

**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

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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]

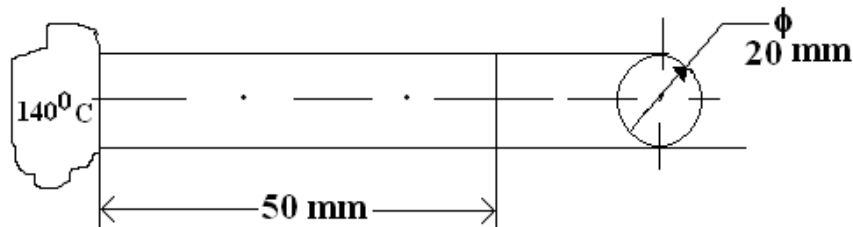


Figure 1

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]

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