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002419

May, 2023

B. Tech. (Civil) IV Semester

Basics of Solid Mechanics (PCC–CE–205R)

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 a non-programmable scientific calculator is allowed.*

PART–A

1. (a) Write Simple Bending Equation. (1.5)

(b) Draw shear stress distribution of T Shapes and circular sections. (1.5)

(c) What is plastic hinge? (1.5)

(d) Explain principal stresses. Also write equation for maximum principal stress. (1.5)

(e) Write crippling load equation or Euler's Equation. (1.5)

(f) Define Saint Venant's theory of failure. (1.5)

(g) Define resilience. (1.5)

(h) What are hoop stress and longitudinal stress? (1.5)

(i) Draw Stress-Strain Curve and define each component including upper and lower yield points. (1.5)

(j) What is the section modulus for rectangular and circular sections? (1.5)

PART–B

2. (a) Derive the torsion equation for solid circular shafts, and state the assumptions involved. (10)

(b) Derive the relationship between maximum shear stress and average shear stress. (5)

3. (a) What factors affect the location of the point of contraflexure in a beam under loading? (5)

(b) Determine the collapse load in a continuous beam ABC, length of span AB and BC is L, both span carrying uniformly distributed load over the entire span. Plastic moment capacity is Mp throughout the beam AB and 2Mp for beam BC. Far end A is fixed and C is simply supported. (10)

4. Derive the formula for shear stress in a beam and explain its significance. Also, describe the shear stress behaviour in triangular and T-shaped beam sections. (15)

5. (a) Explain the Moment Area method and how it is used to calculate slope and deflection. (5)

(b) A shear force of 30 kN and a bending moment of 50 kNm act at a certain cross-section of the rectangular beam 150 mm wide and 200 mm deep. Compute the both major and minor principal stresses at the point 50 mm below the top surface. (10)

6. (a) A cylindrical shell is 3 m long, and is having 1 m internal diameter and 15 mm thickness. Calculate the maximum intensity of shear stress induced, if it is subjected to an internal fluid pressure of 1.5 MPa. (10)

(b) The stess components at a point in a two - dimensional stress system are given as $\sigma x - 40 = Mpa$, $\sigma y = -20$ MPa, and $\tau xy = 30$ MPa. Calculate the principal streses and the oreintation of the principal planes. (5)

7. How do you analyze the combined effects of bending and torsion in circular shafts? A solid shaft subjected to 25 kN m bending moment and 50 kN m torsion, determine the. maximum and minimum principal stresses due to combined bending and torsion. (15)