

TME-303

203

Printed Pages : 4

Roll No. to be filled in your Answer Book

Roll No.

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Semester: III

B. Tech End Semester Examination Dec 2014

SOLID MECHANICS

Time: 3 Hours

MM. 100

Note : Attempt all questions, the marks assigned to each question is indicated at question itself.

Q1. Attempt any four (4X5)

- (a) A tensile load of 80 KN is acting on a rod of diameter 40 mm and of length 2 m. A bore of diameter 20 mm is made centrally on the rod. To what length the rod should be bored so that the total extension will increase by 20% under the same tensile load. Take $E = 2 \times 10^5 \text{ N/mm}^2$.
- (b) What do you understand by the term theories of failure? Name the important theories of failure.
- (c) How many points of contraflexure you will have for simply supported beam overhanging at one end only?
- (d) A beam 3 m long, simply supported at its ends, is carrying a point load W at the centre. If the slope at the ends of the beam should not exceed 1° , find the deflection at the centre of the beam.
- (e) Prove that the torque transmitted by a solid shaft when subjected to torsion is given by

$$T = \pi/16 \tau D^3$$

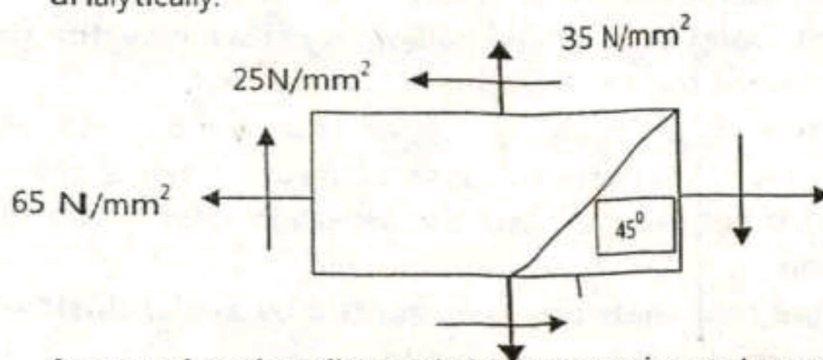
- (f) Define the Principal planes and principal stresses.

Q2. Attempt any four (4X5)

- (a) Explain with reasons which theory of failure is best suited for: Ductile and Brittle material.
- (b) A solid shaft of diameter 80 mm is subjected to a twisting moment of 8 MN mm and a bending moment of 5 MN at a point. Determine: Principal stresses and Position of the plane on which they act.
- (c) A timber beam 100 mm wide 250 mm deep is simply supported over a span of 4 m. Find the uniformly distributed load that can be applied on the beam over the whole span so that the deflection at the centre may not exceed 6 mm. Take $E = 1.12 \times 10^4 \text{ N/mm}^2$.
- (d) Find the central deflection of a simply supported beam carrying a concentrated load at mid span. Assume uniform flexural rigidity.
- (e) Write a note on Mohr's circle of stresses.
- (f) Draw the Shear Force and Bending Moment diagrams for a simply supported beam of length l carrying uniformly distributed load w /unit length across the whole span.

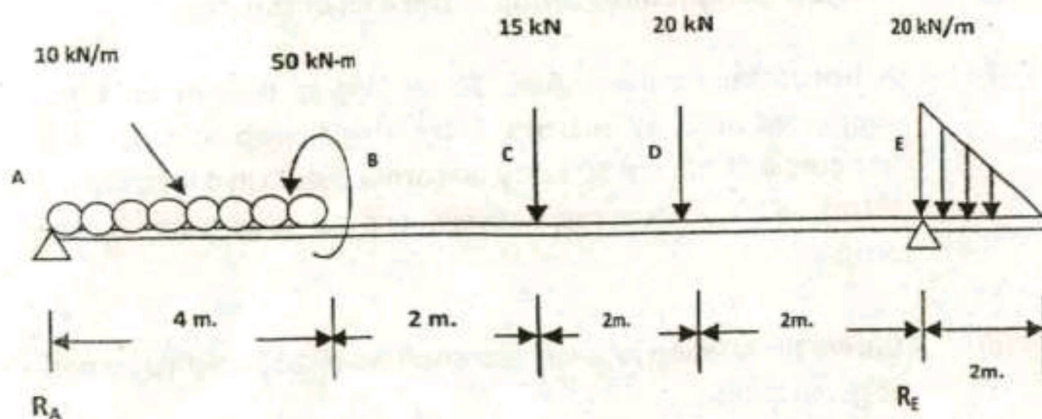
Q3. Attempt any two (2x10)

- (a) A point in a strained material is subjected to stresses shown in figure. Using Mohr's circle method, determine the normal and tangential stresses across the oblique plane. Check the answer analytically.



- (b) At a section of a mild steel shaft, the maximum torque is 8437.5 Nm and maximum bending moment is 5062.5 Nm. The diameter of shaft is 90 mm and the stress at the elastic limit in simple tension for the material of the shaft is 220 N/mm^2 . Determine whether the failure of the material will occur or not according to maximum shear stress theory. If not, then find the factor of safety.

- (c) Draw the bending moment and shear force diagram for the beam loaded as shown in fig. mark the values of salient points. Determine the position of point of contra flexure



Q4. Attempt any two (2x10)

- (a) A beam of length 5 m and of uniform rectangular section is simply supported at its ends. It carries a uniformly distributed load of 9 kN/m run over the entire length. Calculate the width and depth of the beam if permissible bending stress is 7 N/mm^2 and central deflection is not to exceed 1 cm.
- (b) A hollow shaft is subjected to a torque to reach a maximum shear stress f_s , the strain energy stored per unit volume being $5 f_s^2 / 18C$. Find the ratio of the shaft diameters. Find also these diameters if the shaft transmits 350 kW at 120 rpm when the strain energy stored per unit volume of the shaft is $0.0225 \text{ Nmm per mm}^3$. Take $C = 8 \times 10^4 \text{ N/mm}^2$.
- (c) A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on a gauge length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the values of the three moduli.

Q5. Attempt any two (2x10)

- (a) A shaft of length l is fixed at both ends. It is subjected to a torque T applied at a distance a from the left end b from the right end. Find the fixing torques set up at the ends of the shaft.
- (b) A horizontal cantilever ABC, 15 m long, is built in at A and supported at B, 12 m from A, by a rigid prop so that AB is horizontal. If AB and BC carry uniformly distributed loads of 0.5 kN/m and 1.0 kN/m respectively, find the load taken by the prop.
- (c) A Derive the relation for a circular shaft when subjected to torsion as given below:

$$\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{L}$$