Total No. of Questions : 8] *[Total No. of Printed Pages : 3*

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ME-3002-CBGS

B.E., III Semester

Examination, December 2020

Choice Based Grading System (CBGS)

Strength of Materials

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) A 5m long steel bar that is 2.5 cm in dia is stretched 2.0 mm by a load of 80 kN in pulling it axially. Calculate the stress, strain and modulus of rigidity of the bar.

   b) A rectangular bar consists of two sections, AB is 25 mm square and 250 mm long, BC is 12 mm square and 250 mm long. For an axial tensile load of 20 kN applied to the bar, Determine :

   i) Change in length of the complete bar

   ii) Change in dimensions of each portion.

   Take E = 80 GN/m^2 and Poisson's ratio = 0.3

2. a) Define principal stresses.

   b) At a point in an elastic material under strain, there are normal stresses of 50MN/m ^{2} and 30MN/m ^{2} respectively at right angles to each other with a shearing stresses of 25MN/m ^{2}. Find the principal stresses and position of the principal planes if 50MN/m ^{2} is tensile and 30MN/m^2 is compressive. Find also the maximum shear stress and its plane.

3. An element in a structure is subjected to plane stress system that has the stress values σ_x = 120 N/mm^2, σ_y = 160 N/mm^2 and Z_{xy} = 60 N/mm^2. Draw a Mohr's circle and find principal stresses and principal directions, maximum shear stress and accompanying normal stress and directions of planes.

4. a) State the assumptions of pure bending.
   b) What is section modulus? What is its importance?

5. a) Define the terms torsional rigidity and polar moment of inertia.
   b) A hollow shaft of diameter ratio 3/5 is a 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 MPa and the twist in a length of 3m is not to exceed 1.4°. Calculate the minimum external diameter satisfying these conditions.

6. a) Define and explain the maximum shear stress theory.
   b) A closely coiled helical spring made of 10 mm diameter steel wire has 15 coils of 100 mm mean diameter. The spring is subjected to an axial load of 100N. Calculate:
      i) The maximum shear stress induced,
      ii) The deflection, and
      iii) Stiffness of the spring

7. a) Sketch the resultant stress distribution at the base section for condition that direct stress is Equal/Greater/Less than bending stress .
   b) Draw stress strain curve for the Ductile Material (Mild stress).

8. Write short notes :
   a) Radius of Gyration
   b) Parallel Axis Theorem
   c) Strain energy, Resilience and Proof Resilience
   d) Limit of eccentricity

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