C 26878 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION MAY 2012

ME 09 403/PTME 09 402—MECHANICS OF SOLIDS

(2009 Admissions)

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. Distinguish between : stress and strain, normal stress and shear stress.
2. Derive general equation governing the torsion in a circular shaft.
3. What is elastic section modulus ?
4. What is moment area method ? Explain the two Mohr's theorems.
5. Write the assumptions made in Euler's theory of columns. Also mention its limitations.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

1. Derive a relation between modulus of elasticity and modulus of rigidity.
2. Explain the procedure for finding out the stresses developed in a body due to change of temperature.
3. What are the advantages of a hollow shaft over a solid shaft in torsion ? Justify properly any statement, you make.
4. Device the relations among loading, shear force and bending moment in a beam.
5. A 250 mm deep beam experiences a maximum stress of 500 MPa. Give E = 2000 Pa compute the radius of curvature of the beam.
6. Derive an expression for the Rankine's crippling load for a column.

(4 × 5 = 20 marks)

Part C

1. Three bars made of Copper, Zinc and Aluminum are equal length and have cross-sectional areas of 400, 800 and 1200 mm^2 respectively. They are rigidly connected at their ends. If compound member is subjected to a longitudinal pull of 350 kN, estimate the proportion of load carried by each bar and induced stresses. Take elastic moduli of Copper, Zinc and Aluminum to be 1.2×105 N/mm^2 1.0×105 N/mm^2 and 0.89×105 N/mm^2 respectively.

Or

Turn over

2. In A bar 30 mm × 30 mm × 250 mm long is subjected to a pull of 90 KN in the direction of its length. The extension of the bar was found to be 0.125 mm, while the decrease in each lateral dimension is found to be 0.00375 mm. Find the Young's modulus, Poisson's ratio, modulus of rigidity and bulk modulus for the material of the bar.

3. Find the diameter of the shaft required to transmit 60 kW at 150 r.p.m. if the maximum torque is likely to exceed the mean torque by 25 % for a maximum permissible shear stress of 60 N/mm^2. Find also the angle of twist for a length of 2.5 metres.

Or

4. Draw shear force bending moment diagrams for the simply supported beam shown in Figure.

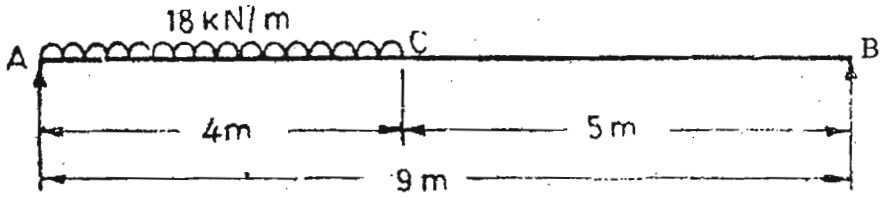

Fig 1.

5. A rolled steel beam having a span of 6 metres carries a point load of 40 kN at 4 metres from the left eflection under the load and the position and amount of maximum deflection. I_{xx} for the section = 7.33 × 107 mm^4. Take E = 207 KN/mm^2 .

Or

6. A cantilever beam with a span of 3 m carries a point load 30 kN at a distance of 2 m from the fixed end. Using movement area method, determine slope and deflection at the free end and at the point where load is applied. Take E = 200 GN/m^2 and I_{xx} = 11924 cm^4.

7. The principal stresses at a point in a bar are 200 KN/mm^2 (tensile) and 100 KN/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 600 to the axis of the major principal stress. Also determine the maximum intensity of stress in the material at the point .

Or

8. A 1.5 m. long column has a circular cross-section 50 mm. diameter. Both ends of the columns are fixed. Taking factor of safety of 3, calculate the safe load using Rankine's formula and Euler's formula. Take α = 1 /1000 and f_c = 560 N/mm^2 and E = 2 × 105 N/mm^2.

(4 × 10 = 40 marks)