CBCS SCHEME

USN | | | | | | | | |

18AE72

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

Time: 3 hrs.

Max. Marks: 100

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

Module-1

1 a. Derive an equation for substantial derivative and explain its physical significance. **(10 Marks)**
   b. Derive expression for continuity equation in integral form and differential form. **(10 Marks)**

OR

2 a. Draw neatly and explain about shock fitting and shock capturing technique. **(10 Marks)**
   b. Comment on partial differential equation and write no-slip boundary condition. **(06 Marks)**
   c. Write about different models of flow. **(04 Marks)**

Module-2

3 a. How does a quasi-linear partial differential equation classified? Explain using Cramer's rule. **(12 Marks)**
   b. Write about stability properties of explicit scheme on CFD. **(08 Marks)**

OR

4 a. Describe the general behaviour of different classes of partial differential equations. **(12 Marks)**
   b. Comment on supersonic blunt body problem using CFD with sketch. **(08 Marks)**

Module-3

5 a. Write about:
      (i) Need for grid generation in CFD
      (ii) Body fitted coordinate system. **(10 Marks)**
   b. Write short notes on:
      (i) Surface grid generation
      (ii) Mesh less grids and its advantages **(10 Marks)**

OR

6 a. Explain about different types of grids and its advantages. **(16 Marks)**
   b. Explain the role of grid control functions. **(04 Marks)**

Module-4

7 a. Explain the importance of discretization and transformation in CFD. **(10 Marks)**
   b. Derive Forward, Backward and Central difference approximations to the first derivative along with error terms. **(10 Marks)**

OR

8 a. For a 2D steady flow, continuity equation in Cartesian coordinates, obtain the transformation from physical plane to computational plane using direct and inverse transformation. **(10 Marks)**
   b. Differentiate between explicit and implicit approach of finite difference equations. **(10 Marks)**

Module-5

9 a. With neat sketch, explain Vertex-Centred and Cell-Centred schemes. **(10 Marks)**

   b. Write short notes on Flux Vector Splitting and Upwind Biasing. **(10 Marks)**

OR

10 a. Write the fundamental difference between FDM and FVM with neat sketch. **(10 Marks)**

   b. Explain about:
       (i)   Temporal discretisation
       (ii) Spacial discretisation **(10 Marks)**

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