Code No: C3ME06 **N5**

III B.Tech.(CCC) Supplimentary Examinations, June 2009
FINITE ELEMENT METHOD
(Mechanical Engineering)

Time: 3 hours **Max Marks: 100**

Answer any FIVE Questions
All Questions carry equal marks

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1. If a displacement field is described as follows,
   u = (-$x^2 + 2y^2 + 6xy$)10^{-4} and v = (3x + 6y - y^2)10^{-4}
   Determine the strain components $\in_{xx}$, $\in_{yy}$, and $\in_{xy}$ at the point x=1 ; y = 0. [20]

2. With a suitable example explain the formulation of finite element equations by direct approach. Assume suitable data for the example. Use I-D analysis [20]

3. For the truss structure shown in figure 3 is subjected to a horizontal load of 4 kN in positive x-direction at node 2. Calculate
   (a) stiffness matrix and
   (b) stresses. [12+8]

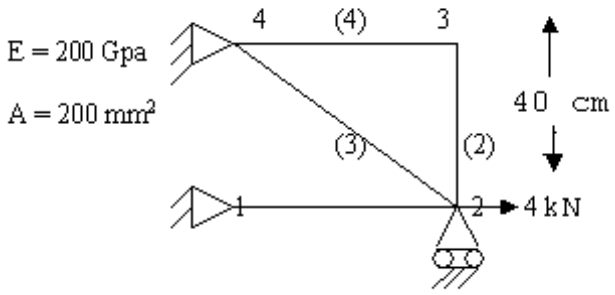

Figure 3

4. Derive the element stiffness matrix for the 2-noded beam element [20]

5. The coordinates of the nodes 1, 2 and 3 of a triangular element are (1, 1), (8, 4) and (2, 7) in mm. The displacements at the nodes are u_1 = 1 mm, u_2 = 3 mm, u_3 = -2 mm, v_1 = -4 mm , v_2 = 2 mm and v_3 = 5 mm. Obtain the strain-displacement relations, matrix B and determine the strains $\varepsilon_x, \varepsilon_y$ and γ_{xy}. [20]

6. Derive the element conductivity matrix and load vector for solving 1-D heat conduction problems, if one of the surfaces is exposed to a heat transfer coefficient of h and ambient temperature of T∞? [20]

7. Consider the axial vibrations of a steel bar shown in the figure 7:
   (a) Develop global stiffness and mass matrices,
   (b) Determine the natural frequencies? [10+10]

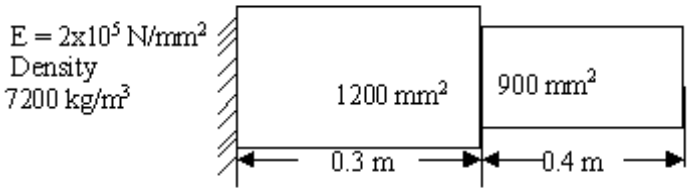

Figure 7

8. (a) How do you calculate the element stresses for 3-Dimensional body?
   (b) Derive the element stiffness term and force term for four noded tetrahedral elements. [10+10]

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