Code.No: R07A62105 | R07 | SET-1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
III B.TECH II SEM–REGULAR/SUPPLEMENTARY EXAMINATIONS MAY - 2010
FINITE ELEMENT AND MODELLING METHODS
(AERONUTICAL ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

\- - -

1. Write short notes on:
   a. Substructures and Super modules.
   b. Degree of Freedom.
   c. Accuracy and Complexity. [6+5+5]

2.a) Derive the standard closed form integration for 2-D triangular element for area co-ordinate system.
   b) Determine the value of an expression $\int L_1^2 L_2^2 L_3^2$ dA for area co-ordinates. [12+4]

3. Find the heat transfer through a uniform cross section fin, one end of the fin is connected and fixed to the heat source (temp. of 140^0C) and the heat will be lost to the surroundings through the perimeter surface and the end. Use 2 elements and take surrounding temperature is 40^0C as shown in figure 1. [16]

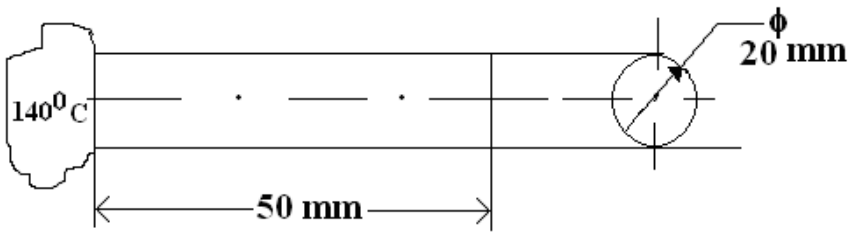

Figure 1

4. Explain the following in detail using a suitable 3-D element.
   a) Concept of work done
   b) Derivation of kinematically consistent load vectors. [6+10]

5.a) Explain the term injection of singularity in field distortions, in fracture mechanics.
   b) State the utilities of injection of singularity in fracture mechanics. [8+8]

6.a) Discuss the Gaussian quadrature two point formula along with their weights to be considered.
   b) Derive the equation for det J in terms of the element area when the linear quadrilateral element is a Square. [8+8]

7. Determine the element stiffness matrix for the axi-symmetric triangular element with its 3 nodes are $(r_1; z_1)=(0,0)$, $(r_2; z_2)=(6,0)$, $(r_3; z_3)=(0,4)$ assume E=210 Gpa, Poisson's ratio=0.3. The coordinates are in cm. [16]

8.a) What is block representation mesh generation technique? Explain the method with the suitable example.

b) Discuss different post processing methods used in finite element analysis packages. [8+8]

--ooOoo--

Code.No: R07A62105 | R07 | SET-2

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
III B.TECH II SEM–REGULAR/SUPPLEMENTARY EXAMINATIONS MAY - 2010
FINITE ELEMENT AND MODELLING METHODS
(AERONUTICAL ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

- - -

1. Write short notes on:
   a. Stiffness
   b. Flexibility
   c. Inertia and Damping models
   d. Transformable Linkages. [4 × 4]

2.a) Derive the expression for the area co-ordinates in natural co-ordinate systems with suitable example.

b) Determine the value of $\int L_1^3 L_2^{\,2}\, dA$ for entire area of `A' for area co-ordinates. [12+4]

3. A composite wall consists of there layers of different material properties as shown in figure1. The outer temperature is 20^0C=T) and convection heat transfer takes on inner surface of the wall. The surrounding temperature is 800^0C and heat transfer coefficient, h=25 watts/m^2-K.
   Take thermal conductivity
   K2i=30 watts/m-0K
   K3i=50 watts/m-0K.
   Find the temperature at the intersections of the slabs and determine the heat transmitted through the wall. [16]

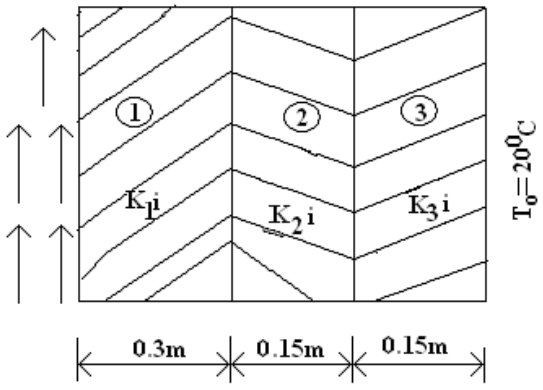

Figure 1

4.a) Explain which type of mass matrix gives more accurate natural frequencies.

