Code No. 3142

FACULTY OF ENGINEERING

B.E. 4/4 (Mech./Prod.) I-Semester (Supplementary) Examination, June/July, 2011

FINITE ELEMENT ANALYSIS

Time : Three Hours] [Maximum Marks : 75

Answer **ALL** questions from Part A. Answer any **FIVE** questions from Part B.

PART—A (Marks : 25)

1. List various steps of the finite element method. 3
2. State the properties of stiffness matrix of a C^o element. 2
3. Explain the condition to be applied for the analysis of a 3-d uniform body. 2
4. Explain the terms : reduced and consistent loading. 2
5. What is continuity ? Explain C^m continuity, C^0, C^1 elements. 3
6. List the essential features required for the interpolation functions. 2
7. Explain how the principle of minimum potential energy is applied in formulation of a finite element problem. 3
8. Explain how two-dimensional analysis will be applied to solve the axisymmetric problem. 2
9. Explain the terms : eigen values, eigen vectors in a vibration problem. 3
10. Explain why isoparametric formulation is most relevant for practical problems. 3

PART—B (Marks : 50)

11. The vertically supported stepped bar is shown in Fig. 1. The specific weight is 75 kN/m^3. A point load of 100 kN acts at the middle node. Determine the stress in each element and the support reaction. Take E = 200 GPa.

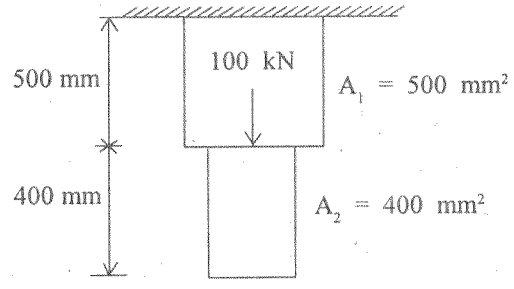

Fig. 1

12. Determine the displacements of node 2 and the stress in the element 2 for the two-bar truss shown in Fig. 2. Area of cross-section of each element is A = 200 mm^2, E = 70 GPa.

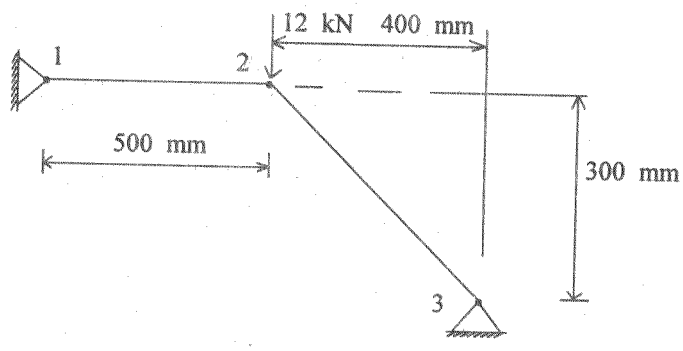

Fig. 2

13. Determine the deflection at the tip of the cantilever for the beam shown in Fig. 3. Take I of the beam = 120 × 10^{-6} m^4. E = 200 GPa.

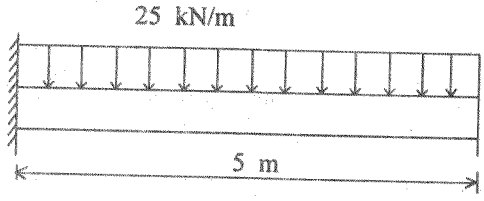

Fig. 3

14. Determine the nodal load vector for the point load acting on a Q_4 element as shown in Fig. 4.

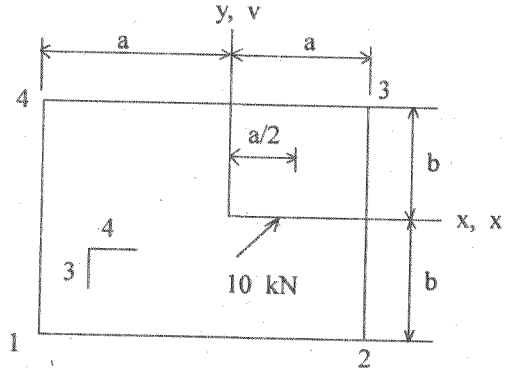

Fig. 4

15. For the quadratic isoparametric triangle shown in Fig. 5, obtain the Jacobian.

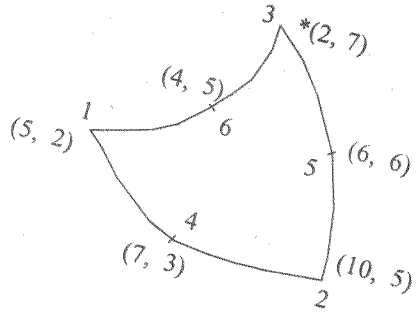

Fig. 5

16. Obtain the temperature distribution in a pin fin of 1 mm diameter, 50 mm long, made of aluminum. The surface of the wall is maintained at 300°C. The surrounding air temperature is 30°C. Use K = 200 W/m°C for aluminum, h = 20 W/m^2 °C for the surface. Assume the tip is insulated.

17. Using a single finite element, determine the natural frequencies of vibration of a cantilever beam of length L, assuming constant values of P, E and A.