Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V EXAMINATION – WINTER 2015

Subject Code: 150104 **Date:05/12/2015**

Subject Name: Computational Fluid Dynamics-I

Time: 10:30am to 1:00pm **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 predictor and corrector step of McCormack technique.	**07**
	(b)	Derive the momentum equations for the subsonic-supersonic isentropic nozzle.	**07**
Q.2	**(a)**	Get the roots of unsteady, compressible, supersonic flow using Cramer's rule.	**07**
	(b)	Explain physical behavior of hyperbolic equations with the concept of characteristic lines.	**07**
		OR	
	(b)	Write a short note on Relaxation Technique.	**07**
Q.3	**(a)**	Explain FVM for 1-D steady state diffusion.	**07**
	(b)	Explain FDM, FEM and FVM in brief.	**07**
		OR	
Q.3	**(a)**	Apply forward difference, backward difference and central difference to first order and 2nd order simple partial derivatives.	**07**
	(b)	Explain the need of CFD software compared to wind tunnels.	**07**
Q.4	**(a)**	Transform the Laplace equation from (x,y) plane to (ξ,η) plane.	**07**
	(b)	Define substantial derivative and partial derivative. Derive the expression for the substantial derivative.	**07**
		OR	
Q.4	**(a)**	Write a brief on adaptive grid and stretched grid.	**07**
	(b)	Derive the differential equation for unsteady 1-D heat conduction equation. Also define the accurate solution and precise solution.	**07**
Q.5	**(a)**	Differentiate between explicit approach and implicit approach for the solution of difference equations. Formulate the explicit form for 1-D heat conduction equation.	**07**
	(b)	Draw and explain the subsonic-supersonic flow through the C-D nozzle and also show the variation in properties along the length of nozzle.	**07**
		OR	
Q.5	**(a)**	Write a short note on Physical boundary conditions for viscid and inviscid fluid flow	**07**
	(b)	Explain Lax Wendfroff method in detail.	**07**

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