C 61574 (Pages : 3) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, APRIL 2014

ME 09 403/PT ME 09 402—MECHANICS OF SOLIDS

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *the questions.*
Each question carries 2 *marks.*

1. Differentiate between axial strain and shear strain.
2. Define stress at a point.
3. What is a bending moment diagram ?
4. State the moment curvature relation.
5. What is principal stress ?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*
Each question carries 5 *marks.*

1. Define strain energy. Write the expression for strain energy in the case of gradually applied load and suddenly applied load.
2. Explain the principle of superposition.
3. State the assumptions in the analysis of torsion of circular shaft.
4. A horizontal cantilever 5 m long carries a point load of 1 kN at free end and UDL of 0.5 kN/m over a length of 3m from the free end. Draw the S.F and B.M. diagrams.
5. What is theory of simple bending and state the assumptions made in the same theory.
6. State the assumptions made in Euler theory for columns.

(4 × 5 = 20 marks)

Part C

Answer all questions.
Each question carries 10 *marks.*

MODULE I

1. A load of 450 kN is applied on a short concrete column 250 mm × 250 mm. The column is reinforced with steel bars of total area 2512 mm^2. If the modulus of elasticity for steel is 18 times that of concrete, find the value of stresses in concrete and steel. If the stress in concrete shall not exceed 4 N/mm^2, find the area of steel required so that the column may support a load of 500 kN. E_{st} = 200 G Pa.

Or

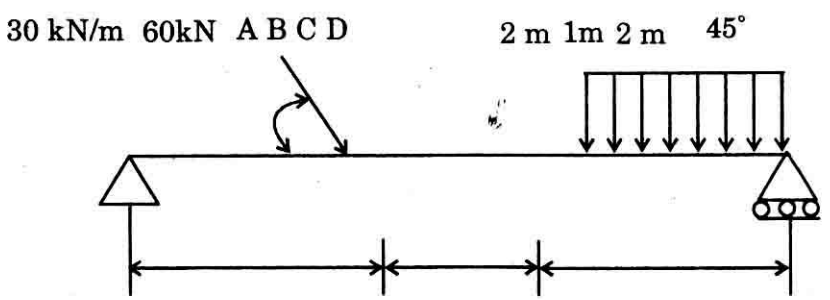
2. In a laboratory, tensile test is conducted and Young's Modulus of the material is found to be 2.1×10^5 N/mm^2. On the same material torsion test is conducted and Modulus of Rigidity is found to be 0.78×10^5 N/mm^2. Determine Poisson's Ratio and Bulk Modulus of Rigidity.

MODULE II

3. A solid shaft of 50 mm diameter and 800 mm long transmits 30 kW at 180 r.p.m. Find (i) Maximum shear stress induced (ii) Angle of twist ; (iii) shear stress at a radius of 20 mm. Take Modulus of Rigidity is 80 MPa.

Or

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



MODULE III

5. A beam of I section with top flange 100 mm × 20 mm, web 20 mm 100 mm and bottom flange 60 mm × 20 mm is 6 m long and is simply supported at ends. If the tensile stress and compressive stress is limited to 20 MPa and 100 MPa respectively, find the value uniformly distributed load the beam can carry.

Or

6. Determine the maximum deflection of a simply supported beam 6 m span carrying point load of 10 kN at 2 m from left support. Use conjugate beam method. $I_{xx} = 73.3 \times 10^{-6}$ m^4 and Young's Modulus is 200 GPa.

MODULE IV

7. At a certain point in an elastic material there are normal stresses of 4.8 MPa tensile and 3.2 MPa compressive on two planes at right angles to each other, together with a shear stress of 2.4 MPa on the same planes. If the loading of the material is increased so that the stresses reaches K times those given find the maximum value of K if the maximum direct stress is not to exceed 12.8 MPa and maximum shear stress is not to exceed 8 MPa.

Or

8. Two columns; one of solid steel and the other of hollow steel are of equal length. They are subjected to axial load in compression independently. Compare their strength if the ratio of diameter for the hollow column is 0.75.

(4 × 10 = 40 marks)