTIONS**

**5 X 4M = 20M**

1. Are stresses developed only due to load applied? Does temperature have any influence on stresses of a member? Explain with equations.  
(CO1) [Knowledge]
2. With proper units for all the components, explain the Bending equation for a shaft.  
(CO5) [Knowledge]
3. Define and differentiate between thin and thick cylinders.  
(CO2) [Knowledge]
4. What is deflection in beams? List the different methods of obtaining deflection.  
(CO3,CO4) [Knowledge]
5. For a symmetrical I section, show the stress distribution as an ideal case.  
(CO5) [Knowledge]

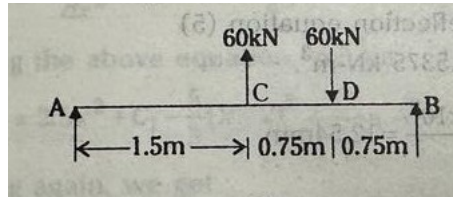
**PART B**

**ANSWER ALL THE QUESTIONS**

**5 X 10M = 50M**

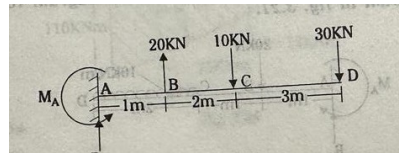
6. Define,
  - a) Poisson's ratio
  - b) Volumetric strain
  - c) Young's modulus
  - d) Thermal stress
  - e) Shear stress  
(CO2) [Comprehension]

7. Calculate the deflection at C and D and slope at A for a beam loaded as shown below. The beam has a span 3m. Take value of  $EI = 84 \times 10^{10} \text{ N-mm}^2$ .



(CO4) [Comprehension]

8. Draw the shear force and bending moment diagrams for a cantilever beam loaded as shown below.



(CO3) [Comprehension]

9. Explain the torsion equation giving its components with proper units. Find the diameter of a solid shaft required to transmit 6000 watts at 150 rpm if the maximum torque is likely to exceed the mean torque by 25% for a maximum permissible shear stress at 60 MPa. Find also the angle of twist over a length of 2.5 m. Take  $C = 7.85 \times 10^4 \text{ N/mm}^2$ .

(CO4) [Comprehension]

10. A tensile stress of  $90 \text{ N/mm}^2$  on the horizontal plane and compressive stress of  $45 \text{ N/mm}^2$  on vertical plane accompanied by shear stress of  $45 \text{ N/mm}^2$  on each plane is acted at a point in a piece of material. Determine the plane of maximum shear stress and value of maximum shear. Verify the values by Mohr's circle

(CO5) [Comprehension]

### PART C

**ANSWER ALL THE QUESTIONS**

**2 X 15M = 30M**

11. a) A shaft transmits a power of 80 kW at a speed of 600 rpm. The maximum torque is 25% more than the average torque. Compute the diameter of the shaft taking allowable shear stress as 60 MPa and allowable angle of twist as 1 degree in 1 m length. Take rigidity modulus,  $C = 80 \text{ GPa}$

b) What size of shaft should be used for the rotor of 7.5 kW motor operating at 3600 rpm if the shearing stress is not to exceed 60 MPa in the shaft?

(CO4) [Application]

12. For an unsymmetrical I section calculate the shear stress and bending stress values. It has top flange of 200 mm x 30 mm, bottom flange of 150 x 24 mm. Web thickness of 40 mm and overall height of section 140 mm, when it carries a maximum shear force of 42 kN and maximum bending moment of 69 kN-m. Draw the neat sketches of shear stress distribution and bending stress distribution diagrams across the section.

(CO5) [Application]