Register Number:……..

KUMARAGURU
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B.E DEGREE EXAMINATIONS: NOV/DEC 2022

Regulation 2018

Fifth Semester

AERONAUTICAL ENGINEERING

U18AET5003: Computational Fluid Dynamics

COURSE OUTCOMES

CO1:	Explain the fluid modeling approaches
CO2:	Develop grids for different fluid flow applications.
CO3:	Analyze fluid flow problems using panel methods
CO4:	Make use of advanced simulation techniques to solve engineering applications using CFD codes such as Fluent, CFX, ROTCFD etc.,
CO5:	Apply appropriate schemes to solve fluid flow problems.
CO6:	Examine the CFD simulation results with validation

Time: Three Hours **Maximum Marks: 100**

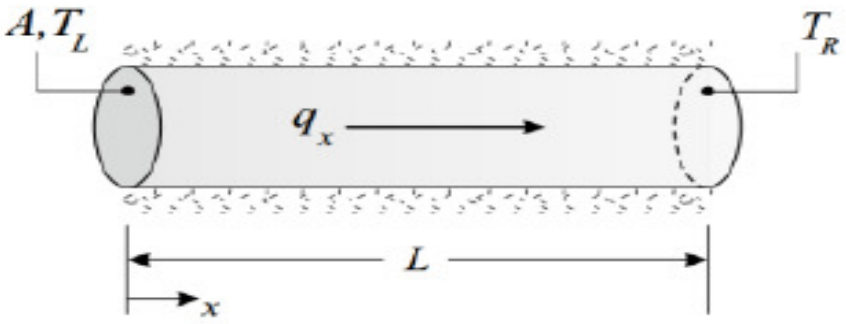
Answer all the Questions:-

PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	What are the most drawbacks can be accrued in computation through non-conservative based governing equations?	CO1	[K_2]
2.	In comparison, the Eulerian approach is more suitable to ANSYS Fluent than the Lagrangian approach. [Yes/No]. Explain your response.	CO1	[K_2]
3.	How does the central difference method work better for computational simulation?	CO2	[K_2]
4.	Enumerate the issues with the Lax-Wendroff approach.	CO2	[K_1]
5.	List the assumption made on the panel strengths in panel methods.	CO3	[K_1]
6.	In panel methods, which one of the portion in cambered airfoil is critical to predict the reliable outcomes? Explain	CO3	[K_2]
7.	State any four stability properties that explicit and implicit methods possess.	CO4	[K_1]
8.	Does numerical dissipation include as one of the truncation errors? Justify your response.	CO4	[K_2]
9.	List out the contributions of continuity equation in pressure based solver's computation.	CO6	[K_1]
10.	How does the adoption of an appropriate turbulence model aid in the achievement of a trustworthy result in computer simulations based on turbulent flow?	CO5	[K_2]

	Answer any FIVE Questions:- PART B (5 x 4 = 20 Marks) (Answer not more than 80 words)			
11.	Explicitly state the step-by-step processes involved in the creation of the mechanical energy conservation equation.	CO1	[K_2]	
12.	Name the discretization method that can deliver an accurate results using coarse mesh. Also, list out the procedures involved in that same method.	CO2	[K_2]	
13.	What are all the parts provides the contribution on the estimation of fluid properties at boundary layer domain from "X" momentum equation? Explain	CO5	[K_3]	
14.	Explain how panel methods are different from other conventional computational fluid dynamics methods?	CO3	[K_3]	
15.	Discuss five assumptions imposed in simplified Navier Stokes equation applicable at boundary layer domains.	CO6	[K_2]	
16.	Explain any four significant turbulence models that are compatible with pressure-based solvers.	CO5	[K_2]	

		Answer any FIVE Questions:- PART C (5 x 12 = 60 Marks) (Answer not more than 300 words)			
17.	a)	Derive the conservative form of momentum equation.	8	CO1	[K_3]
	b)	What are all the parts provides the contribution on the estimation of fluid properties at boundary layer domain in continuity equation?	4	CO6	[K_4]
18.	a)	Derive the approximations of forward, backward, and central schemes involved in Finite Difference Method.	8	CO2	[K_3]
	b)	Name the governing equations that are used to solve pressure based laminar flow computations on drone propeller.	4	CO6	[K_3]
19.	a)	Differentiate between source and vortex panel approaches.	8	CO3	[K_4]
	b)	Briefly explain how the set of algebraic equations are framed in panel methods for the estimation of panel strengths.	4	CO3	[K_3]
20.	a)	A cylinder of thickness L = 0.5 m with constant thermal conductivity k = 1000 W/m.K and uniform heat generation q = 0 kW/m^3. The cross sectional area A is	8	CO4	[K_4]

		0.01 m^2. The faces left and right of the cylinder are at temperatures of 500K and 1000K respectively. Determine the temperature distribution inside the solid cylinder by using 2 nodes [computational nodes]. Take the governing equation for this problem is $\frac{d}{dx}\left(k\frac{dT}{dx}\right) = 0$.  **Figure 1.** Solid Cylinder			
	b)	Sabarish intended to do a CFD simulation on a Multirotor UAV to determine the aerodynamic pressure distributions on the same UAV. Which discretization method is ideal for solving this real-time issue? Justify your response.	4	CO5	[K_4]
21.	a)	Derive the density relationship at next time state through the help of MacCormack method.	8	CO2	[K_3]
	b)	Why "predictor-corrector" philosophy needs in explicit method?	4	CO2	[K_3]
22.	a)	Differentiate Implicit and Explicit computational procedures using Finite Difference Method.	4	CO5	[K_4]
	b)	Elaborate on the computational processes used by SIMPLE pressure correction solvers to estimate fluid characteristics.	8	CO6	[K_4]

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