

CBCS SCHEME

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21AE/AS44

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Mechanics of Materials

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Derive the equilibrium equation for a 3-D stress system. (10 Marks)
- b. Draw and explain stress-strain curves for Brittle and Ductile materials. (10 Marks)

OR

- 2 a. Derive the total extension in a uniformly tapering circular bar with neat sketch. (10 Marks)
- b. Determine the stress in different segments of a circular bar. Also compute the total elongation of the bar if $E = 200 \text{ GPa}$. [Refer Fig.Q2(b)]

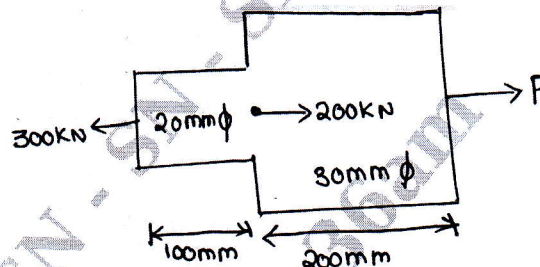


Fig.Q2(b)

(10 Marks)

Module-2

- 3 Draw SFD and BMD for a simply supported beam. [Refer Fig.Q3]

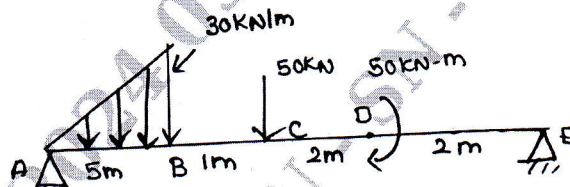


Fig.Q3

(20 Marks)

OR

- 4 A 'T' column of cross section as shown in Fig.Q4 below is subjected to a compressive load at point 'C' as shown in figure. Find stresses produced at point A and C. Take $P = 100 \text{ kN}$ at 'C'.

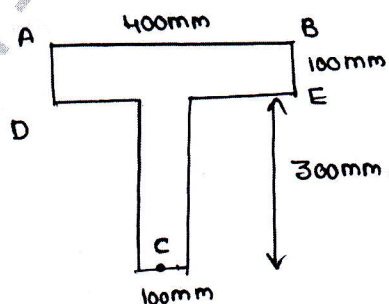


Fig.Q4

(20 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8=50, will be treated as malpractice.

Module-3

- 5 a. Determine the expression for slope and deflection for a cantilever beam subjected to concentrated load not at free end. (10 Marks)
b. Write the relation between slope, deflection and radius of curvature. (10 Marks)

OR

- 6 a. A solid shaft transmits 250 KW at 100 rpm, if the shear stress is not to exceed 75 N/mm^2 , what should be the diameter of the shaft? If this shaft is to be replaced by a hollow one whose internal diameter is 0.6 times outer diameter. Determine the size and percentage saving in material, the shear stress being the same. (10 Marks)
b. Derive torsion equation and list the assumptions of pure torsion. (10 Marks)

Module-4

- 7 a. Define the principle of virtual work for a particle. (10 Marks)
b. Define complementary virtual work and state the difference between principles of virtual work and principle of complementary virtual work. (10 Marks)

OR

- 8 a. State and derive Maxwell's reciprocal theorem. (10 Marks)
b. A simply supported beam of span 'L' carries a point load 'F' at mid span. Determine strain energy stored by the beam. Also find the deflection at mid span. (10 Marks)

Module-5

- 9 a. Define fracture. Explain Type-I, II and III of fractures. (10 Marks)
b. Define creep. Explain all the stages of creep. (10 Marks)

OR

- 10 a. Draw S-N diagram and explain in detail. (10 Marks)
b. Define fatigue and explain the types of fatigue loading. (10 Marks)
