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

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 150104 **Date: 27/04/2017**

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)**	Explain finite differences approaches in brief.	**07**
	(b)	With diagram explain the problems in transonic and supersonic compressible flow.	**07**
Q.2	**(a)**	Explain Euler's Forward time and backward space approximations also state Midpoint Leapfrog method	**07**
	(b)	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**
		OR	
	(b)	Write a note on grid generation.	**07**
Q.3	**(a)**	Describe the concept of stretched grid for viscous flow over a flate surface.	**07**
	(b)	Explain boundary conditions and initial conditions for a flat plate	**07**
		OR	
Q.3	**(a)**	Explain the substantial derivative in brief.	**07**
	(b)	Describe the model of an infinitesimally small fluid element moving with the flow in brief.	**07**
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 Lax Wendroff scheme in detail.	**07**
		OR	
Q.4	**(a)**	Explain in brief the model of the finite control volume moving with the fluid	**07**
	(b)	Discuss in brief the model of infinitesimally small fluid element moving with the flow.	**07**
Q.5	**(a)**	Discuss the basic role of characteristic lines in hyperbolic equations.	**07**
	(b)	Explain cfd as a research tool.	**07**
		OR	
Q.5	**(a)**	Discuss Navior stokes equations in brief	**07**
	(b)	Explain the momentum equation.	**07**

****