

TME-303

1177

Odd Semester Examination 2018-19

B.TECH. (ME) (SEMESTER-III)

SOLID MECHANICS

Time: 03:00 Hours

Max Marks :100

Note: Attempt all the questions. Assume any missing data suitably.

1. Attempt any **four** of the following : [5x4=20]
- (a) What is Cauchy's stress formula? Derive the formula for the same
 - (b) Derive the torque equation.
 - (c) Determine the slope and deflection of a cantilever beam of a cantilever beam carrying a UDL of w KN/mt at its entire length L mt and a point load of W KN at its end.
 - (d) Define the terms
 - (i) Poisson's ratio
 - (ii) Toughness
 - (iii) Principal stresses
 - (iv) Point of contraflexure
 - (e) Distinguish between lateral strain and longitudinal strain, nominal stress and true stress.
 - (f) Derive the relationship between loading, Shear force & Bending moment.
2. Attempt any **four** of the following : [5x4=20]
- (a) Define with sketches types of loading and supports.
 - (b) Derive the relation between slope, deflection and radius of curvature.

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(1)

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- (c) The bar of a circular section as shown in Figure below elongates by 0.45mm when subjected to an axial pull of 100kN. Calculate the value of modulus of elasticity.



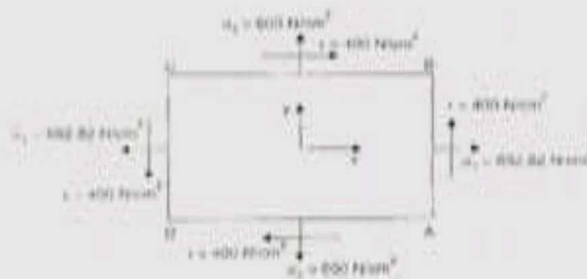
- (d) Discuss the various theories of failure in brief.
- (e) A solid shaft transmits 75KW power at 200rpm. Calculate the shaft diameter, if the twist in the shaft is not to exceed 1° in 2m length of shaft, and shear stress is limited to 50 MN/m^2 . Take $C = 100 \text{ GN/m}^2$.
- (f) Draw stress strain curve for mild steel explain salient features.
3. Attempt any **two** of the following : (5x4=20)

- (a) For a simple beam loaded as shown in the figure determine

(i) Deflection at C, (ii) Maximum deflection and (iii) slope at A. Take $E = 200 \times 10^6 \text{ KN/m}^2$ and $I = 200 \times 10^{-6} \text{ m}^4$.



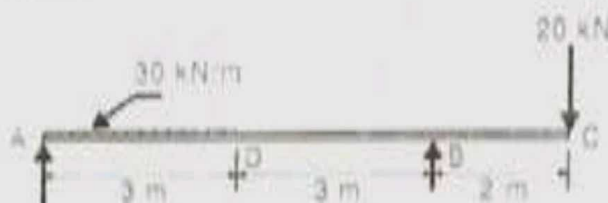
- (b) For the state of stress shown in fig. find the principal plane, principal stress and maximum shear stress by both analytical and by Mohr circle method.



- (c) A water main of 500mm internal diameter and 20mm thick is running full of water. The water main is of cast iron and is supported at two points 10m apart. Find the maximum stress in the metal. The cast iron and water weight 72000N/m^3 and 10000N/m^3 respectively.

4. Attempt any **two** of the following : [5x4=20]

- (a) The overhanging beam ABC is supported at A and B, the span AB being 6 m. The overhang BC is 2 m. It carries a uniformly distributed load of 30 kN/m over a length of 3 m from A and concentrated load of 20 kN at free end. Draw SF and BM diagrams.



- (b) A shaft is subjected to a maximum torque of 10KNm and a maximum bending moment of 7.5KNm at a particular section. If the allowable equivalent stress in a simple tension is 160MN/m^2 find the diameter of the shaft according to the maximum shear stress theory and also according to shear strain energy theory. Compare the result obtained by both.
- (c) The state of stress at a point is given by the following array of terms:

$$\begin{bmatrix} 9 & 6 & 3 \\ 6 & 5 & 2 \\ 3 & 2 & 4 \end{bmatrix} \text{ Mpa}$$

Determine the principal stresses and direction cosine of maximum principal stress.

5. Write short notes on any **four** of the following : [5x4=20]

- (a) Why is the knowledge of shear centre of a beam important?
 (b) Castigliano's theorem.
 (c) Equilibrium equations and its applications

- (d) Superposition theorem
- (e) Explain the process of calculating the principal stresses of like stress (tensile) with the help of Mohr circle.
- (f) How slope and deflection is evaluated with the help of area moment method.

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