Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V- EXAMINATION – SUMMER 2016

Subject Code: 150104 **Date: 06/05/2016**

Subject Name: Computational Fluid Dynamics-1

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.**

Q.1	**(a)**	Discuss forward difference and backward difference in detail with diagram.	**07**
	(b)	Differentiating between explicit approach and implicit approach for the solution of difference equations. Formulate the explicit form for 1-D heat conduction equation.	**07**
Q.2	**(a)**	Explain the aspects of discretization.	**07**
	(b)	Explain the concept Maccormack's Technique for linear equations and state the concept of stability and consistency	**07**
		OR	
	(b)	Write a short note on computational fluid dynamics as a research tool.	**07**
Q.3	**(a)**	Consider the viscous flow of air over a flat plate. Variation in velocity with respect to y is given as $u=1582(1-e^{\frac{-y}{L}})$, where L= 1 unit and μ=3.37×10-7slug/(ft.s). y is from 0 to 0.3 in the steps of 0.1. Find the percentage error in shear stress, involved in 1st ordered and 2nd ordered difference compared to exact solution.	**07**
	(b)	Derive the differential equation to unsteady 1-D heat conduction equation. Also define the accurate solution and precise solution	**07**
		OR	
Q.3	**(a)**	Explain in brief the momentum equation	**07**
	(b)	Explain the substantial derivative in brief.	**07**
Q.4	**(a)**	Explain the inviscid flow of Euler equations.	**07**
	(b)	Describe the model of an infinitesimally small fluid element moving with the flow in brief.	**07**
		OR	
Q.4	**(a)**	List out the fundamental physical principles of fluid flow. With a neat sketch explain the models of fluid flow and derive the continuity equation for the model of an infinitesimally small element fixed in space	**07**
	(b)	Explain the general methods of determining the classification of PDEs	**07**
Q.5	**(a)**	Define adiabatic wall temperature. Also explain physical boundary conditions for a viscous flow.	**07**
	(b)	Explain the setup of purely subsonic isentropic nozzle.	**07**
		OR	
Q.5	**(a)**	Write a short note on grid generation.	**07**
	(b)	Write a short note on shock fitting and shock capturing methods	**07**

****