Paper Id: | 269202 | **Roll No:** [   ]

M. TECH.

(SEM -2) THEORY EXAMINATION 2017-18

COMPUTATIONAL FLUID DYNAMICS

Time: 3 Hours   *Total Marks: 70*

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1.   **Attempt *all* questions in brief.**   2 x 7 = 14

    a.   Differentiate between the uniform flow and non-uniform flow?
    b.   What is a Diaphragm?
    c.   Define substantial derivation?
    d.   Write the Continuity equations for viscous flow?
    e.   Define shock-capturing approach?
    f.   Write the advantage of implicit approach.
    g.   Write the essential characteristic of FEM in CFD?

SECTION B

2.   **Attempt any *three* of the following:**   7 x 3 = 21

    a.   Fine first order derivative by forward deference, backward deference and center deference method.
    b.   Using the central difference formula describe the second order and fourth order accuracy.
    c.   Explain the incompressible Navier Stokes system of equation using Artificial Compressibility Method.
    d.   The outside surface of a cylindrical cryogenic container is at − 10°C. The outside radius is 8 cm. There is a heat flow of 65.5 W/m, which is dissipated to the surroundings both by radiation and convection. The convection coefficient has a value of 4.35 W/m^{2}K. The radiation factor F = 1. Determine the surrounding temperature
    e.   Write short notes on Lax Method & philosophy of FVM

SECTION C

3.   **Attempt any *one* part of the following:**   7 x 1 = 7

    (a)   Solve the following equations by Gauss-Elimination
        method: 5x + 8y + 2z = 19
                    3x + 3y − 4z = 13
                     x + 6y + 2z = 11

    (b)   Obtain the finite difference equation for Laplace equation using central difference approximation

4.   **Attempt any *one* part of the following:**   7 x 1 = 7

    (a)   Derive the stability condition for FTCS discretization of 1-D unsteady state hest conduction equation using Von Neumann stability analysis.
    (b)   Explain the concept of boundary layer approximation.

5. **Attempt any *one* part of the following:** **7 x 1 = 7**

   (a)   Derive the second order accurate central difference approximation for the second derivative of 'f' with respect to 'x' using Taylor series expansion.

   (b)   Explain the various computer graphic techniques used in CFD

6. **Attempt any *one* part of the following:** **7 x 1 = 7**

   (a)   Explain the method of solving an incompressible flow problem using stream function – Vorticity formulation.

   (b)   Explain the concept of artificial viscosity in the finite difference schemes. It is a friend or a trouble maker in dealing with CFD problems.

7. **Attempt any *one* part of the following:** **7 x 1 = 7**

   (a)   Differentiate integral approach and Differential approach.

   (b)   Write the governing equations used in CFD in generic form