M18002137

Registration No: | | | | | | | | | | |

Total Number of Pages : 02 **M.TECH**

M.TECH 2ND SEMESTER REGULAR EXAMINATIONS, MAY 2018
FINITE ELEMENT METHOD
Branch: MD, Subject Code:MMDPE2041
Time: 3 Hours
Max Marks : 70

PART-A (10 X 2=20 MARKS)

1. Answer the following questions.

a) What is meant by finite element analysis? [CO1]
b) Define discretization with an example ? [CO1]
c) Summarize the major steps involved in Finite element analysis. [CO1]
d) Why preprocessing is required in FEA. [CO1]
e) What do you mean by weighted residual method. [CO2]
f) How frame structure is different from bars ? [CO1]
g) State the principle of minimum potential energy. [CO1]
h) What is an isoparametric element ? State its important in finite element method. [CO1]
i) Write down the stiffness matrix equation for one dimensional heat conduction equation. [CO3]
j) Explain axisymmetric element with an example. [CO4]

PART-B (5 X 10=50 MARKS)

Answer any five questions from the following.

2. a) Write down the advantages, disadvantages and limitation of FEM. **[CO1]**
b) List out the typical areas of engineering where the finite element method is applied. **[CO1]**

3.a) Derive the stiffness matrix for the spring assemblage with arbitrarily numbered nodes as shown in Figure 1. A force of 5000 N is applied at node 4 in the x direction. The spring constants are given in the figure. Nodes 1 and 2 are fixed. **[CO1]**

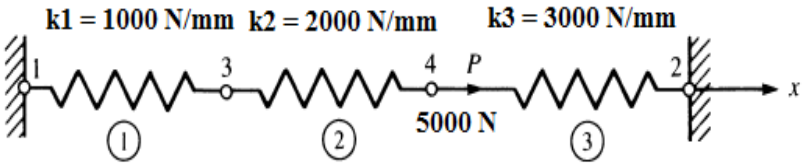

Figure-1

b) Calculate the displacement on nodes 2 and 3 for the three-bar assemblage as shown in Fig.-2. A force of 3000 N is applied in the x direction at node 2. The length of each element is 30 m. Let E = 30 X 10^6 $^N/_{m^2}$ and A = 1 m^2 for elements 1 and 2, and let E = 15 X 10^6 $^N/_{m^2}$, A = 2 m^2 for element 3. Nodes 1 and 4 are fixed. **[CO1]**

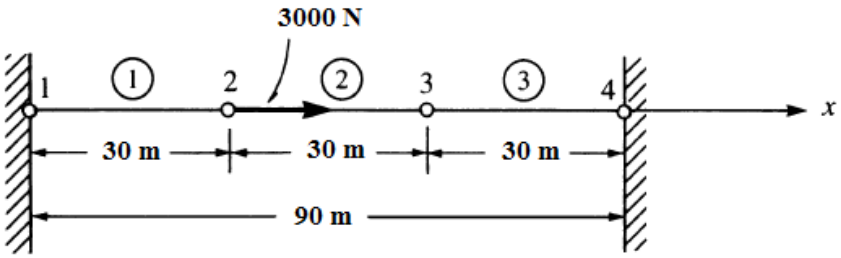

Figure-2 : Figure 3–4 Three-bar assemblage

4. a). Explain Galerkin's Method with its governing equations. **[CO2]**

b) Discuss in detail about the treatment of boundary conditions in terms of elimination approach. **[CO2]**

5. a) Define the stiffness matrix and describe its characteristics **[CO3]**

b). Derive the element stiffness matrix for the plane truss element. **[CO3]**

6. a) The (X,Y) coordinates of the nodes I, j,k of a triangular element are (1,1), (4,2) and (3,5) respectively as shown in figure-3 . The shape functions of a point P located inside the element are given by N1= 0.15 and N2= 0.25 . Determine the X and Y Coordinates of the point P. **[CO3]**

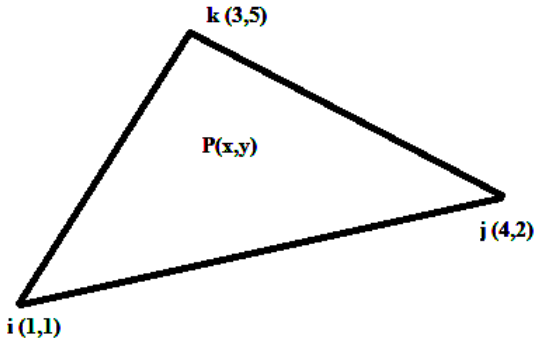

Figure-3

b) Find the shape functions of a quadrilateral element in natural coordinates. **[CO3]**

7. a) How to evaluate the stiffness matrix by Gaussian Quadrature principle. **[CO4]**

b) Derive the stiffness matrix of a plate bending element. **[CO4]**

8. Write short notes on

a) Mesh Generation [CO1]

b) Variational Method [CO2]

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