Seat No.: _____ Enrolment No._____

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**

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