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10AE64

Sixth Semester B.E. Degree Examination, June/July 2015

Finite Element Analysis

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Use Rayleigh – Ritz method to find stress and displacement at the midpoint of a bar shown in Figure Q 1 (a). Take E = 70MPa, A = 100mm^2. **(12 Marks)**

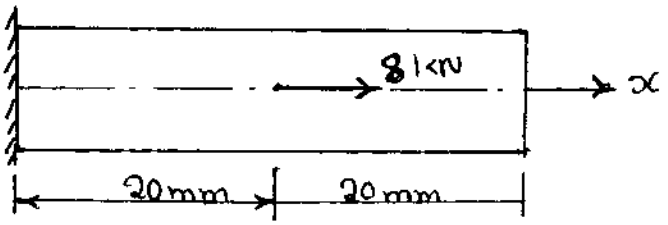


Fig. Q1 (a)

b. Explain simplex, complex and multiplex elements. **(06 Marks)**

c. Define shape function. **(02 Marks)**

2 a. Explain the convergence criteria with suitable examples and compatibility requirements. **(06 Marks)**

b. Derive the shape function for one dimension beam element in natural co – ordinate. **(14 Marks)**

3 a. Derive stiffness matrix for bar element. **(08 Marks)**

b. For the beam element shown in fig Q3 (b) determine deflection under the given load. Take E = 2×10^8 kN/m^2 I = 4×10^{-6} m^4

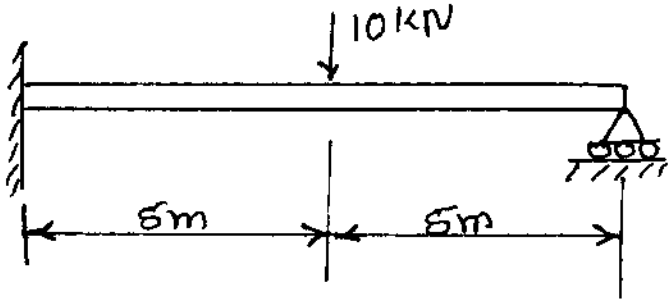


Fig. Q3 (b)

(12 Marks)

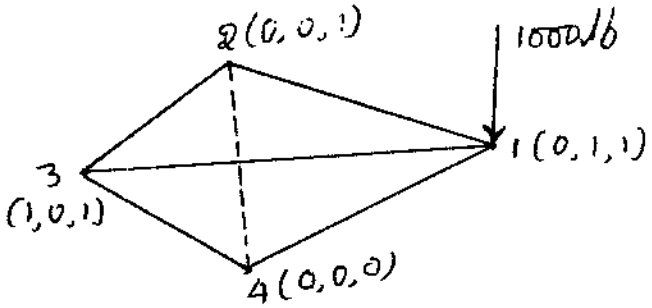
4 a. Derive shape function for quadrilateral element and show the variation of shape function by using neat sketch. **(10 Marks)**

b. Derive shape function for three noded bar element and show the variation of shape function. **(10 Marks)**

PART – B

5 a. Figure Q 5 (a) shows a four node tetrahedral object. The coordinate dimensions shown are in inches. The nodes 2, 3 and 4 are fixed and a 1000 lb load is applied at node 1 as show. Determine the displacement of node 1 using a single element.
Take $E = 30 \times 10^6$ Psi and $\nu = 0.3$ **(14 Marks)**

Fig. Q5 (a)



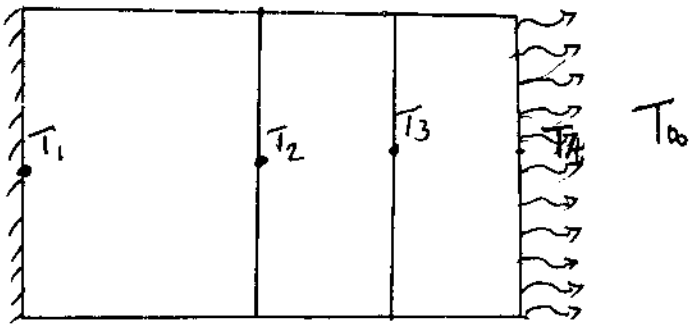
b. Explain serendipity and large family of finite element. **(06 Marks)**

6 a. Briefly explain isoparametric, subparametric and super parametric elements. **(06 Marks)**
b. Mention the different software packages used for FEA. **(04 Marks)**
c. Explain briefly preprocessing, processing and portprocessing in FEA. **(10 Marks)**

7 a. Derive strain – displacement matrix for triangular element in the axisymmetric body. **(15 Marks)**
b. Obtain an expression for potential energy functional to axisymmetric solid subjected axisymmetric loading. **(05 Marks)**

8 a. Derive the element stiffness matrix for heat conduction in one dimensional element. **(08 Marks)**
b. An induction furnace wall is made up of three layer, inside, middle and outer layer with thermal conductivity k_1, k_2 and k_3 respectively as shown in figure Q 8 (b). Determine the nodal temperature. Take $k_1 = 8.5$ W/m°k, $k_2 = 0.25$W/m°k, $k_3 = 0.0.8$W/m°k, h = 45W/m^{2}k, $T_\infty = 30$°C and $T_1 = 600$°C. **(12 Marks)**

Fig. Q8 (b)



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