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10AE64

Sixth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Finite Element Analysis

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Derive the equilibrium equations of elasticity in 3D. **(10 Marks)**

b. Write short notes on plane stress and plane strain with stress – strain relations. **(08 Marks)**

c. List the applications of FEM. **(02 Marks)**

2 a. Obtain the expression for shape functions of 2D triangular element using area co-ordinate method. **(08 Marks)**

b. Explain convergence criteria and its requirements. **(06 Marks)**

c. Explain the local and natural coordinate systems used in FEM. **(06 Marks)**

3 a. For the continuum shown in Fig. 3(a). Determine nodal displacement and reaction at the supports. **(12 Marks)**

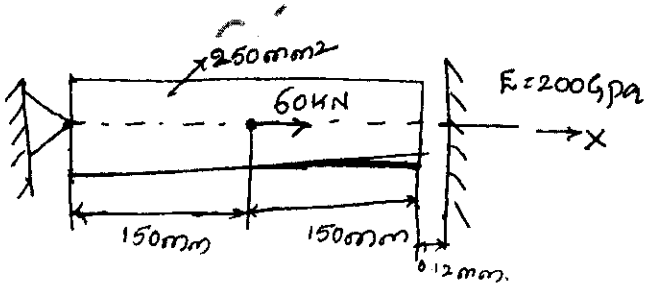

Fig.Q3(a)

b. Write stiffness matrix for :
i) Bar element
ii) Beam element
iii) Truss element. **(08 Marks)**

4 a. Derive the shape functions for CST element. **(08 Marks)**

b. Derive the shape functions for 8 – noded Quadrilateral element. **(12 Marks)**

PART – B

5 a. Write short notes on Lagrangian family of elements and serendipity – family of elements with examples. **(08 Marks)**

b. Derive the shape functions for hexahedral element. **(12 Marks)**

6 a. Write short notes on ISO-parametric, subparametric and superparametric elements. **(12 Marks)**

b. Explain preprocessing, processor and post processing used in commercial FEM analysis software. **(08 Marks)**

7 a. Derive elemental stiffness matrix for axissymetric triangular element. **(12 Marks)**

b. What is Jacobian matrix? Prove that area of axissymetric element $[A_e] = \frac{1}{2} |\det J|$. **(08 Marks)**

8 a. Derive thermal conductivity matrix for 1D bar element. **(06 Marks)**

b. A composite wall consists of thee materials as shown in Fig. Q8(b). The outer temperature is $T_0 = 20°C$, convection heat transfer takes place on the inner surface of the wall with $T_\infty = 800°C$ and $h = 25\ W/m^2C$. Determine temperature distribution in the wall. **(14 Marks)**

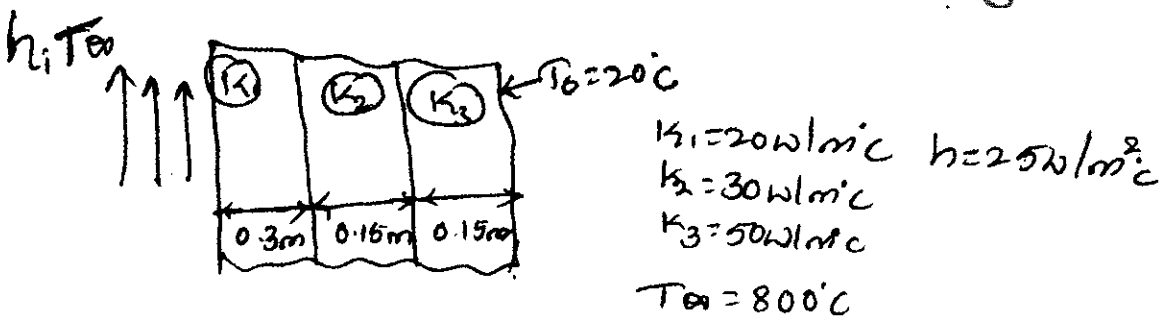

Fig.Q8(b)

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