b) How is consistent mass matrix derived? A plate element has nodes at 1(0,0) 2(5,0) and 3(3,4) is of material with mass density 8 gms/cm^3 and thickness 1 cm. Derive its lumped mass matrix. [4+12]

5.a) Explain the nodal parametric representation of discrete domains with suitable examples.
b) Differentiate between isoperimetric, sub parametric and super parametric elements. [8+8]

6.a) Write in brief about Guass quadrature method with an example.
b) Derive the abscissas and weights for the Gaussian quadrature formula when n = 2. Also check the two abscissa values with the roots of the second order Legendry polynomial equation. [8+8]

7.a) Describe the method to solve the cylinder subjected to internal pressure using axi-symmetric boundary conditions.
b) Derive the strain - displacement relation matrix for axi-symmetric triangular element. [8+8]

8.a) Explain the different modules that are existing in the NISA package and also the advantages over other packages.
b) What is multi level sub-structuring of mesh generation? Explain with suitable examples. [8+8]

--ooOoo--

Code.No: R07A62105 | R07 | SET-3

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
III B.TECH II SEM–REGULAR/SUPPLEMENTARY EXAMINATIONS MAY - 2010
FINITE ELEMENT AND MODELLING METHODS
(AERONUTICAL ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

\- - -

1.a) What is the importance of Substructures & Super modules, Accuracy & Complexity and Degrees of freedom.
b) Explain MACRO and MICRO mechanical views of “THE FINITE ELEMENTS". [8+8]

2.a) Derive the expression for the volume co-ordinates in natural co-ordinate system with suitable example.
b) Find the value of s $\int L_1^2 L_2 L_4$ dV for the entire volume of `V' for volume co-ordinates. [12+4]

3.a) Write the properties of the stiffness matrix(K) for linear ID problem.
b) Find the shape functions of the one dimensional, 2 noded bar element. [8+8]

4.a) What is method of assembly technique for stiffness matrix and force matrices?
b) Briefly explain the methods of direct deduction of matrix equations of equilibrium using assembly technique. [10+6]

5.a) What is refinement strategy of finite element analysis techniques? Explain with the examples.
b) What is the better refinement technique for solving the heat transfer problems? Explain. [8+8]

6.a) What are different frontal techniques used for the minimization of the size of the stiffness matrix? Explain.
b) Explain different storage techniques used for storing the large scale matrices. [8+8]

7.a) State the conditions to be satisfied in order to use axi-symmetric elements
b) Specify the machine components related with axi-symmetric concept. [8+8]

8.a) Explain the advantages and limitations of adaptive mesh generation technique over other meshing principles.
b) What are different analysis capabilities and range of applications of different finite element packages? Explain. [8+8]

--ooOoo--

Code.No: R07A62105 | R07 | SET-4

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
III B.TECH II SEM–REGULAR/SUPPLEMENTARY EXAMINATIONS MAY - 2010
FINITE ELEMENT AND MODELLING METHODS
(AERONUTICAL ENGINEERING)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

\- - -

1.a) What are the various steps in solving a problem by finite element method with suitable example?
b) What are the sources of error in different phases of solving a physical problem by FEM? [8+8]

2.a) Explain the shape functions and non-dimensional coordinates for a triangular plane stress element.
b) Plot a general triangular element and a quadrilateral element in Cartesian coordinate system and non-dimensional coordinate system. [8+8]

3.a) A tapered bar of 100 mm diameter at the larger end and 50 mm at the smaller end is clamped at larger end and it is hanging. The bar is subjected to a pull of 100 KN at the free end, Length of the bar is 200 mm. Find the displacements in the bar for 3 elements using FEM technique?
b) What are the various forces that can be considered in FEM approach? [10+6]

4.a) What is meant by principle of minimum potential energy? Explain for a simple spring mass system
b) Derive the stiffness property of a 1-Dimensional line element on the energy basis. [6+10]

5.a) What are the assumptions made in solving the fracture mechanics problems in finite element methods?
b) Explain the significance of sub-parametric elements in solving the fracture mechanics problems. [8+8]

6.a) Explain the importance of band width of a banded stiffness matrix in storage space.
b) Suggest the methods to reduce band width of a stiffness matrix to half. [8+8]

7. Derive the equivalent point loads acting on the axi-symmetric triangular element with uniformly distributed body force in the element and variable traction force along the surface of the element. [16]

8.a) Discuss the limitations of NASRTRAN package with some examples.
b) How to estimate the percentage error in automatic mesh generation technique? Explain. [8+8]

--ooOoo--