

Roll No: 59

B.E. (Full Time) DEGREE END SEMESTER EXAMINATIONS
NOV/DEC 2011
MANUFACTURING ENGINEERING

MN502 FINITE ELEMENT ANALYSIS IN MANUFACTURING ENGINEERING
(Regulations 2005)

Duration: Three hours

Max. Marks: 100

Answer ALL questions:

PART A (10 x 2 = 20 marks)

1. What are the benefits of FEM?
2. Differentiate essential and non essential boundary conditions.
3. Derive the shape functions for a two noded element using Lagrange interpolation.
4. List the criteria to be considered in selecting the element type.
5. What are the characteristics of shape functions?
6. Compare natural coordinates system with generalized coordinate system.
7. What is meant by serendipity elements?
8. What kind of element is used for metal cutting? Justify.
9. Define warpage in FEA.
10. List any four FEA packages.

Part-B (5 x 16 = 80)

11. a. (i) Explain the preprocessing, processing and post processing in detail. 10
(ii) Describe the different convergence requirements in FEA. 6

12. a. A copper bar is 900 mm long and circular in section. It consists of 200 mm long bar of 40 mm diameter, 500 mm long bar of 15 mm diameter and 200 mm long bar of 30 mm diameter. If the bar is subjected to a tensile load of 60 kN, find the total extension of the bar. Assume E for the bar as 100 GPa. Solve using subdomain method. 16

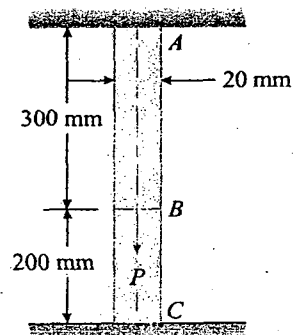
OR

b. The surface temperatures of a steel wall ($k=53.6 \text{ W/mK}$) 0.3 m thick are maintained at 1000C and 400C. Water at temperature of $T_{\infty} = 200\text{C}$ flows over the surface at 400C. The convection coefficient associated with the water flow is 40 W/m²K. Calculate the intermediate temperature using Ritz method. 16

13. a. Heat is transferred through a stainless plate, 40 mm thick, one face of which is maintained at 350°C and the other face at 50°C . The thermal conductivity of stainless steel is 19.1 W/mK at 200°C . Calculate the temperature distribution along the plate. Solve using two dimensional element. 16

OR

b. A square bar of 20mm side is held between two rigid plates and loaded by an axial force P equal to 450 kN as shown below. Find the reactions at the ends A and C and the extension of the portion AB. Take $E = 200 \text{ GPa}$. 16



14. a. Derive the stiffness matrix in isoparametric formulation. 16

OR

b. Explain the solution procedures adopted in FEA of nonlinear plasticity problems. 16

15. a. How metal casting analysis is carried out using FEA? Discuss about the choice of the finite element to be used and the solution procedure to be adopted. 16

OR

b. How metal forming analysis is carried out using FEA? Discuss about the choice of the finite element to be used and the solution procedure to be adopted. 16