C 80682 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE EXAMINATION, APRIL 2015

ME 09 403/PTME 09 402—MECHANICS OF SOLIDS

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. Define normal stress and shear stress.
2. What is an elastically isotropic material ?
3. What is point of inflection ?
4. Define statically indeterminate beams.
5. What is Mohr's circle ?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

1. Explain the term "complimentary shear stress.
2. Derive the relation between modulus of elasticity and bulk modulus.
3. Hollow shafts are preferred over circular shafts. Why ?
4. Obtain a relation among slope, deflection and radius of curvature of a simply supported beam.
5. Define principal stress and principal strain. Give expressions for the same.
6. Derive the expression for safe load for a long column under eccentric loading by Rankine's formula.

(4 × 5 = 20 marks)

Part C

MODULE I

1. A 12 mm. diameter bronze bolt is co-axially passes inside an aluminum tube of inner diameter 14 mm. and wall thickness 3 mm. A nut is turned on the threaded end of the bolt such that it first touches the tube. When the nut is further tightened by half a revolution, determine stresses in the materials and deformation produced. Pitch of the thread is 1.6 mm. Length of tube is 300 mm. E_B = 84 GPa. and E_{AI} = 70 GPa.

Or

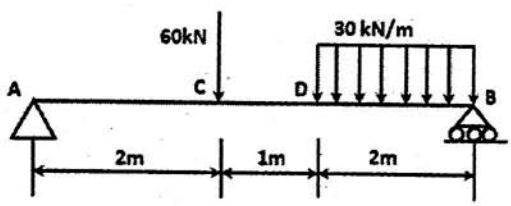
2. A 500 mm. long bar has rectangular cross-section 20 mm. × 40 mm. This bar is subjected to : (i) 40 kN tensile force on 20 mm. × 40 mm. faces ; (ii) 200 kN compressive force on 20 mm. × 500 mm. faces ; and (iii) 300 kN tensile force on 40 mm. × 500 mm. faces. Find the change in volume if Modulus of Elasticity is 200 GPa. and Poisson's ratio is 0.3.

MODULE II

3. Calculate the maximum torque and mean power being transmitted in the case of a hollow shaft of outer diameter 200 mm. and inner diameter 100 mm. the shear stress is no to exceed 60 MPa and the shaft speed is 300 r.p.m. Assume maximum torque to be 25 % more than the mean.

Or

4. Draw the Shear Force and Bending Moment diagram for the beam loaded as shown in figure below :



MODULE III

5. A cantilever beam of span 2 m. has linearly varying cross-section of size 200 mm. × 200 mm. at fixed end and 100 mm. × 100 mm. at free end. If it carries a concentrated load of 4 kN at free end, find the maximum stress developed in the beam.

Or

6. Derive the expression for maximum deflection and slope for a cantilever subjected to uniformly distributed load.

MODULE IV

7. At a point in an elastic material under strain, there are normal stresses of 50 MPa and 30 MPa respectively at right angle to each other with a shearing stress of 25 MPa. Find the principal stresses and position of principal planes if 50 MPa stress is tensile and 30 MPa stress is compressive. Find also the maximum shear stress and its plane.

Or

8. State the assumptions in Rankine formula for very long column. Derive the Euler equation for crippling load for long column one end fixed and other end free. Assume 1 as the length of the column and EI constant.

(4 × 10 = 40 marks)