CBCS SCHEME

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18MT741

Seventh Semester B.E. Degree Examination, June/July 2023
Finite Element Analysis

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive equilibrium equation for 2D elastic body. **(10 Marks)**

b. Explain the application areas of FEM. **(10 Marks)**

OR

2 a. Explain the Basic procedure in Finite Element Method. **(10 Marks)**

b. Briefly explain Node Numbering Scheme. **(06 Marks)**

c. Discuss the different software package used in FEA. **(04 Marks)**

Module-2

3 a. Define Boundary Conditions. Explain the two types of Boundary Conditions. **(08 Marks)**

b. Derive an expression for potential energy functional for a three dimensional body. **(12 Marks)**

OR

4 a. For the spring shown in Fig.Q3(a) using the principle of minimum potential energy, determine the nodal displacement. Take $F_1 = 75N$ and $F_2 = 100N$.

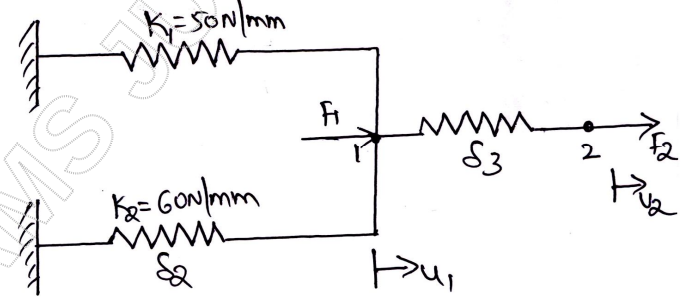

Fig.Q3(a) **(10 Marks)**

b. Use Rayleigh – Ritz method to find stress and displacement at the midpoint of a bar shown in Fig.Q3(b). Take E = 70 GPa, A = 1000mm^2. Assume the displacement model to be a 2nd order polynomial. Data : P = 8×10^3 N.

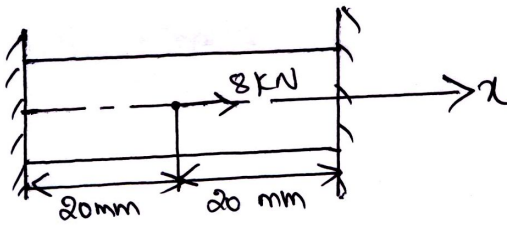

Fig.Q3(b)

(10 Marks)

Module-3

5 a. Explain the steps in finding FEM solution for elimination method. **(08 Marks)**

b. Fig.Q5(b) shows a 1-dimensional bar subjected to an axial loading. Taking it as a single bar element, determine
i) Nodal displacement ii) Stress in each element iii) Reaction at the support.

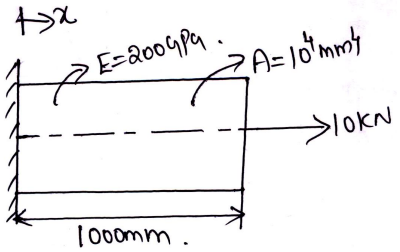

Fig.Q5(b) **(12 Marks)**

OR

6 Consider the bar shown in Fig.Q6. An axial load P = 200×10^3 N is applied as shown using the penalty approach for handling Boundary conditions, do the following :
a. Determine the nodal displacement
b. Determine the stress in each material
c. Determine the Reaction forces. **(20 Marks)**

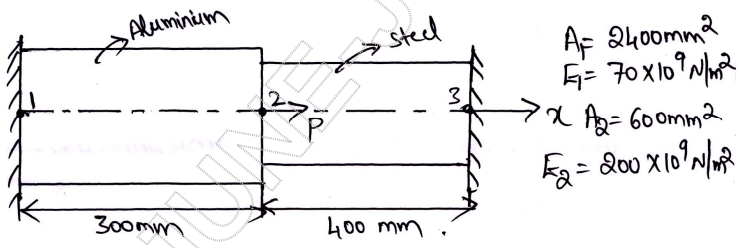

Fig.Q6

Module-4

7 a. Explain the different types of Elements. **(06 Marks)**
b. Briefly explain ISO parametric, sub parametric and super parametric elements. **(14 Marks)**

OR

8 a. Derive the shape function for a 4 noded quadrilateral element by making use of generalized coordinates. **(10 Marks)**
b. Briefly explain the different types of coordinate systems in FEM. **(10 Marks)**

Module-5

9 a. Explain 3 modes of Heat transfer. **(10 Marks)**
b. Explain 1-Dimensional Heat Conduction. Derive differential equation for an 1-D Heat Conduction. **(10 Marks)**

OR

10 a. Derive a shape function for finite element formulation of an 1-D Heat Conduction. **(10 Marks)**
b. Briefly explain Galerkin approach for an 1-D Heat Conduction. **(10 Marks)**

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