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10AE64

Sixth Semester B.E. Degree Examination, June/July 2014
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. Enlist the steps involved in a typical Rayleigh Ritz-method. **(10 Marks)**

b. Derive the expression for potential energy of a 3D elastic body. **(10 Marks)**

2 a. Derive the shape functions for a typical beam element. **(10 Marks)**

b. Define shape function. Derive the shape functions for a typical bar element and plot them across the element. **(10 Marks)**

3 a. Determine Jacobian of the transformation J for the triangular element shown in the Fig. Q3 (a).

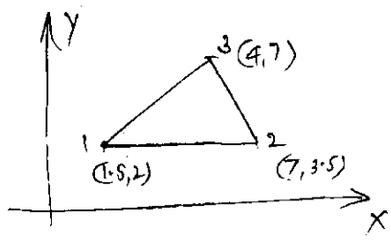

Fig. Q3 (a) **(08 Marks)**

b. Consider truss bar stress shown in the Fig Q3 (b). Determine displacements and stresses in each member. Find the support reaction also. A_1 = 1500 mm^2, A_2 = A_3 = 2000 mm^2 and E = 200 GPa.

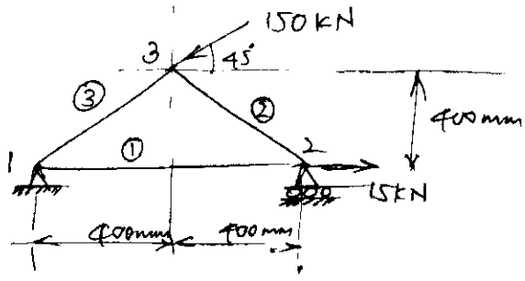

Fig. Q3 (b) **(12 Marks)**

4 a. Sketch and explain CST and LST elements. Write the difference between them. **(10 Marks)**

b. Write down the shape functions for a quadrilateral element with midside nodes. **(10 Marks)**

PART – B

5 a. Sketch the 8 noded hexahedral element, with suitable node numbering. Enlist the shape functions for the same element. **(10 Marks)**

b. Sketch and explain serendipity and Lagrange family of finite elements. **(10 Marks)**

6 a. Describe the various modules of finite element analysis tools with suitable examples. **(10 Marks)**

b. What are isoparametric, subparametric, and super parametric elements. Explain with suitable sketches. **(10 Marks)**

7 a. Compare three dimensional finite element model with the axisymmetric finite element model. **(08 Marks)**

b. Compute the strain displacement matrix for the axisymmetric triangular element. Use the following data: Fig.Q.7(b).

$u_1 = 0.002mm$; $w_1 = 0.001mm$

$u_2 = 0.001mm$; $w_2 = -0.004mm$

$u_3 = -0.003mm$; $w_3 = 0.007mm$ **(12 Marks)**

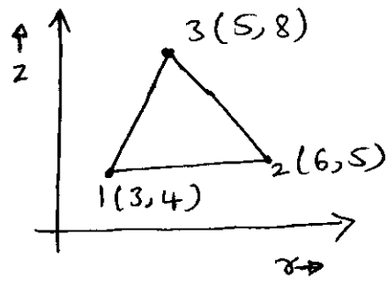

Fig.Q.7(b)

8 a. Derive the shape functions for a three noded, 1D thermal element and plot the shape functions across the element. **(10 Marks)**

b. Find the temperature distribution in one dimensional fin of length 50mm and radius 10mm by taking one element model. The heat will be lost to the surroundings through the perimeter surface and at the end (tip). Thermal conductivity of the material is 7000 (watt)/(m-k) conductivity heat transfer coefficient is $50kW/m^2$-K, film temperature is 40 degrees and the left end of the fin is maintained at a temperature of 140°C. **(10 Marks)**

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