CBCS SCHEME

USN | | | | | | | | | | |

15MN34

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain stress-strain diagrams for Mild steel with salient features. **(08 Marks)**

b. A circular rod of diameter 20mm and 500mm long is subjected to tensile force 45kN. The modulus of elasticity for steel may be taken as 200kN/mm^2. Find :
i) Stress ii) Strain iii) % of elongation. **(08 Marks)**

OR

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

b. A bar shown in Fig Q2(b) is tested. It is observed that at a load of 40kN the total extension of bar is 0.285mm. Determine the Young's modulus of the material.

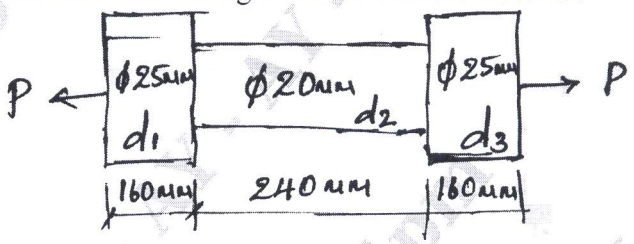

Fig Q2(b) **(06 Marks)**

Module-2

3 a. Derive an expression for establishing a relationship between Modulus of elasticity, Modulus of rigidity and Bulk modulus. **(08 Marks)**

b. The state of stress at a point in a strained material is shown in Fig Q3(b). Determine :
i) Principal stresses ii) Principal planes iii) Maximum shear stress.

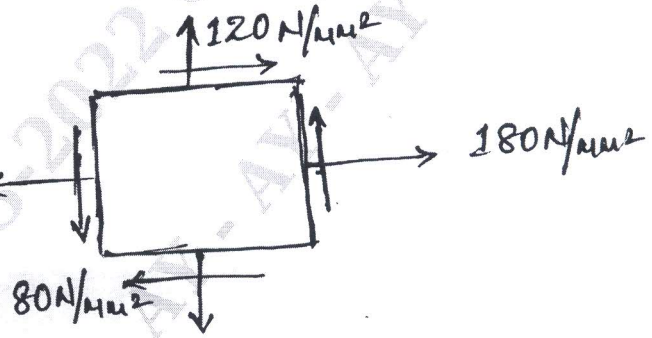

Fig Q3(b) **(08 Marks)**

OR

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

b. A cylindrical shell is 3mtr long, and is having 1 mtr internal diameter and 15mm thickness. Calculate the maximum intensity of shear stress induced and changes in the dimensions of the shell. If it is subjected to an internal fluid pressure of 1.5N/mm^2.
Take E = 2×10^5 N/mm^2, $\mu = 0.3$. **(10 Marks)**

Module-3

5 Find the magnitude of load P such that magnitude of support reactions shown in Fig Q5 are equal. Also draw SF and BM diagram.

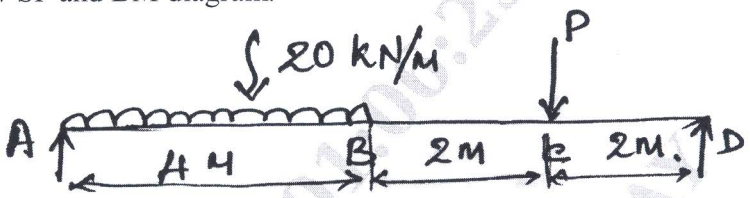

Fig Q5 **(16 Marks)**

OR

6 Draw shear force and bending moment for the beam shown in Fig Q6.

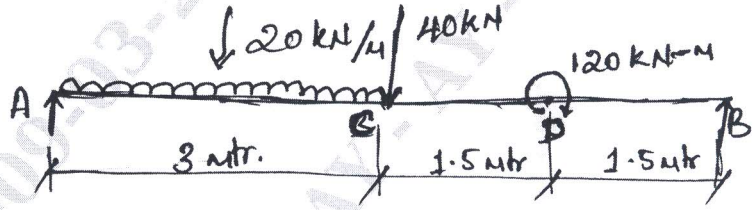

Fig Q6 **(16 Marks)**

Module-4

7 a. State the assumptions of theory of simple bending and explain the theory of simple bending. **(08 Marks)**

b. The cross – section of a beam is shown in Fig Q7(b). If permissible stress is 150N/mm^2, find its moment of resistance. i) Sqare section ii) Rectangular section.

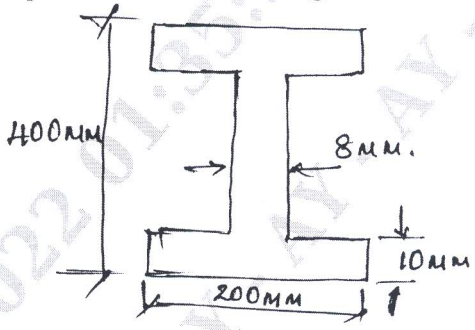

Fig Q7(b) **(08 Marks)**

OR

8 a. Derive an expression for simply supported beams subjected to uniformly distributed load. **(08 Marks)**

b. A 3mtr long cantilever is subjected to a UDL 30kN/mtr over a length of 2mtr. Starting from the fixed end. Determine the deflection at the free end. Taking E = 200GPA, I = 20 × 10^{-5}m^4 (Ref Fig Q8(b))

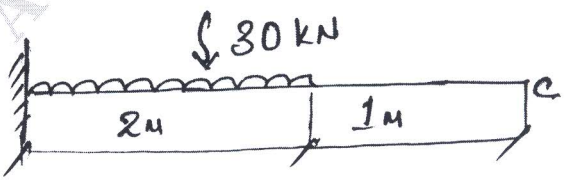

Fig Q8(b) **(08 Marks)**

Module-5

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

b. A brass solid circular shaft of diameter 40mm is length of 1mtr. Determine:
i) Torsional strength
ii) Torsional rigidity.
Take G = 40GPa. **(06 Marks)**

OR

10 a. Derive an expression for Euler's buckling load for column with both ends hinged. **(08 Marks)**

b. A 2 meter long column has a square cross section of side 40mm. Taking the factor of safety as 4. Determine the safe load for the end conditions.
i) Both ends are hinged
ii) Both ends are fixed. **(08 Marks)**

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