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Sixth Semester B.E. Degree Examination, July/August 2022 Finite Element Method

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 and explain the steps involved in FEM. (10 Marks)
- b. Explain Rayleigh – Ritz method with different steps involved in it. (10 Marks)

OR

- 2 a. Discuss the convergence and compatibility requirements of elements. (10 Marks)
- b. What are simplex, complex and multiplex element explain. (10 Marks)

Module-2

- 3 a. Derive the shape function for Quadratic 1-D bar element. (10 Marks)
- b. A compound bar is subjected to a load of 50kN as shown in Fig Q3(b). Determine the following :
 - i) Nodal displacement
 - ii) Stresses in each element
 - iii) Reaction at the support.

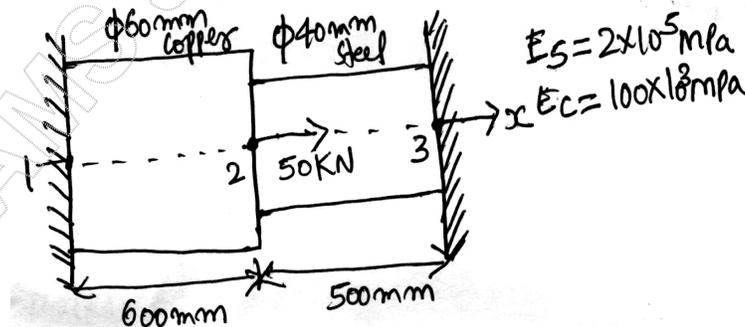


Fig Q3(b)

(10 Marks)

OR

- 4 a. Derive the equation for element stiffness matrices and load vector for BAR element. (10 Marks)
- b. What is a truss element? Explain what are determinate and indeterminate trusses. (10 Marks)

Module-3

- 5 a. Derive the shape functions for 8-nodal quadrilateral element (serendipity family). (10 Marks)
- b. Explain the Lagrange's method to derive the shape function for 4-nodes Quadrilateral element. (10 Marks)

OR

- 6 a. Explain constant and linear strain triangle element. (10 Marks)
- b. Explain the properties of shape function. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-4

- 7 a. Explain Isoparametric, subparametric and super parametric elements. (10 Marks)
 b. Explain Pre-processing and post processing in finite element software. (10 Marks)

OR

- 8 a. Explain Axisymmetric element and higher order element. (10 Marks)
 b. Explain the characteristics of quadrilateral element and software packages available for FEM packages. (10 Marks)

Module-5

- 9 a. Derive the shape functions of a 1-D element with temperature T_1 and T_2 at the nodes. (10 Marks)
 b. What are different types of boundary conditions in heat transfer problems? (10 Marks)

OR

- 10 a. Explain three different modes of heat transfer. (10 Marks)
 b. Composite wall consists of three materials as shows in Fig Q10(b). Determine the temperature distribution in the wall.

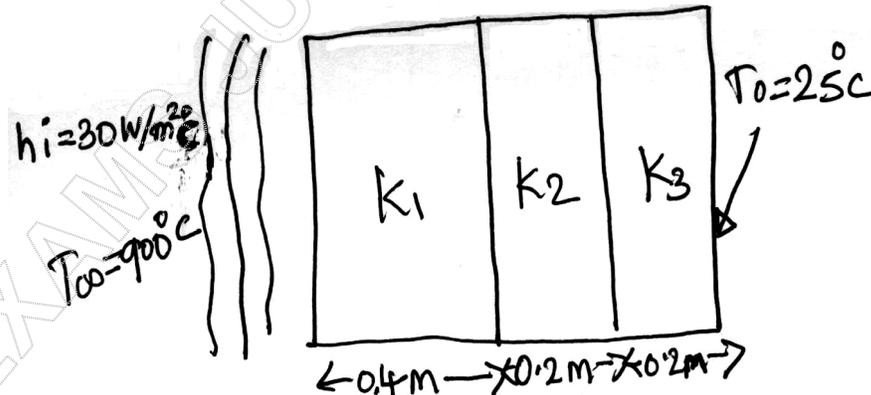


Fig Q10(b)

$$K_1 = 25 \text{ W/m}^\circ\text{C} \quad K_2 = 35 \text{ W/m}^\circ\text{C} \quad K_3 = 55 \text{ W/m}^\circ\text{C},$$

$$h_i = 30 \text{ W/m}^2\text{C}, \quad T_\infty = 900^\circ\text{C}, \quad A = \text{unit area.}$$

(10 Marks)
