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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: CE201

Course Name: MECHANICS OF SOLIDS (CE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Define stress and strain. (4)

b) What are the fundamental types of stresses? Give one example for each type. (4)

c) State and explain Hooke's Law. (7)

2 a) Prove that the maximum value Poisson's ratio can have is 0.5 (5)

b) A cylindrical bar with two sections of lengths 50cm and 25cm, and diameters 20mm and 15mm respectively, is subjected to an axial pull such that the maximum stress is 150MN/m^2. Calculate the strain energy stored in bar. E= 200 GN/m^2. (10)

3 a) Find an expression for the elongation of a prismatic bar due to self-weight. (5)

b) A mild steel rod 20mm diameter and 300mm long is enclosed centrally inside a hollow copper tube of external diameter 30mm and internal diameter 25mm. The ends of the tube and rod are brazed together, and the composite bar is subjected to an axial pull of 50N. If E for steel and copper are 200 GN/m^2 and 100 GN/m^2 respectively, find the stresses developed in the rod and the tube. Also, find the change in length. (10)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Name and explain the various types of beam supports, indicating the reaction components diagrammatically. (4)

b) Derive a relationship between bending moment and shear force. (5)

c) Draw the shear force and bending moment diagrams for a cantilever of span 3m, with a UDL of 10kN/m on the entire span, and a point load of 100kN at the free end. (6)

5 a) Draw the shear force and bending moment diagrams for a simply supported beam of span 4m, with a UDL of 10kN/m on the left half of its span. (7)

b) A cantilever beam with span 3m and cross section 200×300mm is to carry a UDL on the entire span. If the tensile stress is limited to 3MPa, what is the maximum UDL that can be applied on the beam? (8)

6 a) Derive the classic bending equation. (9)

b) A simply supported rectangular wooden beam of span 2.5m has cross section 150mm×250mm and carries a central point load of 100N. Find the shear stressat 50mm below the top edge of the middle cross section. (6)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Draw Mohr's circlefor the two-dimensional state of stress shown in Fig. 2. Find the principal stresses and their planes. (14)

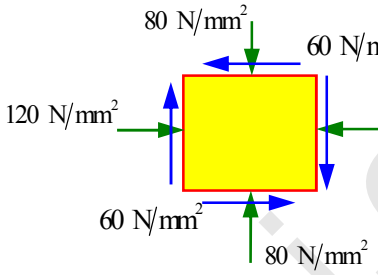

Fig. 2

b) A solid circular shaft is to transmit 75 kW power at 200 rpm. If the shear stress is not to exceed 50 MPa, find the diameter of shaft. G = 100 GPa. (6)

8 a) A 2m long thin cylindrical shell (both ends closed), internal diameter 90cm and thickness 12mm, is subjected to internal pressure 2N/mm^2. Find 1) hoop and longitudinal stresses, 2) changes in diameter and length shell. Take E = 2×10^5 N/mm^2 and Poisson's ratio = 0.3. (10)

b) Derive an expression for Euler's buckling load for a column fixed at both ends. (10)

9 a) Using moment-area method, find the deflection and slope at the free end of a cantilever applied with a couple at the free end. (10)

b) Find the buckling load given by Rankine's formula for a tubular strut hinged at both ends, 6 m long having outer diameter 15 cm and thickness 2 cm. Given, E = 2×10^{5}N/mm^2, σ_c= 567N/mm^2 and Rankine's constant, a= 1/1600. For what length of the column does the Euler's formula cease to apply? (10)

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