Code No: RR420302 **Set No. 1**

IV B.Tech II Semester Regular Examinations, Apr/May 2007
FINITE ELEMENT METHODS
(Common to Mechanical Engineering and Production Engineering)
Time: 3 hours **Max Marks: 80**

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 $x = 1; y = 0$.

   [16]

2. Explain the mathematical interpretation of finite element method for one dimensional field problems. [16]

3. A cantilever beam is loaded with point load at end and Uniform distributed load throughout the beam of length L m. Explain how will you proceed with the solution using FEM? [16]

4. (a) Using three point Gaussian quadrature find $\int xy \; dA$ for a triangular element whose vertices are (1,1), (3,2), and (2, 3).
   (b) Find the shape functions of a quadrilateral element in natural coordinates. [10+6]

5. A composite slab consists of three materials of different thermal conductivities i.e 20 W/m K, 30 W/m-^{0}K, 50 W/m-^{0}K of thickness 0.3 m, 0.15 m, 0.15 m respectively. The outer surface is 20^0C and the inner surface is exposed to the convective heat transfer coefficient of 25 W/m^2-K at 300^0C. Determine the temperature distribution within the wall? [16]

6. Consider axial vibrations of the steel stepped bar as shown in figure6:
   (a) develop global stiffness matrix and mass matrix,
   (b) natural frequencies and
   (c) mode shapes. [16]

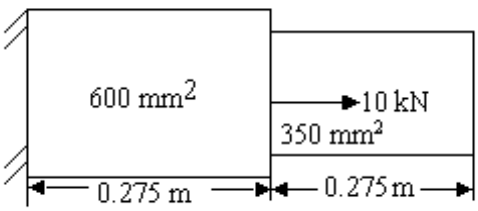

Figure 6

7. The coordinates of the nodes of a 3-D simplex elements are given below.

Node number	Coordinate of the node		
	X	Y	Z
i	0	10	0
j	10	0	0
k	0	15	0
l	0	0	20

Determine the shape function of the element. [16]

8. (a) What is the necessity of determining Von misses stresses in finite element static analysis?
   (b) Briefly explain about ANSYS software package. [8+8]

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Code No: RR420302 **Set No. 2**

IV B.Tech II Semester Regular Examinations, Apr/May 2007
FINITE ELEMENT METHODS
(Common to Mechanical Engineering and Production Engineering)
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain briefly about the following:
   (a) Variational method.
   (b) Importance of Boundary conditions. [8+8]
2. With a suitable example, explain the physical interpretation of finite element method for one dimensional analysis. [16]
3. Define and derive the Hermite shape functions for a two nodded beam element? [16]
4. (a) Show that the shape function at node i (N_i), for the simplex triangle is one and zero at nodes j and k.
   (b) The nodal displacements for the simplex two-dimensional element shown figure4b are u_1 = 2 mm, u_2 = 6 mm, u_3 = -1 mm, v_1 = 4 mm , v_2 = 5 mm and v_3 = 8 mm. Determine the displacement components at an interior point B (10,10). The nodal coordinates (in mm) are given in parenthesis. [5+11]

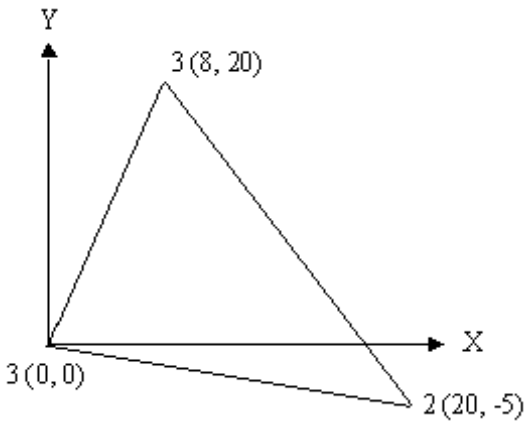

Figure 4b

5. A composite slab consists of three materials of different thermal conductivities i.e 20 W/m K, 30 W/m-^{0}K, 50 W/m-^{0}K of thickness 0.3 m, 0.15 m, 0.15 m respectively. The outer surface is 20^{0}C and the inner surface is exposed to the convective heat transfer coefficient of 25 W/m^2-K at 300^{0}C. Determine the temperature distribution within the wall? [16]
6. Determine the natural frequencies of a simply supported beam of length 800 mm with the cross sectional area of 75 cm X 25 cm as shown in the figure6. Take E= 200 Gpa and density of 7850 kg/m^3. [16]

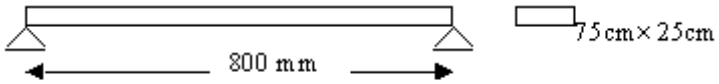

Figure 6

7. (a) Explain the mesh generation schemes for 3-D problems.
   (b) State the considerations governing the choice of finite elements to be used in three-dimensional problems. [8+8]

8. With an example, explain the procedure involved in solving an engineering problem in computational finite element analysis using computer software. [16]

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Code No: RR420302 **Set No. 3**

IV B.Tech II Semester Regular Examinations, Apr/May 2007
FINITE ELEMENT METHODS
(Common to Mechanical Engineering and Production Engineering)
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain briefly about the following:
   (a) Variational method.
   (b) Importance of Boundary conditions. [8+8]
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. [16]
3. Starting from the first principles derive the stiffness matrix for a 1- d bar element and extend it for the plane truss element? [16]
4. With suitable examples explain the meaning and formulations of properties of axisymmetric elements. State their applications. [16]
5. The coordinates of the nodes of a triangular element are 1(-1,4), 2(5,2) and 3(3,6) of thickness 0.2 cm. The convection takes place over all surfaces with a heat transfer coefficient of 150 W/m^{2}K and T$\propto$= 30^{0}C. Determine the conductivity matrix and load vector if the internal heat generation is 200 W/cm^3. Assume thermal conductivity the element is 100 W/m K. [16]
6. Derive the elemental mass matrix for 1-D bar element and 1-D plane truss element? [16]
7. Derive strain displacement matrix (B) for four node tetrahedral element. [16]
8. With an example, explain the procedure involved in solving an engineering problem in computational finite element analysis using computer software. [16]

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Code No: RR420302 **Set No. 4**

IV B.Tech II Semester Regular Examinations, Apr/May 2007
FINITE ELEMENT METHODS
(Common to Mechanical Engineering and Production Engineering)
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Discuss the following basic principles of finite element method.
   (a) Derivation of element stiffness matrix.
   (b) Assembly of Global stiffness Matrix. [8+8]
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. [16]
3. Define and derive the Hermite shape functions for a two nodded beam element? [16]
4. Derive the shape functions for a triangular linear element in global Co-ordinate system. [16]
5. Find the temperature distribution in the square plate as shown in figure5. Assume K = 30 W/m K, T$\propto$ = 50^0C and q = 100 W/m^3.

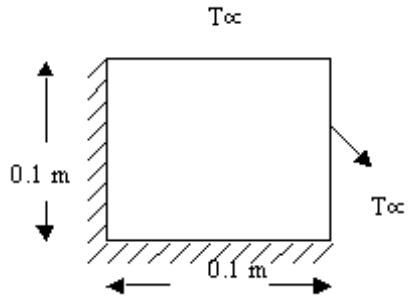

Figure 5

6. Derive the elemental mass matrix for 1-D bar element and 1-D plane truss element? [16]
7. Explain the following semiautomatic mesh generation techniques
   (a) Conformal mapping approach.
   (b) Mapped element approach. [8+8]
8. Give the necessity of rotating and offsetting the work plane in ANSYS environment. What are the useful features of CAEFEM package in analysis? [16]

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