

Code No: C7610

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH I - SEMESTER EXAMINATIONS, APRIL/MAY-2012
MODELING AND SIMULATION OF FLUID FLOWS
(AEROSPACE ENGINEERING)**

Time: 3hours**Max. Marks: 60**

**Answer any five questions
All questions carry equal marks**

- - -

- 1.a) List the basic equations of motion for a two dimensional, constant property and steady flow field.
- b) What are boundary layer approximations? Using the order of magnitude approach, explain how the pressure at a location along the flat plate is evaluated for laminar boundary layer flow over a flat plate.
2. Give the classification of Partial Differential Equations, explaining the characteristics of each type of PDE.
3. a) Using the Taylor's series approximation, derive the finite difference expressions for first order and second order differential terms of variable, Φ .
- b) Explain the Method of Weighted Residuals to solve PDEs using FEM.
4. Using the Von Neumann Stability Analysis, derive the criterion for stability Analysis of Parabolic PDE. Make necessary assumptions, but state them clearly.
5. What are the different methods of obtaining the matrix inverse? Briefly explain each one, mentioning their relative advantages and disadvantages.
6. An Aluminum rod, 2.5 cm in diameter and 15 cm long protrudes from a wall maintained at 300⁰C. The environment temperature is 38⁰C. The surface heat transfer coefficient is 17 W/m²K. Taking the mesh size as 5 cm, obtain the nodal equations, considering the fin as short. What is the type of coefficient matrix? What is the suitable matrix inversion technique? Using that technique, obtain the nodal temperatures using FDM.
- 7.a) Illustrate the Lax-Wendroff Technique for unsteady, two dimensional inviscid flow.
- b) Explain ADI Technique for solving 2D, unsteady diffusion problem.
8. Write short notes on the following.
 - a) SIMPLE Algorithm for Pressure Linked Equations.
 - b) Numerical methods for solving potential equations.
 - c) Basic rules of Finite Volume Method.
