Code No: **RT41033** **R13** **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, February/March - 2018

FINITE ELEMENT METHODS

(Common to Aeronautical Engineering, Automobile Engineering and Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B
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PART–A *(22 Marks)*

1. a) Explain about plane stress and plane strain. [3]
   b) Discuss about the elements used in discretization. (1D,2D,3D case). [3]
   c) Write the Hermite shape functions of beam element and plot them. [4]
   d) Write the advantages and applications of axisymmetric element. [4]
   e) Explain about isoparametric and subparametric elements. [4]
   f) Discuss about the softwares used to evaluate the problems in FEM [4]

PART–B *(3x16 = 48 Marks)*

2. a) Discuss about different weighted residual methods with the help of an example. [8]
   b) For the spring assemblages shown in figure 2 (b), determine the nodal displacements by using the concept of potential energy.

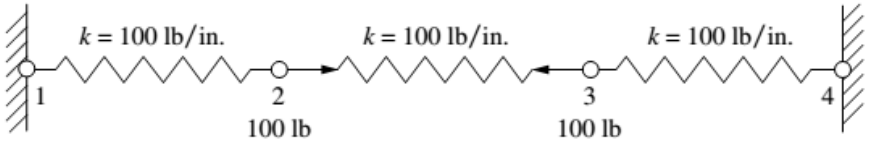

Figure 2 (b) [8]

3. a) Consider a simple one dimension structure with three elements, explain the process of stiffness matrix and load vector assembly. [8]
   b) Discuss about the types of elements used in domain discritization. [4]
   c) Write the properties of stiffness matrix. [4]

4. For the plane trusses shown in figure 4, determine the horizontal and vertical displacements of node 1 and the stresses in each element. All elements have E=210 GPa and A=4.0 X 10^{-4} m^2.

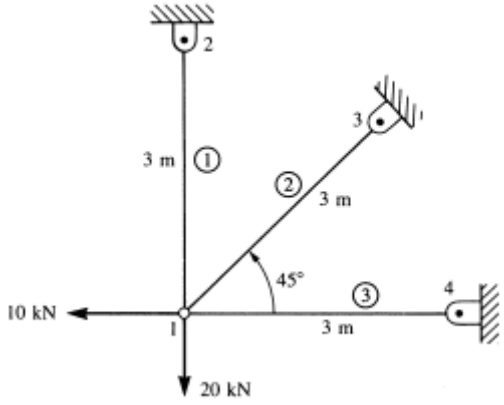

Figure 4 [16]

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5. For the two dimensional loaded plate shown in figure 5, determine the displacements of node 1 and 2 and the element stresses using plane stress conditions.

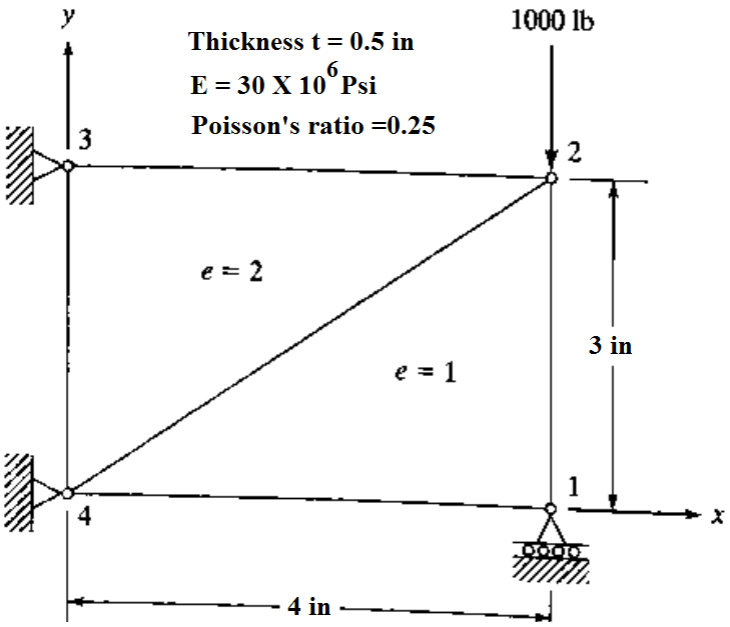

Figure 5 [16]

6. a) Derive the strain displacement matrix of two dimensional four noded isoparametric elements. [10]

b) Evaluate the integral by two and three point gauss quadrature rule.

$$I = \int_{-1}^{1} x^3 - 2x^2 + 5x - 7 \; dx$$

[6]

7. a) For the composite wall shown in figure 7 (a), determine the interface temperatures considering three elements.

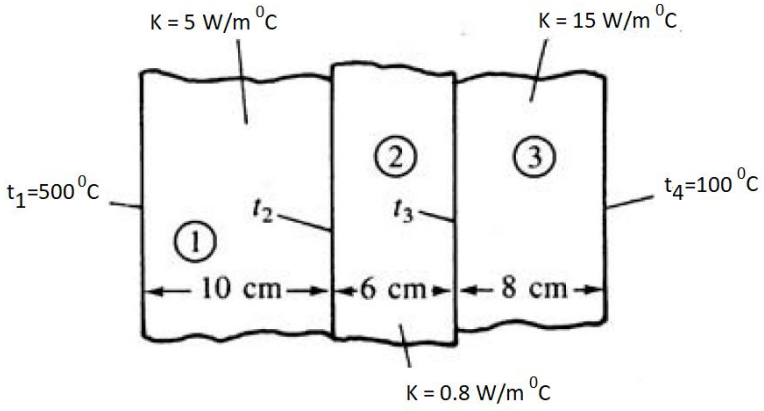

Figure 7 (a) [12]

b) Derive the consistence mass matrix of a two node bar element. [4]