MMMD-202
M.E./M.Tech. II Semester Examination, June 2016
Finite Element Method

Note: i) Attempt *any five* questions. *Time : Three Hours* *Maximum Marks : 70*
ii) All questions carry equal marks. iii)Draw neat diagrams wherever required.

1. a) Discuss the advantages and disadvantages of finite element method over conventional methods.

   b) What are the various steps in FEM? Explain boundary and initial value condition in FEM.

2. a) Derive the shape functions for four nodded bar element using Legrangian interpolation function. Nodes are equally spaced.

   b) Differentiate conforming and non-conforming elements.

3. a) Derive the element stiffness matrix for a typical Mindlin's plate bending element.

   b) State Node numbering scheme in FEM problems. How automated mesh is generated?

4. a) Write about Galerkin method.

   b) What are the various types of elements and nodes in FEM? Give examples.

5. Three-dimensional simplex elements are used to find the pressure distribution in a fluid medium. The (x, y, z) co-ordinates of nodes i, j, k, and l of an element are given by $(2, 4, 2)$, $(0, 0, 0)$, $(4, 0, 0)$ and $(2, 0, 6)$ in. Find the shape functions N_i, N_j, N_k, and N_l of the element.

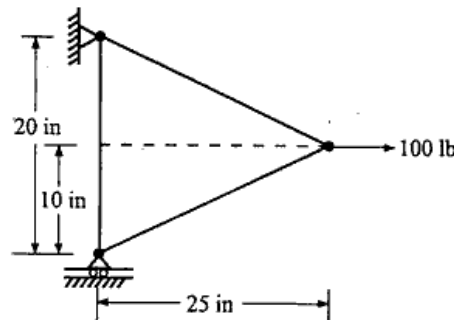6. Find the stresses induced in the steel plate shown in Figure 1, using a single triangular membrane element.

Figure 1

7. Figure 2 shows a uniform aluminum fin of diameter 2 cm. The root (left end) of the fin is maintained at a temperature of $T_0 = 100$ °C while convection takes place from the lateral (circular) surface and the right (flat) edge of the fin. Assuming k = 200 W/m- °C, h = 1000 W/m²- °C, and $T_\infty = 20$ °C, determine the temperature distribution in the fin using a two-element idealization.
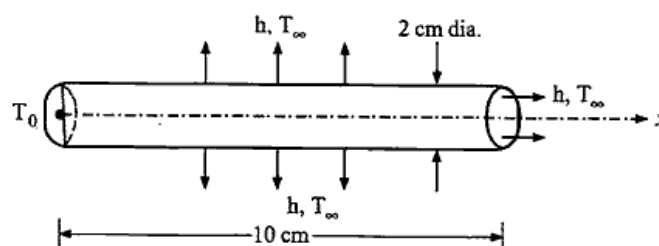

Figure 2

8. Write short note on following: (any two)
   a) Patch Test   b) Applications of FEM in fluid flow problems   c) EFM software packages.

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