

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI • EXAMINATION – WINTER • 2014****Subject Code: 160105****Date: 03-12-2014****Subject Name: Computational Fluid Dynamics II****Time: 02:30 pm - 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) Why transformation is needed? Obtain equations of first derivative with respect to x, y & t to be transformed into derivatives with respect to ξ, η and τ . **07**
- (b) Explain the development of upwind scheme. Explain the same for first order wave equation. Also state the disadvantages of upwind scheme. **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 shear stress calculation 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) write a short note on high resolution schemes. **07**
- (b) Explain flux splitting method in first order upwind scheme for linear advection equation. **07**
- OR**
- Q.3** (a) a supersonic flow is expanded from the corner having the deflection angle of 10° . The upstream conditions are $M_1=2.2$, $P_1=2$ bar and $T_{01}=700K$. Obtain the flow static and stagnation properties downstream the expansion wave and the mach angles that the Mach lines made with the upstream flow direction. **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 Godunov Approach for the shock tube problem. **07**
- OR**
- Q.4** (a) Derive the flux terms for the 2-D, unsteady, viscous flow over the flat plate. **07**
- Q.4** (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 procedure to apply the shock capturing method in a subsonic, supersonic flow through the convergent divergent nozzle. **07**
- (b) Write a short note on Abbet's boundary conditions for the Prandtl Mayer expansion waves. **07**
- OR**
- Q.5** (a) Write a step wise procedure to apply the finite difference equation for the supersonic viscid flow over the flat plate. **07**
- (b) Write a short note on relaxation technique for low speed inviscid flow **07**
