CBCS SCHEME

USN

15AE72

Seventh Semester B.E. Degree Examination, June/July 2019
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. Why is CFD a research tool? Elaborate its importance in aerospace and non-aerospace applications. **(08 Marks)**

b. Describe various types of fluid flow models with suitable sketch and bring out what type of models leads to what type of governing equations forms. **(08 Marks)**

OR

2 a. Elaborate Euler form of NS equation. Derive the same for a finite volume Eulerian flow model along x-direction. **(05 Marks)**

b. Given the general form of governing equation suitable for CFD in care of steady, inviscid flow by explaining the terms involved in it and describe the procedure of obtaining primitive variables of the same. **(08 Marks)**

c. Differentiate between shock fitting and shock capturing methods with neat sketches. **(03 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. Explain the features of the following :
i) Structured grids
ii) Unstructured grids. **(08 Marks)**

b. Write a short notes on algebraic grid generation technique. **(08 Marks)**

OR

6 a. Brief the importance of various co-ordinate system in grid generation. **(06 Marks)**

b. Describe adaptive grids. **(10 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. Explain the dual-control technique in finite volume discritization. **(10 Marks)**

b. List and explain important features of an FVM. **(06 Marks)**

OR

10 a. Elaborate on numerical dissipation and dispersion. **(08 Marks)**

b. Describe flux vector splitting with an example. **(08 Marks)**

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