CBCS SCHEME

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18MN34

Third Semester B.E. Degree Examination, Jan./Feb. 2021
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. Define Stress, Strain and Young's modulus. **(06 Marks)**

b. Explain stress strain diagram for mild steel with silent features. **(06 Marks)**

c. A Steel specimen of 12.5mm diameter and length of 150mm subjected to tensile test. It is observed that load at yield point is 43KN and maximum load is 60KN. A load of 16.4KN is required to cause an elastic extension of 0.1mm. Final length of specimen is 190mm and the neck diameter after the fracture is 8mm. Determine:
i) Yield stress ii) Ultimate stress. iii) Young's modulus iv) % of increase in length. **(08 Marks)**

OR

2 a. Derive an expression for a elongation of taper circular bar subjected to axial load. **(10 Marks)**

b. A stepped bar is subjected to forces as shown in Fig.Q2(b). Determine:
i) Stress induced in each portion.
ii) Net deformation in bar where E=200 GPa. **(10 Marks)**

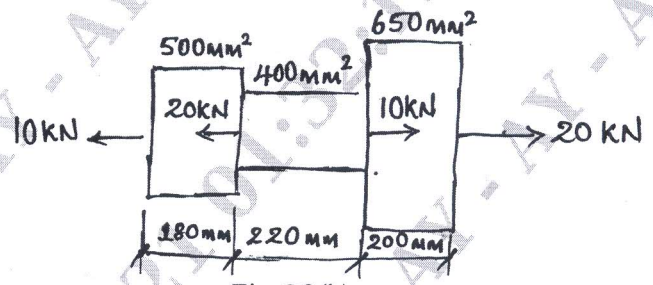

Fig.Q2(b)

Module-2

3 a. Define Principal Stress and Principal Planes. **(04 Marks)**

b. Derive an expression for establishing a relationship between modulus of elasticity, modulus of rigidity and bulk modulus. **(06 Marks)**

c. At a point in a strained material, the state of stress is shown in Fig.Q3(c). Determine principal stress and orientation of principal planes. **(10 Marks)**

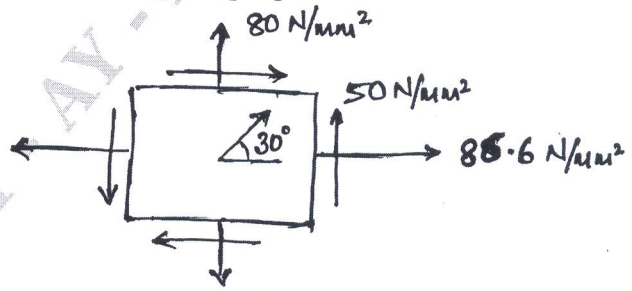

Fig.Q3(c)

OR

4 a. Differentiate thin and thick cylinder. **(04 Marks)**

b. Derive an expression for circumferential stress and longitudinal stress. **(06 Marks)**

c. A cylindrical pressure vessel of 1000mm in diameter and 1500mm long is subjected to an internal pressure P. Thickness of cylinder wall is 15mm. Taking allowable stress for cylinder material is 90Mpa. Determine:

i) Magnitude of maximum internal pressure P, that pressure vessel can withstand.

ii) Change in dimensions. Take E = 200GPa and V = 0.3. **(10 Marks)**

Module-3

5 Fine the magnitude of load P such that magnitudes of support reaction shown in Fig.Q5 are equal. Also draw SF and BM diagram. **(20 Marks)**

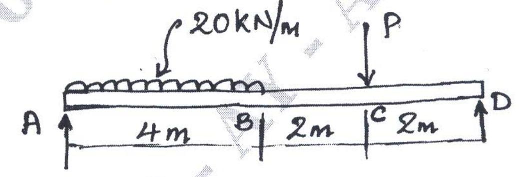

Fig.Q5

OR

6 Draw shear force and bending moment diagram for the simply supported beam shown in Fig.Q6 indicating values at silent point. **(20 Marks)**

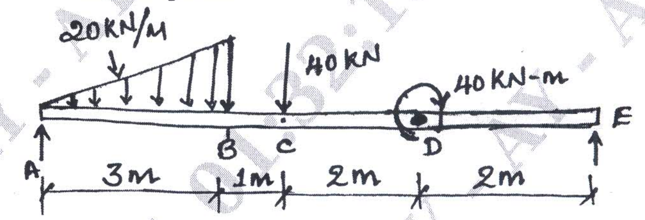

Fig.Q6

Module-4

7 a. State the assumptions in theory of simple bending and explain the theory of simple bending. **(10 Marks)**

b. The T section of a beam is shown in Fig.Q7(b). The material of beam has yield strength of 250MPa. Determine maximum moment of resistance that the beam can support if yielding is to be avoided. **(10 Marks)**

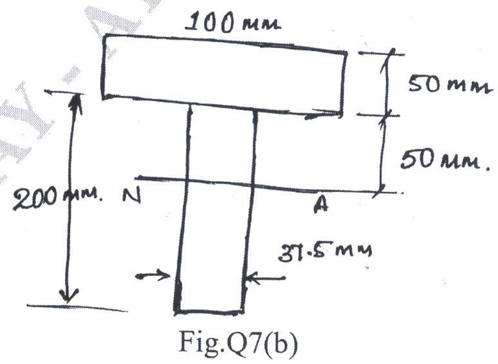

Fig.Q7(b)

OR

8 a. Derive an expression for simply supported beam subjected to uniformly distributed load. **(10 Marks)**

b. A 3m long cantilever is subjected to a UDL 30KN/m over a length of 2mtr, starting from the fixed end. Determine the deflection at the free end. Taking E=200 GPa. $I = 20\times10^{-5}\ m^4$

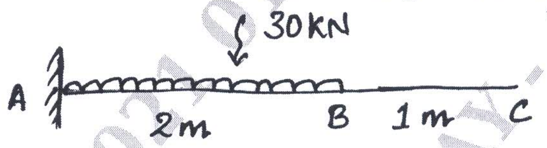

Fig.Q8(b) **(10 Marks)**

Module-5

9 a. Derive the torsional equation $\frac{T}{J} = \frac{\tau}{R} = \frac{G\theta}{L}$ with usual notation. **(10 Marks)**

b. A brass solid circular shaft of diameter 40mm is 1mtr long. Determine:
i) Torsional strength. ii) Torsional rigidity. Take G = 40 GPa. **(10 Marks)**

OR

10 a. Derive an expression for Euler's buckling load for column with both ends hinged and state the assumptions made. **(10 Marks)**

b. A 1.5 meter long 10kg column with a circular section of 30mm diameter has both ends hinged. Discuss the stability of column when it is subjected to axial loads.
i) W = 20KN ii) W = 35KN iii) W = 44 KN. Take E = 200 GPa. **(10 Marks)**

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