Sr. No. 002511

December 2023

B.Tech (CIVIL) Re-Appear 5th Semester

Advanced Mechanics of Materials (PCC-CE301R)

Time: 3 Hours **Max. Marks:75**

Instructions:
1. *It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.*
2. *Answer any four questions from Part -B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Use of non-programmable calculator is allowed.*

PART -A

Q1 (a) Write equation of stresses due to both flexure and torsional loads M and T. (1.5)

(b) Define Buckling. (1.5)

(c) Write Lame's equations. (1.5)

(d) Write generalized Hooke's law. (1.5)

(e) What is Mohr's Circle. (1.5)

(f) Define Betti's theory. (1.5)

(g) Write Torsion equation. (1.5)

(h) What is effective length of column having both end fixed. (1.5)

(i) What is Kern. (1.5)

(j) Define Shape factor. (1.5)

PART -B

Q2 (a) A material with tensile yield of 100 MPa, subjected to stresses σ_x = 62 MPa, σ_y =-28 MPa and τ_{xy} = 48 MPa. Assess failure using Maximum Principal stress theory and Maximum Shear stress theory. (10)

(b) At a point in a beam the longitudinal tensile stress is 80 MPa and the shear stress is 45 MPa. Find the magnitude and direction of principal stresses and maximum shear stress at that point. (5)

Q3 (a) Explain various theories of failure in detail with neat sketch of principal stresses for each theory. (5)

(b) A brass tube of external diameter 80 mm and internal diameter 50 mm is closely fitted to steel rod of 50 mm diameter to form a composite shaft. If a torque of 6 kN-m is to be resisted by the shaft, find the maximum stresses developed in each material and the angle of twist in 3 m length. Given G_{brass} = 40 kN/mm^2 and G_{steel} = 80 kN/mm^2. (10)

Q4 Write the assumptions made in Theory of simple bending. Also derive the equation of simple bending. (15)

Q5 (a) Explain Maxwell's reciprocal theorem. (5)

(b) A cantilever beam supports a uniformly distributed load of w kN/m throughout the span of L m and P point load at free end. Given that L = 2 m, w = 4 kN/m, P = 6 kN, and EI = $5x10^6$ N/mm^2. Determine the deflection at free end using Castigliono's theorem. (10)

Q6 (a) A thick cylinder pipe with outside diameter 300 mm and internal diameter 200 mm is subjected to an internal fluid pressure of 14 N/mm^2. Determine the maximum hoop stress developed in the cross-section using Lame's equation. Sketch the variation of hoop stress across the thickness of the pipe. (10)

(b) Determine the shape factor of a simply supported bar of circular cross section. (5)

Q7 A hollow cast iron column having outer diameter of 200 mm and thickness of 20 mm is 4.5 m long and is fixed at both ends. Calculate the safe load by Rankine's formula using a factor of safety of 2.5. Find the ratio of Euler's Rankine's Load. Take E = 100 KPa and Rankine's constant = 1/1600, fc = 550 MPa. (15)

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