CBCS SCHEME

USN | | | | | | | | | | |

15AE72

Seventh Semester B.E. Degree Examination, June/July 2023
Computational Fluid Dynamics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Derive non conservative form of momentum equation for a infinitesimally small moving fluid element. **(10 Marks)**

b. Explain various physical boundary conditions with suitable examples for CFD problems. **(06 Marks)**

OR

2 a. Explain : i) Shock capturing ii) Shock fitting methods. **(08 Marks)**

b. Derive the expression for divergence of velocity. **(08 Marks)**

Module-2

3 a. Apply Cramer's rule to a quarilinear partial differential equation for the mathematical classification as elliptic, hyperbolic and parabolic. **(08 Marks)**

b. Explain the impact of partial differential equation classifications on unsteady thermal conduction phenomenon. **(08 Marks)**

OR

4 Describe the general behaviour of the different classes of partial differential equation. **(16 Marks)**

Module-3

5 a. With the help of relevant sketch explain the elliptic grid generation. **(08 Marks)**

b. Define grid quality. List the measures of quality and explain in detail. **(08 Marks)**

OR

6 a. List the advantages and disadvantages of structured and unstructured grids. Explain in brief. **(08 Marks)**

b. Write short notes on : i) Adaptive grids ii) Meshless grids. **(08 Marks)**

Module-4

7 a. Differentiate between explicit and implicit approach of finite difference equations. **(08 Marks)**

b. Write short notes on :
i) Time and space marching in CFD
ii) Upwind schemes in CFD. **(08 Marks)**

OR

8 a. For the 2D steady flow, continuity equation in Cartesian co-ordinates obtain the transformation from physical plane to computational plane, using direct and inverse transformations. **(08 Marks)**

b. Derive the generic form of the governing flow equation with strong conservative form in the transformed space for 2D unsteady flow with no source term. **(08 Marks)**

Module-5

9 a. Write short notes on :
   i) Cell-centered technique
   ii) Cell-vertex technique. **(10 Marks)**

   b. With suitable expression explain explicit time stepping scheme. **(06 Marks)**

OR

10 Describe the following finite volume techniques with their applications :
   i) Flux vector splitting
   ii) Spatial discritization. **(16 Marks)**

* * * * *