

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 $\mu = 3.37 \times 10^{-7}$ slug/ (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 flat 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 Navier stokes equations in brief **07**
 (b) Explain the momentum equation. **07**
