Indian Maritime University

(A Cent5ral University, Govt of India)

Supplementary Examinations – March/April 2025

Programme Name: B.Tech (Marine Engineering)

Semester: Fifth

Subject Code: UG11T4501

Subject Name: Introduction to CFD

Date: 11.04.2025	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Fill in the Blanks of 01 Mark each.

1. Computational fluid dynamics is the analysis of systems involving _____ by means of computer-based simulation.

2. The rate of increase of mass in fluid element is equal to _____

3. Disturbance signals travel in all directions through the interior solution of _____ problems.

4. Marching problems are governed by _____ equations.

5. Hyperbolic equation type has _____ real characteristics.

6. Computational stability, convergence, and accuracy may be improved using multistep intermediate step between _____ schemes.

7. The first step in the finite volume method is to divide the domain into _____ control volumes.

8. A numerical scheme used for the solution of finite difference equations is stable if the error remains _____

9. Structured adaptive mesh is constructed by _____ function approach.

10. If temperature gradients are high, the fluctuation components of temperature can be very large, leading to _____ waves.

Section B

Five Questions of 02 Marks each

11. Write the steps for McCormack multistep scheme.
12. Discuss the application of fractional step methods.
13. What is hyperbolic grid generator?
14. What is point Gauss-Seidel iteration method?
15. Discuss in brief Jacobi iteration method.

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. Derive the unsteady, three-dimensional mass conservation or continuity equation at a point in a compressible fluid.
17. Explain equilibrium and marching problems with examples.
18. Describe Von Neumann stability analysis with an example.
19. Discuss adaptive methods for grid generation.
20. Explain total variation diminishing (TVD) property with its applications in CFD.
21. Derive Navier-Stokes equation for a Newtonian fluid.
22. Discuss explicit discretisation of the unsteady conductive heat transfer equation.