Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME SEMESTER – I (OLD) EXAMINATION – SUMMER 2017

Subject Code: 711103N **Date:10/05/2017**

Subject Name: Fluid Mechanics and Gas Dynamics

Time: 02:30 P.M. to 05:00 P.M. **Total Marks: 70**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Define the continuity equation. Obtain the expression for continuity equation for a three dimensional flow.	**07**
	(b)	Write a brief note on: Eulerian and Langrangian methods for representing fluid flow.	**07**
Q.2	**(a)**	Derive the Navier-Stokes equation for viscous compressible fluid with constant viscosity.	**07**
	(b)	Obtain the generalized Bernoulli's equation from fundamentals.	**07**
		OR	
	(b)	Differentiate between: (i) stream function and velocity potential function (ii) stream line and streak line.	**07**
Q.3	**(a)**	Write in details about : (i) sources and sinks (ii) doublets and vortices	**07**
	(b)	Explain the Joukowski hypothesis.	**07**
		OR	
Q.3	**(a)**	Discuss about circulation and vorticity and find out their relation with each other.	**07**
	(b)	Prove that Laplace's equation $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = 0$ is satisfied for irrotational flow.	**07**
Q.4	**(a)**	Explain the different types of hydraulic similarities that must exist between a prototype and its model.	**07**
	(b)	What are the methods of dimensional analysis? Describe the Buckingham's method for dimensional analysis.	**07**
		OR	
Q.4	**(a)**	Prove that stagnation temperature and stagnation density are given as $T_s = T_1\left[1 + \frac{k-1}{2}M_1^2\right]$ and $\rho_s = \rho_1\left[1 + \frac{k-1}{2}M_1^2\right]^{\frac{1}{k-1}}$	**07**
Q.4	**(b)**	Define: (i) Mach number (ii) Sub-sonic flow (iii) supersonic flow (iv) sonic flow (v) Mach angle (vi) Mach cone (vii) compressibility factor	**07**
Q.5	**(a)**	Obtain expression for the critical pressure ratio for a compressible flow through a nozzle.	**07**
	(b)	Explain about supersonic pitot tube.	**07**
		OR	
Q.5	**(a)**	Flow through a convergent divergent nozzle depends on the downstream ambient pressure; explain which five possible cases of flow conditions are?	**07**
	(b)	What do you understand by the terms: stagnation point, stagnation pressure and stagnation temperature?	**07**

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