

D 016

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2003.

Third Semester

Chemical Engineering

CH 235 --- MECHANICS OF SOLIDS

(Common to Textile and Leather Technology)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A --- (10 × 2 = 20 marks)

1. What does the word equilibrium signify? What are the conditions for equilibrium to exist?
2. Define the three elastic moduli and give a relationship between Young's modulus and shear modulus.
3. What is shear force in a beam and relate it to the load?
4. Draw the SF and BM diagrams for a cantilever beam subjected to a uniformly distributed load over its entire span.
5. Write down the two area - moment theorems.
6. What is the conjugate of a cantilever beam?
7. Draw the shape of the shear stress distribution across the depth of a T-beam.
8. What are the assumptions of simple bending theory?
9. A solid circular shaft of 50 mm diameter is subjected to a torque. If the maximum permissible shear stress of the material is 50 N/mm², determine the maximum torque that can be applied and also determine the angle of twist if the shear modulus of the material is 80 GPa.
10. Define slenderness ratio and draw the plot of the Euler critical stress in a column against its slenderness ratio.

PART B — (5 × 16 = 80 marks)

11. A cast iron pipe of 300 mm bore and 15 mm thick is supported at two points 6 m apart. Find the maximum stress in the pipe when it is running full of water. Specific gravity of cast iron is 7.2 and that of water is 1.
12. (a) A bar 300 mm long, is 50 mm square in section for 120 mm of its length and then 25 mm diameter circular section for 80 mm of its length and 40 mm diameter circular section for the rest of its length. If a tensile force of 10 tonne is applied to the ends of the bar, determine the maximum and minimum stresses induced in it and also calculate the total elongation of the bar.
- Or
- (b) A copper rod of 30 mm diameter is surrounded tightly by a cast iron tube of 60 mm external diameter, the ends being firmly fastened together. When this compound bar is subjected to 12 kN compressive load, what will be the share of load carried by copper rod and cast iron tube? How much will be the shortening of the bar in 1 m length.
13. (a) Draw the shear force and bending moment diagrams for the beam shown in Fig. Q. 13. (a).

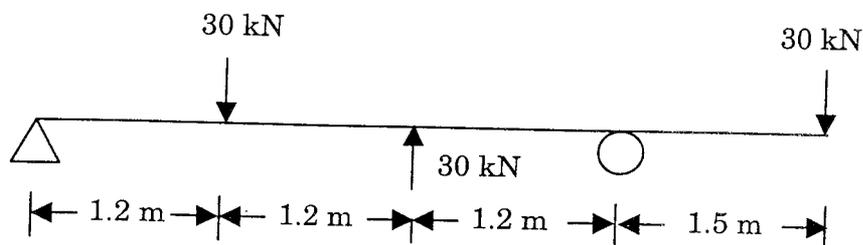


Fig. Q. 13. (a)

Or

- (b) A maximum shear stress of 500 N/mm^2 is induced in a hollow circular shaft of 100 mm and 60 mm external and internal diameters respectively. What maximum shear stress will be developed in a circular solid shaft of the same weight, material and length subjected to the same torque?
14. (a) A simply supported beam of span L and flexural rigidity of EI is loaded with a single concentrated load P at $L/3$ from the left support. Using area moment theorems determine the slope and deflection of the beam below the load.

Or

- (b) A simply supported beam of span L and flexural rigidity EI is loaded with two concentrated loads W and $2W$ at $L/4$ and $2L/3$ respectively from the left support. Employing Macaulay's method determine the midspan deflection.
15. (a) Calculate the safe compressive load on a 10 m long hollow cast iron column of 150 mm outer and 100 mm inner diameter, with one of its ends rigidly fixed and the other pinned. Use Euler's formula with a factor of safety 5 and E value of the material as 100 GPa .

Or

- (b) Determine the ratio of the buckling strengths of two columns, one hollow and the other solid. Both are made of the same material and have the same length, cross sectional area and end conditions. The internal diameter of the hollow column is half its external diameter.