RollNo. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, MAY 2024

MECHANICAL ENGINEERING
VI
ME5072 & COMPUTATIONAL TECHNIQUES FOR FLUID DYNAMICS
(Regulation 2019)

Time:3 hrs Max. Marks: 100

CO1	Apply the fundamentals of CFD, and develop case specific governing equations.
CO2	Perform finite difference and finite volume based analysis for steady and transient diffusion problems.
CO3	Implement various mathematical schemes under finite volume method for convention diffusion
CO4	Solve complex problems in the field of fluid flow and heat transfer with the support of high speed computers
CO5	Apply the various discretization methods, solution procedure and the concept of turbulence modeling.

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10x2= 20Marks)
(Answer all Questions)

Q. No.	Questions	Marks	CO	BL
1	What is meant by CFD and list out the application of CFD in Engineering field?	2	1	1
2	List down the advantages of CFD over experimental methods.	2	1	1
3	How do you classify the boundary conditions?	2	2	1
4	Differentiate between structured and unstructured mesh	2	2	2
5	What are limitations of using central difference scheme to solve fluid flow problems?	2	3	2
6	List out the advantage of FVM over FDM.	2	3	1
7	What is meant by stream function	2	4	1
8	Explain the application of PISO algorithms	2	4	1
9	What are the advantages and disadvantages of κ -ε model?	2	5	1
10	What are the three stages of CFD software?	2	5	1

PART- B (5x 13= 65 Marks)

(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
11 (a)	Write down the governing equations for fluid flow problem, and stating the assumptions in deriving the equation.	13	1	1
	OR			
11 (b)	What are the different types of partial differential equations and Explain the physical Behaviour of PDE.	13	1	2
12 (a)	Approximate the derivates of $f(x) = x^2+2x$ at $x=3$, using the central, forward and backward difference method.	13	2	2

	OR			
12 (b)	Derive the first order accurate forward difference and backward finite difference approximation for the second derivative of with respect 'X' using Taylor's series expansion.	13	2	1
13 (a)	Derive the 1 dimensional convection and diffusion equation.	13	3	1
	OR			
13 (b)	Compare upwind, and central difference approximations scheme for convection diffusion problems.	13	3	2
14 (a)	What is the checker-board problem? Explain in detail, how it can be solved using staggered grid arrangement.	13	4	2
	OR			
14 (b)	Explain in detail the step by step procedure for coupling pressure and velocity using SIMPLE algorithm.	13	4	2
15 (a)	Write a short notes on Turbulence models for Reynolds-averaged Navier–Stokes (RANS) equations.	13	5	2
	OR			
15 (b)	Explain in detail the standard k-ε model equations.	13	5	2

PART- C (1x 15= 15 Marks)
(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	Evaluate the function u, satisfying at the lattice point as follows: $\nabla^2=0$	15	2	3

2000	2000	2000	
1000	U1	U2	700
1000	U3	U4	0
1000	U5 1000	U6	0