Reg. No. : | | | | | | | | | | |

Question Paper Code: 41213

M.E. DEGREE EXAMINATION, DECEMBER 2014.

First Semester

CAD / CAM

14PCD102 – FINITE ELEMENT ANALYSIS IN MANUFACTURING ENGINEERING

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (5 x 1 = 5 Marks)

1. The accuracy of the results can be improved by _____the order of the polynomial
   (a) decreasing
   (b) increasing
   (c) keeping constant
   (d) no relation between accuracy and polynomial function.

2. The sum of the elements in any column of a stiffness matrix must be equal to
   (a) 0 (b) 1 (c) 2 (d) 3

3. Conditions for a problem to be axisymmetric is _____ about axis of revolution
   (a) Domain in not symmetric
   (b) All boundary conditions must be symmetric
   (c) All loading conditions must be symmetric
   (d) the boundary conditions are not considered

4. In an isotherm line the temperature
   (a) remains constant
   (b) increases
   (c) decreases
   (d) not depends on temperature

5. When the aspect ratio increases, the accuracy of the solution

(a) neither increases nor decreases

(b) increases

(c) decreases

(d) accuracy not depends on aspect ratio

PART - B (5 x 3 = 15 Marks)

6. Distinguish between essential boundary conditions and natural boundary conditions.
7. Derive the shape function of one dimensional bar element.
8. What is the need for developing the overall stiffness matrix of the entire structure in terms of its global coordinate system? Give an example.
9. Where can we use the gap elements?
10. What is meant by non-linearity?

PART - C (5 x 16 = 80 Marks)

11. (a) Compute the value of centre deflection by assuming $y=a \sin\pi x/L$, for a simply supported beam carries central point load P. (16)

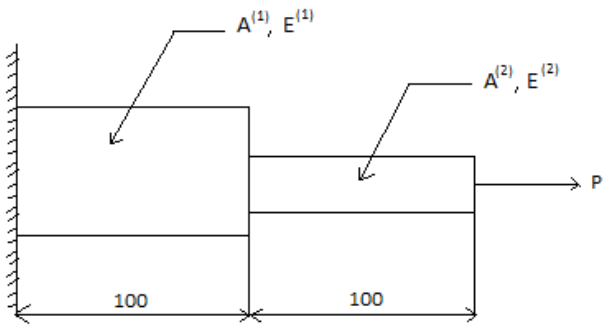
Or

(b) Elucidate the step by step procedure for solving static structural problem in FEM with an example. (16)

12. (a) Determine the shape function and element matrices for quadratic bar element. (16)

Or

(b) Find the stresses induced in the axially loaded stepped bar shown below. The bar has cross sectional areas $A^{(1)}$ of $200mm^2$ and $A^{(2)}$ of $100mm^2$ with a pulling force of 1N. Assume $E^{(1)}= E^{(2)}= 2\times10^5$ N/mm^2.



(16)

13. (a) Derive the stiffness matrix for a CST element under plane stress condition. (16)

Or

(b) For the element shown, the nodal displacements are as u_1=2mm, v_1=1mm, u_2=0.5mm, v_2=1.5mm, u_3=3mm and v_3=1mm.The coordinates are given in mm. Assume plane stress condition. Let E= 210GPa, μ = 0.3 and thickness is 10mm. Determine the element stresses.

(16)

14. (a) A composite wall consists of three materials with lengths of 0.3m,0.15m ,0.15m and thermal conductivity of K_1=20W/m°C, K_2=30 W/m°C, K_3=50 W/m°C respectively. The outer temperature is 20°C.Convective heat transfer take place on the inner surface of the wall with T_∞=800°C and h=25W/m^2 °C. Determine the temperature distribution in wall.

(16)

Or

(b) (i) Explain the concept of FE analysis of metal cutting. (8)

(ii) Enumerate the usage of crank-Nicholson algorithm in FE analysis of metal casting. (8)

15. (a) Explain the concept of modeling, meshing, applying boundary conditions and processing characteristics of an axial member analysis using ANSYS software.

(16)

Or

(b) Write short notes about

(i) Element connectivity and node numbering. (8)

(ii) Application of ANSYS and DEFORM in different fields. (8)