

J 1097

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2006.

Third Semester

Chemical Engineering

CH 235 — MECHANICS OF SOLIDS

(Common to Textile Technology and Leather Technology)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define (a) Young's modulus (b) Poisson's ratio.
2. Draw the shear force diagram for the beam shown in Fig. 1.

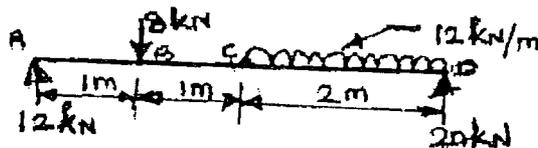


Fig.1.

3. Define (a) point of contraflexure (b) pure bending.
4. Determine the deflection at free end of a cantilever beam of length 2 m subjected to a moment of 10 kNm at free end using area moment method. $EI = 20000 \text{ kNm}^2$.
5. State whether the following are true or false :
 - (a) The maximum / minimum deflection occurs at the point where the slope is zero.
 - (b) A simple support in a real beam becomes a rigid support in conjugate beam.
6. State the assumptions made in the theory of simple bending.
7. Determine the moment required to bend a circular rod of diameter 20 mm to have mean radius of 100 m. $E = 200 \text{ GPa}$.
8. The power generated by a shaft running at 150 rpm is 300 kW. Determine the maximum torque is carried by shaft. The maximum torque is 15% greater than the mean torque.
9. Two springs having stiffness 5N/mm and 10 N/mm are connected in series. Determine the effective stiffness of the spring. Determine also the effective stiffness if they are connected in parallel.
10. Define effective length and what is its value for a column with both ends fixed.

PART B — (5 × 16 = 80 marks)

11. Draw the shear force and bending moment diagrams for the beam shown in Fig. 2 and mark the salient values on them.

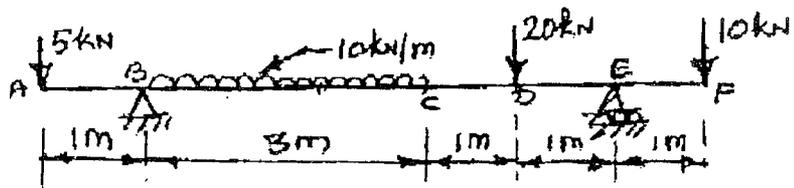


Fig.2.

12. (a) A solid circular rod of diameter 40 mm and of length 1000 mm is placed inside a brass tube of 45 mm internal diameter and 60 mm outer diameter. The length of the tube is 1002 mm. A compressive load of 350 kN is applied to the compound bar. Determine the stresses in steel and brass tube. $E_s = 200$ GPa, $E_b = 100$ GPa. Determine also the deformation of the brass tube.

Or

- (b) A circular bar of length 2 m is subjected to a tensile load of 50 kN. If the allowable tensile stress of the material of the rod is 250 N/mm^2 and the allowable axial deformation of bar is 4 mm, determine the diameter of the rod. Determine the change in diameter and volume of the rod due to the above load. $E = 200$ GPa, $\mu = 0.25$.

13. (a) Determine the slope at B and deflection at C for the beam shown in fig. 3.

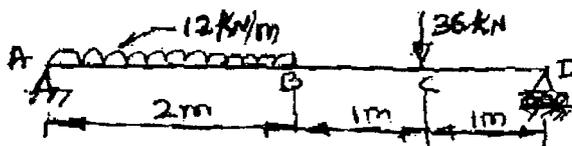


Fig.3.

Or

- (b) A beam ABC of length 4 m is simply supported at A and B. The beam carries a concentrated load of 60 kN at the free end C. Determine the slope at supports A and B and the deflection at c. Use area moment method. Length AB = 3 m.
14. (a) A simply supported beam of span 4 m carries a udl of 6 kN/m over the entire span. If the maximum allowable stress due to bending is limited to 150 N/mm^2 determine cross sectional dimension if the section is

- (i) Rectangular with depth twice the breadth
- (ii) solid circular section

Compare the cost of the above beams.

Or

shown in

(b) A simply supported beam of span 5 m is subjected to a concentrated load of 100 kN at a distance of 2 m from one of the support. The cross-section of the beam is a "T" section with flange 150 mm × 20 mm and web 120 mm × 20 mm. Sketch the shear stress distribution at the section of maximum shear force. Mark on the diagram all salient stress values.

15. (a) Determine the power transmitted by a solid shaft of diameter 50 mm running at 150 rpm, if the allowable shear stress is limited to 60 MPa and the angle of twist is limited to 1.2° per metre length. $G = 80 \text{ GPa}$.

Or

(b) A square column of length 2 m fixed at one end and free at other end has to carry a load of 200 kN with a factor of safety of 2.5. Determine the size of the column, if $\sigma_y = 250 \text{ MPa}$ and $\alpha = 1/7500$.

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