R18

Time: 3 Hours   **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks
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1. Explain in detail the similarities, differences, advantages and disadvantages between finite difference methods, finite volume methods and finite element methods used for solving fluid flow problems.   [15]

2.a) Classify the following Partial Differential Equation for different real values of the parameter M.

$$(1 - M^2)\frac{\partial^2 \emptyset}{\partial x^2} + \frac{\partial^2 \emptyset}{\partial y^2} = 0$$

   b) Compare the Gauss Seidel and Jordan Methods using the following set of equations.
   $5x + y = 10$; and $2x + 3y = 4$.   [5+10]

3.a) Elliptic equations are typically used to characterize steady-state systems. Justify the statement with suitable examples with the prescribed boundary conditions.
   b) Explain discretization methods using Taylor's series expansion for 1st order forward, backward and 2nd order central difference schemes.   [3+12]

4. Consider a steady conduction in 1-dimensional bar with known temperature at $x = 0$ and $x = L$ are 0 K and 200 K respectively. The length of the bar is 8 m; conductivity is constant at 1.5 W/K-m. Find the temperature at the center of 3 equal pats.   [15]

5. Explain the explicit and implicit approach with the help of one dimensional heat conduction equation. Perform von-Neumann stability analysis.   [15]

6.a) Prove that the Wave equation is a hyperbolic.
   b) What is CFL Condition? Discuss its significance
   c) Enumerate the various steps involved in Alternating-direction implicit method.   [5+5+5]

7.a) Reduce the general form of Navier-Stokes and continuity equations for the case of 2D Viscous Incompressible flow problems.
   b) Discuss geometry, boundary conditions and solution methods for the Lid Driven Cavity Problem.   [7+8]

8.a) What is meant by staggered grid? Explain the importance of staggered grids for flow computations.
   b) Describe the first order forward time and centered space method of solving one dimensional transient diffusion equation.   [6+9]

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