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B.Tech. DEGREE EXAMINATION, MAY 2014
Fourth Semester

ME0204 – MECHANICS OF SOLIDS

(For the candidates admitted from the academic year 2007-2008 to 2012-2013)

Time: Three hours

Max. Marks: 100

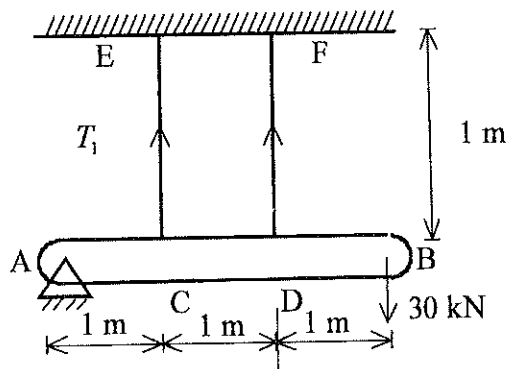
Answer **ALL** Questions

PART – A (10 × 2 = 20 Marks)

1. Define: Poisson's ratio.
2. Define: Principal plane.
3. Define: Shear force and Bending moment.
4. Define: Section modulus.
5. Define: Polar moment of inertia.
6. Define: Spring.
7. Write the relation between slope, deflection and radius of curvature of a simply supported beam.
8. Define: Strain energy.
9. Define: Slenderness ratio.
10. Differentiate thin and thick cylinders.

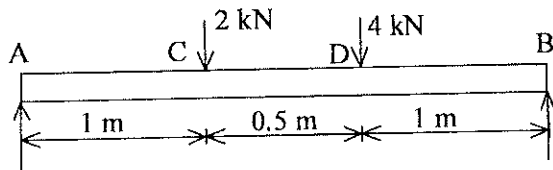
PART – B (5 × 16 = 80 Marks)

11. a. A rigid bar ACDB is hinged at A and supported in a horizontal position by two identical steel wires as shown in figure. A vertical load of 30 kN is applied at 'B'. Find the tensile forces T_1 and T_2 induced in these wires by the vertical load.



(OR)

- b. A plane element in a boiler is subjected to tensile stresses of 400 MPa on one plane and 150 MPa on the other at right angles to the former. Each of the above stresses is accompanied by a shear stress of 100 MPa such that when associated with the minor tensile stress tends to rotate the element in anticlockwise direction. Find
- Principal stresses and their directions.
 - Maximum shear stress
12. a. A simply supported beam AB of span 2.5 m is carrying two point loads as shown in figure. Draw the shear force and bending moment diagrams.



(OR)

- b. A rectangular beam 60 mm wide and 150 mm deep is simply supported over a span of 4 m. If the beam is subjected to a uniformly distributed load of 4.5 kN/m, find the maximum bending stress induced in the beam.

13. a. A hollow shaft having an internal diameter 40% of its external diameter transmits 562.5 kW power at 100 rpm. Find the external diameter of the shaft if the shear stress is not to exceed 600 N/mm² and the twist in a length of 2.5 m should not exceed 1.3°. Assume maximum torque as 1.25 times mean torque and the modulus of rigidity as 9×10^4 N/mm².

(OR)

- b. A close-coiled helical spring is required to carry a load of 150 N. If the mean coil diameter is to be 8 times that of wire, calculate these diameters. Take maximum shear stress as 100 MPa.

14. a. A simply supported beam of span 4 m is carrying a uniformly distributed load of 2 kN/m over the entire span. Find the maximum slope and deflection of the beam. Take EI as 80×10^9 N-mm².

(OR)

- b. A cantilever beam 120 mm wide and 150 mm deep carries a uniformly distributed load of 10 kN/m over its entire length of 2.4 m. Find the slope and deflection of the beam at its free end. Take $E = 180$ GPa.

15. a. A steel rod 5 m long and of 40 mm diameter is used as a column with one end fixed and other end free. Determine the crippling load by Euler's formula. Take E as 200 GPa.

(OR)

- b. A steam boiler of 800 mm diameter is made of 10 mm thick plates. If the boiler is subjected to an internal pressure of 2.5 MPa, find the circumferential and longitudinal stresses induced in the boiler plates.
