

TME-303

1210

Odd Semester Examination, 2017-18

B.TECH. (SEMESTER-III)

SOLID MECHANICS

Time: 03:00 Hours

Max Marks: 100

1. Attempt any four questions: [5x4=20]
- (a) ✓ A square steel rod 20mm\*20mm in section is to carry an axial load (compressive) of 100KN. Calculate shortening in length of 50mm. Take  $E=2.14 \times 10^8 \text{ KN/m}^2$ .
  - (b) ✗ Discuss stress and strain with their classification.
  - (c) ✗ What do you mean by Mohr's circle? Explain its procedure with neat diagram.
  - (d) Derive the equilibrium equation in three dimensions with neat diagram.
  - (e) Describe the compatibility relations.
2. Attempt any four questions: [5x4=20]
- (a) ✓ Describe the stress strain curve for ductile and brittle materials.
  - (b) Explain with reasons which theory of failure is best suited for ductile and brittle material.
  - (c) A shaft is subjected to a maximum torque of 10 KN-m and a maximum bendy moment of 7.5 KN-m at a particular section. If allowable equivalent stress in a simple tension is  $160 \text{ MN/m}^2$ , find the diameter of shaft according to maximum shear stress theory.
  - (d) ✓ Define and explain the following:
    - i. Isotropic material
    - ii. Proof stress
    - iii. Poisson's ratio
  - (e) ✓ Explain the stress and strain invariants.

3. Attempt any two questions: [10x2=20]

- (a) ✓ A simply supported beam 6m long is carrying a uniformly distributed load of 5KN/m over a length of 3m from the right end. Draw shear force and bendy moment diagrams for the beam. Also calculate the maximum bending moment on the section. ✓
- (b) Derive bending equation of a beam. Also discuss its importance and assumptions.
- (c) A beam consists of symmetrical rolled steel joint. The beam is simply supported at its ends and carries a point load at the centre of the span. If the maximum stress due to bending is 140 MPa. Find the ratio of depth of the beam section to span in order that the central deflection may not exceed 1/480 of the span. Take  $E=200 \text{ GPa}$ .

4. Attempt any two questions: [10x2=20]

- (a) A cantilever 2.5m long is carrying a load of 25KN at free end and 35 KN at a distance of 1.3m from the fixed end. Take  $E=2.0 \cdot 10^8 \text{ KN/m}^2$  and  $I=1.5 \cdot 10^{-4} \text{ m}^4$  using moment area formula. *Calculate Slope & Max deflection.*
- (b) Derive the relation between slope, deflection and radius curvature.
- (c) Explain the superposition for determining elastic deflection of beams.

5. Attempt any two questions: [10x2=20]

- (a) ✓ Using Castigliano's theorem, calculate the central deflection of a simply supported beam which carries a UDL of intensity  $w$  over the full span. The flexural rigidity  $EI$  of the beam is constant and only strain energy of bending is to be considered.
- (b) A hollow shaft of diameter ratio 3/8 is required to transmit 600 KW at 110 rpm, the maximum torque being 20% greater than the mean. The shear stress is not to exceed  $63 \text{ MN/m}^2$  and the twist in a length of 3m not to exceed 1.4 degrees. Calculate the maximum external diameter satisfying these conditions. Take  $C=84 \text{ GN/m}^2$ . *007445*
- (c) (i) Explain reciprocity theorem. ✓  
(ii) Explain strain energy due to transverse shear.

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