INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
B.Tech VI Semester End Examinations (Regular), November – 2020
Regulation: IARE–R16
COMPUTATIONAL AERODYNAMICS

Time: 2 Hours   (AE)   Max Marks: 70

Answer any Four Questions from Part A
Answer any Five Questions from Part B

PART – A

1. How can CFD influence the way swimmers improve their swimming strokes?   **[5M]**

2. Determine the quasi linear partial differential equation by using by Cramer's rule   **[5M]**

3. Write the advantages & disadvantages of implicit method and its applications in CFD techniques   **[5M]**

4. Obtain an expression for second order accuracy in both space and time by using the Lax Wendroff method explicitly.   **[5M]**

5. What are the features which separate the finite volume methods from the finite difference approach.   **[5M]**

6. Explain the physical meaning of divergence of velocity that frequently appears in the equations of fluid dynamics.
                [5M]

7. What is the need for classification of PDE and how do you classify second order PDE?   **[5M]**

8. Differentiate between structured grid and unstructured grid   **[5M]**

PART – B

9. What is substantial derivative? Obtain the expression for time rate of change of fluid element.   **[10M]**

10. Describe the details that CFD can capture in the simulation of hydro cyclones a process commonly used in the minerals industry?   **[10M]**

11. What are characteristic lines? Explain the philosophy of the Method of characteristics. Consider the full velocity potential equation for the steady, two dimensional supersonic flows and determine the equation for characteristic curves in the physical xy space and classify the nature of velocity potential equation based on Mach number.

                [10M]

12. Discuss the physical behavior of flows governed by parabolic equations with an example of steady boundary layer flows. Explain PNS model for high speed flows and explain its merits.   **[10M]**

13. Describe the formulation of central difference scheme for u velocity in the X direction. What is the truncation error in terms of x and state the order of this discretization scheme?   **[10M]**

14. Write short notes on the following properties of numerical solutions of fluid flows: i) Stability ii) Consistency iii) Accuracy iv) Convergence.   **[10M]**

15. Highlight PISO algorithm for solving incompressible viscous flow problems.   **[10M]**

16. Elaborate Crank-Nicolson implicit scheme used for solving the parabolic partial differential equations.   **[10M]**

17. Explain the reasons that make finite volume method superior to other discretization methods in CFD. Discuss the cell-centered and cell-vertex approaches to finite volume discretization using sketches.   **[10M]**

18. Obtain the formal expression of a conservative discretization by stating the theorem for the discretized equation.
                [10M]

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