Roll. No.										

B.E. /B.Tech. (Full Time)DEGREE END SEMESTER EXAMINATION, April/May 2012

Mechanical Engineering Branch

46

Seventh Semester- (Regulations 2004)

ME 473 – FINITE ELEMENT ANALYSIS

Time: 3 hr Max. Marks: 100

Answer ALL Questions

PART - A (10x 2= 20 Mark)

1. Why polynomial terms are preferred for shape functions in finite element method?
2. What are the characteristics of the stiffness matrix?
3. What are Natural co-ordinates? What are the advantages of the same?
4. What is meant by Pascal's triangle? What is its use?
5. What are h and p elements?
6. Distinguish between essential and non-essential boundary condition.
7. Using lagrangian polynomials drive the shape functions for a 1D quadratic element. Plot the variation of shape function of a quadratic element.
8. Name any five analysis software.
9. What is meant by CST?
10. What are the three main modules of any finite element analysis package?

PART - B (5 x16 = 80 Mark)

11. The thin plate of uniform thickness 20 mm,is as shown in Figure 11.In addition to the self weight, the plate is subjected to a point load of 400 N at mid-depth. The young's modulus $E = 2 \times 10^5$ N/mm^2 and unit weight $\rho = 0.8 \times 10^{-4}$ N/mm^2.Analyse the plate after modeling it with two elements and find the stresses in each elements. Determine the support reactions also. 16

12.a Determine the nodal displacements at node 2,stresses in each material and support reactions in the bar shown in Figure.12.a,due to applied force P = 400 x 10^3 N and temperature rise of 30° C. $E_{aluminium}$=0.7 x 10^5 N/mm^2,E_{steel}= 2 x 10^5 N/mm^2, $\alpha_{aluminium}$ =22 x 10^{-6} /C° and α_{steel} = 12 x 10^{-6} /C°. 16

Or

12.b Determine the nodel displacement,element stress and support reactions of the axially loaded bar as shown in Figure 12.b.Take E = 200 GPa and P = 30 kN 16

13.a Determine the shape function for the constant strain triangle using Polynomial function. 16

Or

13.b Determine the displacement and the reaction forces at nodes in the spring system shown in Figure.13.b Use minimum of potential energy principal to assemble equations of equilibrium. 16

14.a Find the nodal displacements and element stresses in the propped beam shown in Figure 14.a. Idealize the beam into two CST elements as shown in Figure. Assume plane stress condition. Take μ =0.25, E =2 X 10^5 N/mm^2, Thickness =15 mm. 16

Or

14.b Determine the shape function for 9 noded quadratic rectangular elements. 16

15.a Write short notes on (i)Serendepity and (ii)Nonlinear solution Techniques. (iii) C_o,C_1 continuity elements.(iv)Isoparametric elements. 16

Or

15.b Find the natural frequencies of longitudinal vibration of the constrained stepped bar shown Figure15.b. 16

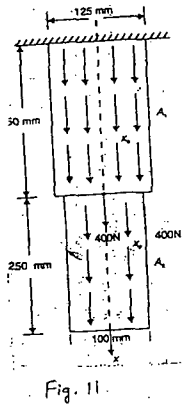

Fig. 11

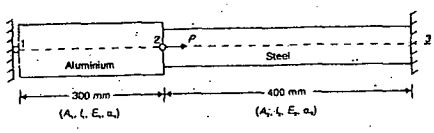

Fig. 12.a

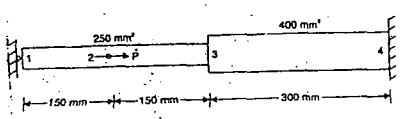

Fig. 12.b

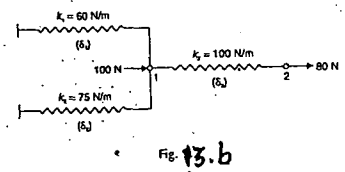

Fig. 13.b

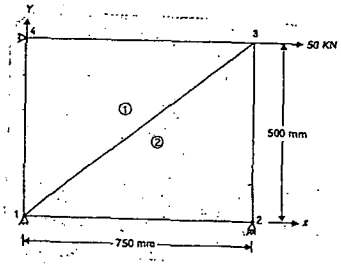

Fig. 14.a

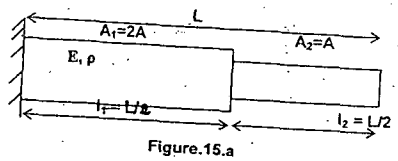

Figure.15.a