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Question Paper Code : 51634

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Fourth Semester

Mechanical Engineering

ME 2254/ME 45/CE 1259/10122 ME 405/080120018 — STRENGTH OF
MATERIALS

(Common to Production Engineering and Automobile Engineering)

(Regulation 2008/2010)

(Common to PTME 2254 – Strength of Materials for B.E. (Part-Time)
Third Semester, Mechanical Engineering, Regulation 2009)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is Bulk modulus of material?
2. Define Resilience and Proof Resilience.
3. Draw a typical shear force and bending moment diagram of a simply supported beam of span 'L', carrying a point load 'P' at mid span.
4. Mention the assumptions made in the theory of simple bending.
5. Define Torsion and give at least two practical example for it.
6. Write short notes on types of springs.
7. State the Mohr's theorem I and II.
8. What is equivalent length of a column?
9. How do you classify a cylinder or a shell in to thick or thin?
10. Define Principle plane.

PART B — (5 × 16 = 80 marks)

11. (a) (i) A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the value of the three moduli. (8)
- (ii) A rectangular block 350 mm long, 100 mm wide and 80 mm thick is subjected to axial load as follows. 50 kN tensile in the direction of length, 100 kN compression in the direction of thickness and 60 kN tensile in the direction of breadth. Determine the change in volume, bulk modulus, modulus of rigidity. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio = 0.25. (8)

Or

- (b) (i) A resultant tensile stress of 70 MPa is acting over as shown in the figure 11(b)(i). Another direct tensile stress of 40 MPa is acting over a plane, which is at right angle to the previous one. Find the resultant stresses in the second plane, the principle planes and stresses and the plane of maximum shear intensity. (8)

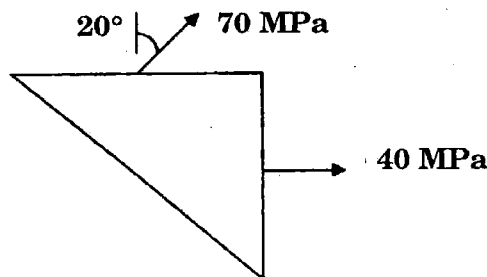


Figure 11(b)(i)

- (ii) Determine the strain energy due to self weight of a bar of uniform cross section ' a ' having length ' l ' which is hanging vertically down. (8)
12. (a) (i) Draw the shear force and bending moment diagram for the simply supported beam shown in figure 12(a)(i). (8)

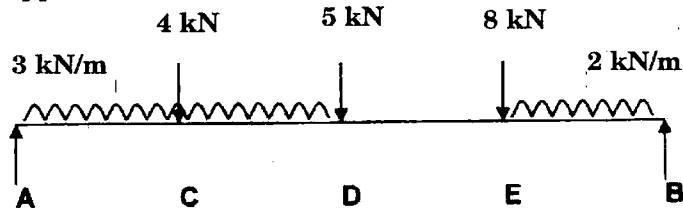


Figure 12(a)(i)

- (ii) Draw the shear force and bending moment diagram for a cantilever carrying load whose intensity varies uniformly from zero at the fixed end to ' w ' per unit run at the free end. (8)

Or

- (b) A T – section of a simply supported beam has the width of flange = 100 mm, overall depth = 100 mm, thickness of flange and stem = 20 mm. Determine the maximum stress in beam when a bending moment of 12 kN-m is acting on the section. Also calculate the shear stress at the neutral axis and at the junction of web and flange when shear force of 50 kN acting on beam. (16)
13. (a) The internal and external diameter of a hollow shaft is in the ratio of 2 : 3. the hollow shaft is to transmit a 400 kW power at 120 rpm. The maximum expected torque is 15 % greater than the mean value. If the shear stress is not to exceed 50 MPa, find section of the shaft which would satisfy the shear stress and twist conditions.
Take $G = 0.85 \times 10^5$ MPa. (16)

Or

- (b) Determine the bending stress, shear stress and total work done on an open coiled helical spring subjected to axial force having mean radius of each coil as 'r' and 'n' numbers of turns. (16)
14. (a) A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN at a distance of 1 m and 3 m respectively from left and support. Find the deflection under each load, the maximum deflection and the point at which occurs. Assume $E = 2 \times 10^5$ MPa and $I = 85 \times 10^6$ MPa. Use Macaulay's method. (16)

Or

- (b) Find the Euler's crippling load for a column with one end fixed and other end free. (16)
15. (a) A cylindrical shell 1 m dia and 3 m length is subjected to an internal pressure of 2 MPa. Calculate the maximum thickness if the stress should not exceed 50 MPa. Find the change in dia and volume of shell. Assume Poisson's ratio of 0.3 and Young's modulus of 200 kN/mm². (16)

Or

- (b) A thin cylindrical tube 80 mm internal diameter and 5 mm thick is closed at its ends. It is subjected to an internal pressure of 6 N/mm² and a torque of 2009600 kN-m. Find the hoop stress, longitudinal stress, maximum and minimum principle stresses and maximum shear stress. (16)