B.M.E. Third Year 2nd Semester Examination, 2018 (Old) **Ex/ME/T/326C/2018 (Old)**

Elements of Computational Fluid Dynamics

Time:-Three Hours Full Marks:-100

Answer any **five** Questions

1. Explain the importance of CFD in solving the fluid flow and heat transfer problems by an example. (20)
2. Classify the Partial Differential equations and explain thoroughly how they can be solved with different boundary conditions. (20)
3. a) Explain thoroughly what you understand by forward and backward different schemes. When they are used? (10)

   b) Find by forward difference scheme the second order accurate expressions for $\partial\phi/\partial x$ and $\partial^2\phi/\partial x^2$, where ϕ is a general variable. (10)
4. What do you understand by the grid generation? What are uniform and non-uniform mesh systems? When they are used? Show a typical grid in cylindrical coordinate. (20)
5. Explain different types of errors and convergence, stability. On what factors truncation error is dependent? Show the grids and boundary conditions pictorially for elliptic equations. (20)
6. Find the expression for the truncation error related with the unsteady heat equation as:

   $\frac{\partial T}{\partial t} = \alpha \frac{\partial^2 T}{\partial x^2}$, where T is the temperature and α is the thermal diffusivity. (20)
7. Explain different boundary conditions used in solving PDEs. (20)
8. Write short note on any two. (20)

   a) Upwinding scheme b) Central different scheme c) Use of Order of Magnitude for N-S equations d) Importance of Computer in CFD