Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – WINTER 2023

Subject Code:3161915 Date:18-12-2023

Subject Name: Computational Fluid Dynamics

Time: 02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	What are the needs for problem solving with CFD?	**03**
	(b)	State application of CFD in the field of aeronautical.	**04**
	(c)	Derive Continuity equation for any model of finite control volume. fixed in space.	**07**
Q.2	**(a)**	Define Discretization.	**03**
	(b)	Derive the expression for substantial derivative.	**04**
	(c)	Derive energy equation in non conservation form.	**07**
		OR	
	(c)	Explain the classification of quasi-linear partial differential equation by using Cramer's rule.	**07**
Q.3	**(a)**	Explain inlet and outlet boundary condition	**03**
	(b)	Explain advantages and disadvantages of implicit approach.	**04**
	(c)	Using Taylor's series expansion 1st order forward, backward and 2nd order central difference formulas.	**07**
		OR	
Q.3	**(a)**	Draw a small element representing all the forces acting on it to derive a momentum equation in X direction.	**03**
	(b)	Write a short note on error and stability. And define the stable equation.	**04**
	(c)	Solve FVM problem for 1-D heat diffusion.	**07**
Q.4	**(a)**	Define: Truncation error Round-off error	**03**
	(b)	Discuss unstructured grid.	**04**
	(c)	Explain steps for CFD Preprocessing and CFD Post Processing.	**07**
		OR	
Q.4	**(a)**	What is Boundary Condition? State its importance in solving fluid flow problem.	**03**
	(b)	Write a note on stretched grid.	**04**
	(c)	Derive expressions to transform first derivatives w.r.t x, y & t to ξ, η & τ.	**07**
Q.5	**(a)**	What is grid transformation? Why it is required?	**03**
	(b)	Derive 2nd order derivative terms of Laplace equation in difference terms	**04**
	(c)	Write a short note on Lax-Wendroff technique	**07**
		OR	
Q.5	**(a)**	Explain factors affecting grid generation.	**03**
	(b)	Write a note on relaxation technique.	**04**
	(c)	Using Taylor's series, derive second order central difference for the mixed derivative expressions for $\left(\frac{\partial^2 u}{\partial x \partial y}\right)_{i,j}$	**07**

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