Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2150107 **Date:17/05/2016**

Subject Name:Aerodynamics I

Time:02:30 PM to 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)**	Write a short note on Normal Shock with neat sketch.	**07**
	(b)	Explain Pitot tube with neat sketch.	**07**
Q.2	**(a)**	Derive $a = \sqrt{rRT}$, where a = Speed of sound	**07**
	(b)	Write a short note on Oblique Shock with neat sketch.	**07**
		OR	
	(b)	Define Compressible flow. Explain "when is a flow Compressible?" with suitable example.	**07**
Q.3	**(a)**	Consider a point in an airflow where the local Mach number, static pressure, and static temperature are 3.5, 0.3 atm, and 180K, respectively. Calculate the local values of P_o, T_o, T*, a*, and M* at this point.	**07**
	(b)	What is vortex flow? With a neat sketch derive the expression for Velocity potential and stream function for vortex flow.	**07**
		OR	
Q.3	**(a)**	Draw and explain qualitative pictures of flow through oblique and normal shock waves.	**07**
	(b)	Consider a normal shock wave in a supersonic airstream where the pressure upstream of the shock is 1 atm. Calculate the loss of total pressure across the shock wave when the upstream Mach number is 1. M_1=2, 2. M_1=4. Compare these two results and comment on their implication.	**07**
Q.4	**(a)**	Consider a supersonic flow with M = 2, p = 1 atm, T = 288K. This flow is deflected at a compression corner through 20^0. Calculate M, p, T, p_0, and T_0 behind the resulting oblique shock wave.	**07**
	(b)	Define the terms: chord, camber, pressure surface, maximum thickness and zero lift angle	**07**
		OR	
Q.4	**(a)**	Derive the Energy equation.	**07**
	(b)	State Kutta Joukowsky Theorem. Derive an equation for it with a suitable diagram.	**07**
Q.5	**(a)**	With a neat sketch derive the Navier – Stokes momentum equation in Cartesian coordinates.	**07**
	(b)	Derive Bernoullie's equation with neat sketch.	**07**
		OR	
Q.5	**(a)**	Explain NACA Series with suitable examples.	**07**
	(b)	Derive equations for Lift and drag for Aerodynamic forces and moments.	**07**

****