

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI- EXAMINATION – SUMMER 2016

Subject Code:160105

Date:11/05/2016

Subject Name:Computational Fluid Dynamics -II

Time: 10:30 AM to 01:00 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) Describe Oshero approximate Riemann solver. **07**
(b) Explain Godunov approach and state the development of the upwind scheme for the same. **07**
- Q.2** (a) Explain the need of beam warming approach and apply the same on multidimensional problem. **07**
(b) Draw the flow chart for main program for a supersonic viscous flow over a flat plate at zero incidences. **07**
- OR**
- (b) Briefly describe the flux splitting method. **07**
- Q.3** (a) Give the forms of Euler's equation and describe high resolution scheme. **07**
(b) Explain flux splitting method in first order upwind scheme for linear advection equation. **07**
- OR**
- Q.3** (a) How the expansion waves are generated? Derive the expression for the Prandtl-Mayer function for the expansion wave. **07**
(b) Get the roots of one dimensional, unsteady inviscid flow using the methods of Jacobians. **07**
- Q.4** (a) Explain the main transformation and inverse transformation of partial differential equations. **07**
(b) Explain the concept of the boundary conditions for the Prandtl Mayer expansion wave. **07**
- OR**
- Q.4** (a) Derive the pure form of the flux terms related to the setup of the subsonic supersonic isentropic nozzle. **07**
(b) Write the generic form for Euler's equation for a steady, two dimensional expansion waves and transform each term of Euler's set in terms of flux terms F_1, F_2, F_3 & F_4 **07**
- Q.5** (a) Explain the organization of Navier Stokes equation code for the supersonic viscous flow over the flat plate. **07**
(b) Explain purely subsonic flow through the CD nozzle. Also explain the boundary conditions for the same. **07**
- OR**
- Q.5** (a) Write a step wise procedure to apply the finite difference equation for the supersonic viscous flow over the flat plate. **07**

- (b) Consider a supersonic expanding flow through a corner of 15° . The properties at upstream the expansion wave are Mach 1.5, static pressure and static temperature are 1bar and 288K respectively. Get the stagnation and static properties at the downstream the expansion wave. Also find the angles that the forward and rearward Mach lines make with respect to upstream flow direction. **07**
