

Indian Maritime University

(A Central University, Govt of India)

Supplementary Examinations – March / April 2024

Programme Name: B Tech (Marine Engineering)

Semester: V

Subject Code: UG11T4501

Subject Name: INTRODUCTION TO CFD

Date: 26.03.2024

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

Answer All Questions

10X1=10 Marks

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. Marcing problems are governed by _____ equation
4. Navier-Stokes are _____ equations
5. CFD can be used to _____ the experimental results.
 - a) Replace
 - b) Improve
 - c) Convert
 - d) Interpret
6. which among these used to specify a particular problem which we consider for solving in CFD
 - a) Boundary condition
 - b) Governing equation
 - c) Governing laws
 - d) Solution method
7. The region of interest for analysis in CFD is called as

- a) Cell
- b) Grid
- c) Mesh
- d) Domain

8. Which of these is the oldest method for numerical solution of partial differential equations?

- a) Finite Element Method
- b) Finite Difference Method
- c) Finite Volume method
- d) Spectral Element Method

9. To obtain the derivatives of the variables with respect to the coordinates, which of these approximations are used in the Finite Difference Method?

- a) Taylor series and polynomial fitting
- b) Fourier series and polynomial fitting
- c) Taylor series and Fourier series
- d) Taylor series and interpolation

10. MacCormack's technique is _____

- a) explicit, finite-difference method
- b) implicit, finite-difference method
- c) explicit, finite volume method
- d) implicit, finite volume method

Section B

Answer All Questions

5X2=10 Marks

11. Evaluate $\int_4^{5.2} \ln x dx$ using trapezoidal rule

12. Why is it important to use CFD analysis?

13. Discuss substantial derivative

14. State the conservation laws of used in CFD

15. Discuss the i) Finite element method ii) Finite volume method

Section – C

Answer Any FIVE Questions

5X10=50 Marks

16. Solve $U_{xx} + U_{yy} = 0$ in $0 \leq x \leq 4, 0 \leq y \leq 4$, Given that $U(0, y) = 0, U(4, y) = 8 + 2y$, and $U(x, 0) = \frac{x^2}{2}, U(x, 4) = x^2$ taking $h=k=1$. Obtain the result correct to one decimal

17. Derive an equation for continuity in conservation form

18. Discuss the advantages of TVD scheme

19. Discuss the applications and advantages of adaptive grid refinement

20. Explain explicit and implicit approaches of discretization

21. Discuss the importance of grid transformation.

22. Explain Richardson and DuFort-Frankel methods

