CBCS SCHEME

USN | | | | | | | | | | 21AU644

Sixth Semester B.E. Degree Examination, June/July 2024
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. A bar a length L_1 cross sectional area A and modulus of elasticity E_1 is subjected to a distributed axial load q = Cx where C is a constant. Find the displacement of the bar using Rayleigh – Ritz method.

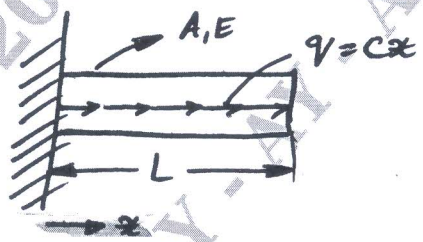

Fig Q1(a) **(10 Marks)**

b. Explain briefly the application of finite element method. **(10 Marks)**

OR

2 a. Explain simplex, complex and multiplex elements. **(10 Marks)**

b. Explain the global and natural coordinate systems. **(10 Marks)**

Module-2

3 a. Explain and derive the Gaussian quadrature for one point formula. **(10 Marks)**

b. Derive the Lagranger's interpolation function for a linear bar element. **(10 Marks)**

OR

4 a. A bar subjected to an axial loading is shown Q4(a) below. determine :

i) Nodal displacement
ii) Stress in each element
iii) Reaction force.

Consider it as a single bar element.

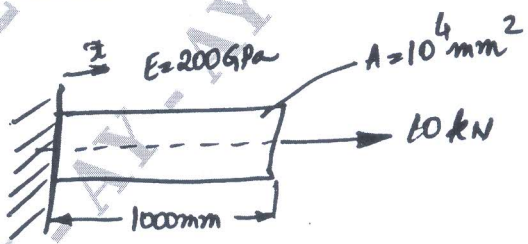

Fig Q4(a) **(10 Marks)**

b. Determine the nodal displacement stress in each element and reaction at the fixed support for the thin plate of uniform thickness 1mm as shown in the Fig Q4(b). Let the Young's modulus be 200GPa, weight density of the plate 76.6×10^{-6}N/mm^2. In addition to its weight, it is subjected to a point load of 100N at its mid point. Model the plate with two bar element.

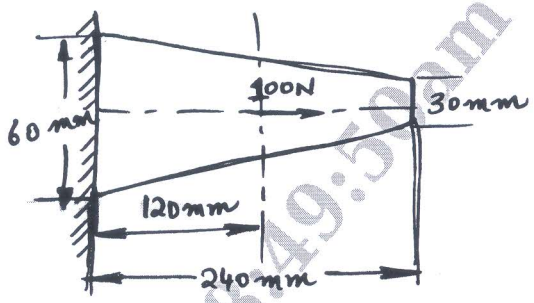

Fig Q4(b) **(10 Marks)**

Module-3

5 a. Derive the Harmite shape function of a beam element (Any one). **(10 Marks)**

b. Derive the element stiffness matrix of a 2 nodal beam element. **(10 Marks)**

OR

6 a. Derive the finite element formulation of a shaft. **(10 Marks)**

b. Determine the stress in insular shafts, using the finite element method, explain the steps involved. **(10 Marks)**

Module-4

7 a. Derive the shape function of a 1D – heat conduction equation. **(10 Marks)**

b. Derive the force equation by FEM of the force vector due to free end convection. **(10 Marks)**

OR

8 a. Find the distribution in the 1D fin.

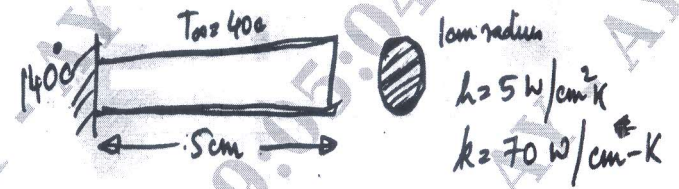

Fig Q8(a) **(10 Marks)**

b. Determine temperature distribution in a rectangular fin. Neglect heat transfer from convection and assume heat generated inside fin = 500W/m^3.

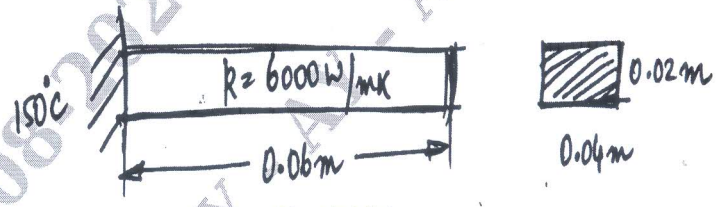

Fig Q8(b) **(10 Marks)**

Module-5

9 a. Derive the stiffness matrix of a axisymmetric loads with triangular elements. **(10 Marks)**

b. Explain the numerical solution of axisymmetric triangular element subjected to point loads. Explain steps involved. **(10 Marks)**

OR

10 a. Explain the formulation of transverse vibration based finite element equations. **(08 Marks)**

b. Explain the applications of FEM in dynamic systems. **(12 Marks)**

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