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B.E./B.Tech. END SEMESTER EXAMINATIONS NOV / DEC 2011

MECHANICAL ENGINEERING

VII SEMESTER – (REGULATIONS 2004)

ME473 – FINITE ELEMENT ANALYSIS

Time: 3 hours Maximum marks: 100.

PART – A (10 x 2 = 20 Marks)

1. Compare the Raleigh Ritz with the nodal approximation method.
2. List the various weighted residual methods.
3. Write the stiffness matrix for a one dimensional 2 noded linear element.
4. Write the mass matrix for a one dimensional linear element
5. What is meant by band width and give its significance
6. What are the assumptions made in plane strain analysis?
7. Write the jacobian of transformation for a 1D linear isoparametric element.
8. Name a few FEA packages
9. What are natural co-ordinate systems? What are its advantages?
10. Derive the shape functions for a ID linear iso parametric element

PART – B (5 x 16 = 80 Marks)

11. (a) Determine the nodal displacements, element stresses and support reactions for the bar loaded as shown in fig.11

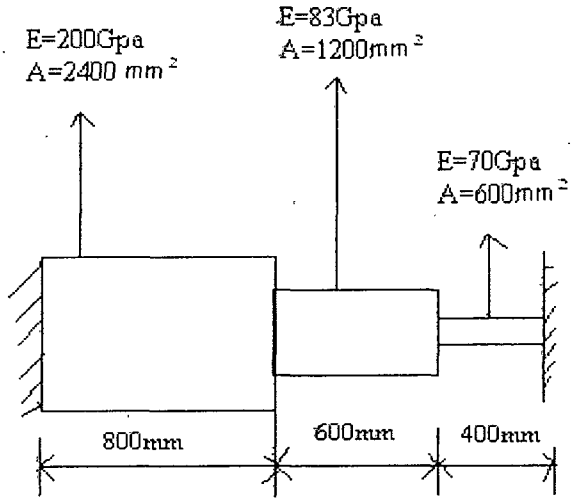

Fig 11

12(a) Determine the temperature distribution in the circular fin shown in fig. 12(a) Include the convection heat loss from the end of the fin also. Assume K=2 W/cm °C. h=0.2 W/cm^2 °C, T_α =10°C.

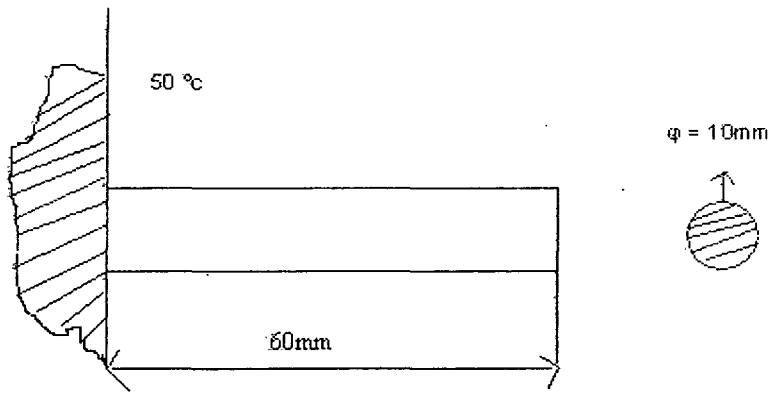

Fig 12(a)

(OR)

12(b) Derive the shape function for 1-D four nodded cubic element

13(a) Determine the natural frequency of longitudinal vibration of a bar fixed at one end using two linear elements.

(OR)

13(b)Derive the element stiffness matrix for a beam element and also derive the slope and deflection for a cantilever beam.

14(a) Triangular elements are used for the stress analysis of a plate subjected to in plane loads. The components of displacements parallel to the x and y axes at nodes i, j and k of an element are found to be (-0.001, 0.01); (-0.002, 0.010) and (0.002, 0.02) cm respectively. If the (x,y) coordinates of the nodes are (20, 20), (40,20) and (40,40) at nodes i, j,k. Find (i) the distribution of the displacement components inside the element and (ii) the components of displacements at point P (30,25).

(OR)

14(b) Solve the torsion problem for a square shaft using four triangular elements shown in fig.14(b). Solve for the nodal values of φ, Use $2g\theta = 2790$.

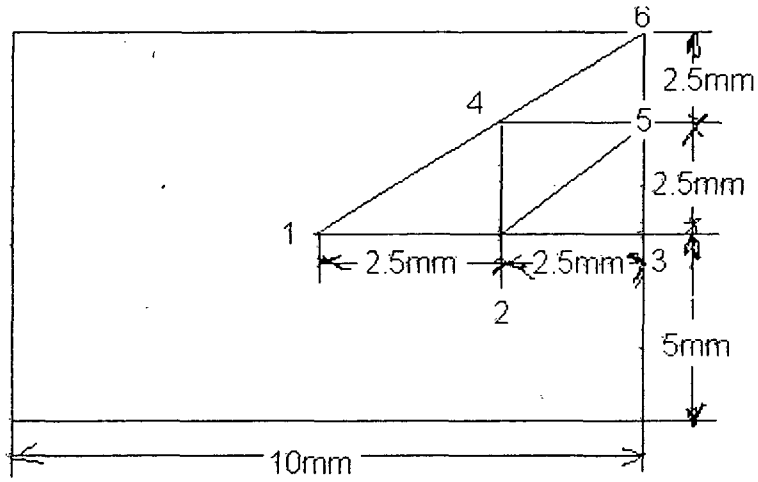

Fig. 14(b)

15(a) (i) What is the basis of isoparametric formulation? How are isoparametric elements different from sub parametric and super parametric elements?

(ii) For the 4 noded element shown in fig 15(a), Evaluate the Jacobian at the point ½, ½.

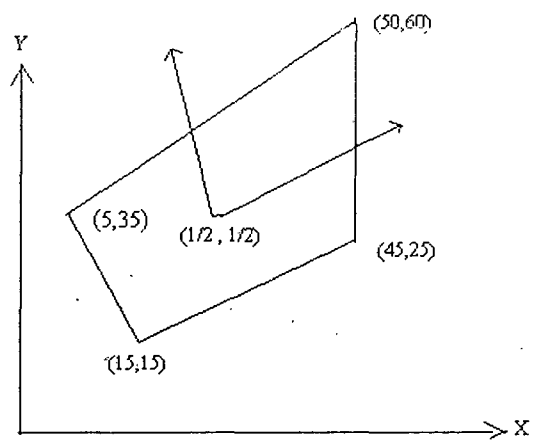

Fig 15(a)

(OR)

15(b) Derive the shape functions for an eight nodded serendipity element.