

BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING)
THIRD YEAR
SECOND SEMESTER EXAM 2019

Ref. No.: Ex/ME/5/T/323C/2019

Elements of Computational Fluid Dynamics

Time:-Three Hours

Full Marks:-100

Answer any **five** Questions

1. a) The analysis of fluid flow and heat transfer can be done better by CFD tools, explain thoroughly the basic idea of CFD by an example. (10)
- b) By a pictorial diagram explain the role of a computer in solving fluid flow and heat transfer problems in CFD. (10)
2. a) What is the canonical form of a partial difference equation? Explain in details parabolic, elliptic and hyperbolic PDEs. (15)
- b) What do you understand by discretisation of the domain or the grid generation? How a grid is identified by indices? (05)
3. Explain thoroughly different types of boundary conditions used in solving PDEs. (20)
4. Explain thoroughly what do you understand by central, forward and backward different scheme. When they are used? With a neat diagram show the neighboring points (a_p , a_E , a_W , a_N , a_S) used in this schemes. (20)
5. What is discretisation of PDE equation? Find second order accurate discretisation equations for
$$\frac{\partial \phi}{\partial x} \text{ and } \frac{\partial^2 \phi}{\partial x^2} \quad . \quad (20)$$
6. a) Explain Gauss-Elimination method. (10)
- b) Write a computer program to solve Laplaces equation. (10)
7. Explain different errors in numerical algorithm. What are convergence and stability? (20)
8. Write down Laplace's equation and the algorithm for solving the same in FORTRAN. (20)