CBCS SCHEME

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

21AU644

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025
Finite Element Methods

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define FEM. Explain the steps involved in FEM. **(10 Marks)**

b. Explain the Engineering applications of FEM. **(10 Marks)**

OR

2 a. Explain plane stress and plane strain conditions. **(10 Marks)**

b. Brief about simplex, complex and multiply elements. **(10 Marks)**

Module-2

3 a. Derive an expression for Body force, Traction force and point load. **(10 Marks)**

b. Fig. Q3(b) shows 1 – D bar element subjected to axial loading. Determine :
i) Nodal displacement ii) Stress in each element.
Take it as two bar element

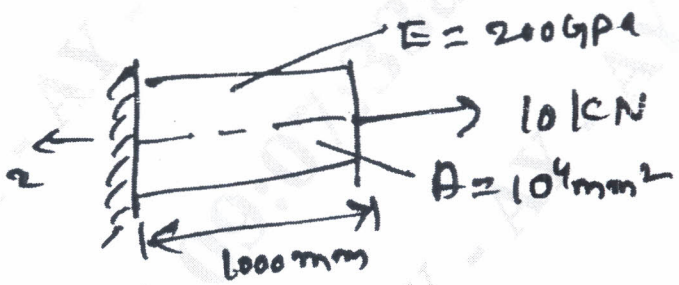


Fig Q3(b) **(10 Marks)**

OR

4 For the axially loaded bar shown in Fig.Q4. Determine: i) Nodal displacement ii) Element stress iii) Support reaction. Take E = 200 GPa, P = 200 kN.

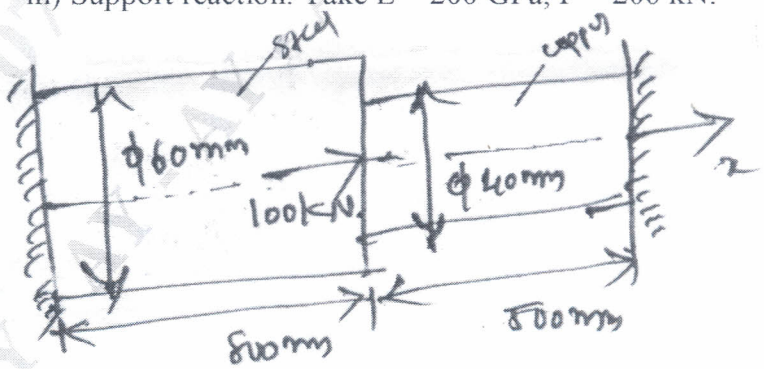


Fig Q4 **(20 Marks)**

Module-3

5 a. Derive hermite shape function for beam element. **(16 Marks)**

b. Give short note on boundary conditions. **(04 Marks)**

OR

6 Fig Q6. Shows simply supported beam subjected to uniformely distributed load. Obtain the maximum deflection. Take Young's modulus E = 200 GPa, and moment of inertia $I = 2 \times 10^6 mm^4$

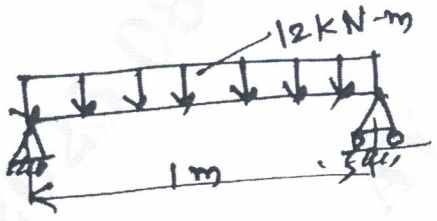


Fig Q6 **(20 Marks)**

Module-4

7 a. Obtain basic equations for heat transfer problems. **(08 Marks)**

b. Determine the temperature distribution in the rectangular fin shown in Fig Q7(b). Neglect convection heat transfer and assume heat generated inside the fin as 500 W/m^3.

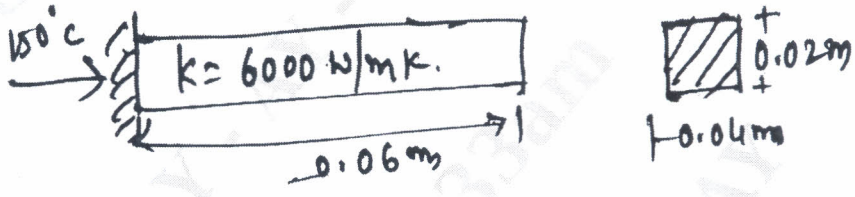
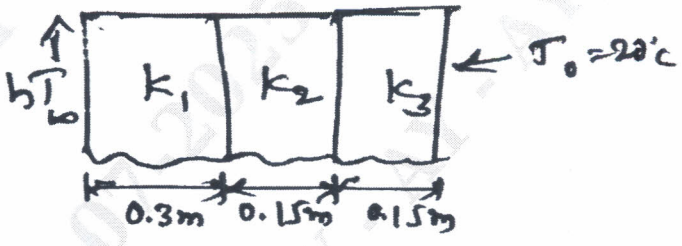


Fig Q7(b) **(12 Marks)**

OR

8 Solve for temperature distribution in the composite wall using 1 – D heat elements. Use penalty approach of handling boundary conditions. **(20 Marks)**



$K_1 = 20$ W/m°C
$K_2 = 30$ W/m°C
$K_3 = 50$ W/m°C
$T_\infty = 800$°C
$h = 25$ W/m°C

Module-5

9 a. Explain the conditions for axisymmetric elements and give the axisymmetric formulation for triangular element. **(14 Marks)**

b. Give any three differences between consistent and lumped mass matrix. **(06 Marks)**

OR

10 a. Explain axisymmetric Quadrilateral element. **(10 Marks)**

b. Give brief note on Eigen values and eigen vectors. **(10 Marks)**