

Time: 3 Hours

Max. Marks: 75

**Note:** Answer all questions from Part A. Answer any Five questions from Part B.**PART – A (25 Marks)**

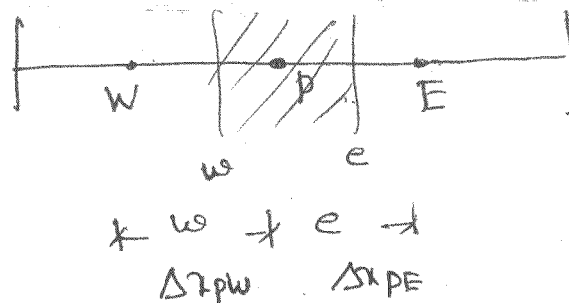
1. Explain Reynold's stress matrix.
2. Write down the assumptions made in deriving N-S equation.
3. What is turbulence closure? List any four turbulence models.
4. Explain Dirichlet and Neumann Boundary conditions.
5. Differentiate between explicit and implicit approaches in CFD.
6. Define the terms stability, consistency and convergence.
7. What is the difference between Jacobi and Gauss Seidel methods?
8. Explain the mapping layout of O-types grid.
9. Write brief notes on staggered grid.
10. List out the advantages of FVM.

**PART – B (50 Marks)**

11. Derive the momentum equation for viscous flow from fundamentals.
12. Explain K-ε turbulence model and mention clearly why it fails on a curved boundary.
13. Derive the condition of stability for the following equation using Von-Neumann stability analysis.

$$U_i^{n+1} - U_i^n = \frac{\alpha \Delta t}{\Delta x^2} [U_{i+1}^{n+1} - 2U_i^{n+1} + U_{i-1}^{n+1}]$$

14. What are different methods to solve viscous incompressible flow? Explain Vorticity – stream function method in detail.
15. Consider one dimensional convective diffusive term. Using finite volume method discretize the equation over control volume using upwind differencing scheme.



16. Without writing any discretized equation, explain semi implicit method for pressure linked equation.
17. Write short notes on:
  - a) Laminar and Turbulent flows
  - b) Potential and viscous flows
  - c) Mixing length model.