Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2015

Subject Code: 2140107 **Date:30/05/2015**

Subject Name: Computational Fluid Dynamics I

Time:10:30am-1.00pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	What is CFD? Why it is required? List the areas where it is applicable?	**07**
	(b)	Explain three different approaches of fluid dynamics? State the advantages of CFD over Experimental fluid dynamics?	**07**
Q.2	**(a)**	Using Taylor's series expansions derive 1st order forward difference, 1st order backward difference and 2nd order central difference.	**07**
	(b)	Derive Continuity equation for any two models of fluid flow.	**07**
		OR	
	(b)	Define difference equation. Derive difference approximation for unsteady, one dimensional heat conduction equation with constant thermal diffusivity.	**07**
Q.3	**(a)**	What is Descretization? Why it is required? List the basic descretization techniques.	**07**
	(b)	Using Taylor's series expansions derive 2nd order central second difference and 2nd order central difference for the mixed derivative.	**07**
		OR	
Q.3	**(a)**	Using Polynomial approach derive one sided 2nd order accurate difference quotient at the boundary.	**07**
	(b)	State the advantages and disadvantages of Explicit and Implicit approach.	**07**
Q.4	**(a)**	Explain FVM for one dimensional steady state diffusion problem.	**07**
	(b)	Draw the stencil diagram for following finite modules:	**07**

i. First order forward difference with respect to x
ii. Second order central mixed difference with respect to x and y
iii. Second order central difference with respect to x
iv. First order forward difference with respect to y
v. Second order central second difference with respect to x
vi. First order rearward difference with respect to y
vii. Second order central difference with respect to y

		OR	
Q.4	**(a)**	What do you mean Error and stability? Define stable solution and stable equation.	**07**
	(b)	Derive an exact analytic solution for Prandtl – Meyer expansion wave.	**07**
Q.5	**(a)**	What is Grid Transformation? Why it is required? Explain the same with an example of an airfoil.	**07**
	(b)	What is Grid? What are the factors affecting the grid? Explain structured and Unstructured grid.	**07**
		OR	
Q.5	**(a)**	Write a short note on Mac-cormack technique.	**07**
	(b)	Write a short note on Lax-wendroff technique.	**07**

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