Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – V (NEW) EXAMINATION – WINTER 2015

Subject Code: 2150107 **Date:14/12/ 2015**

Subject Name: Aerodynamics-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)**	What is Airfoil? Explain NACA 4-digit Series, 5-digit Series and 6 series with suitable diagram.	**07**
	(b)	What are the Aerodynamic forces and moments? Derive equations for Lift and drag with a suitable diagram.	**07**
Q.2	**(a)**	Derive Bernoulli's equation for incompressible flow.	**07**
	(b)	What is Shock Wave? Write a note on Normal Shock with a suitable diagram.	**07**
		OR	
	(b)	What is the function of Pitot Tube? How is it work?	**07**
Q.3	**(a)**	Explain Doublet Flow and derive an equation of Circulation and Vorticity for doublet flow.	**07**
	(b)	Derive an equation of Speed of Sound.	**07**
		OR	
Q.3	**(a)**	Write a note on Lifting Flow over a Circular Cylinder.	**07**
	(b)	Derive Θ-β-M relation.	**07**
Q.4	**(a)**	Write a note on Non-Lifting Flow over a Circular Cylinder.	**07**
	(b)	Write a note on Prandtl-Meyer Expansion Waves.	**07**
		OR	
Q.4	**(a)**	At a point in airflow, the pressure, temperature and velocity are 1 atm, 320 k and 1000 m/s. Calculate the total temperature and total pressure at this point.	**07**
	(b)	Consider an airplane flying at a velocity of 250 m/s. Calculate its Mach number if it is flying at a standard altitude of (a) sea level, (b) 5 km and (c) 10 km.	**07**
Q.5	**(a)**	State Kutta Joukowsky Theorem. Derive an equation for it with a suitable diagram.	**07**
	(b)	What is Airfoil Stalling? Explain it with a suitable diagram.	**07**
		. **OR**	
Q.5	**(a)**	Consider a normal shock wave in air where the upstream flow properties are u_1 = 680 m/s, T_1 = 288 K and p_1 = 1 atm. Calculate the velocity, temperature and pressure downstream of the shock.	**07**
	(b)	Consider an oblique shock wave with a wave angle of 30o. The upstream flow Mach number is 2.4. Calculate the deflection angle of the flow, the pressure and temperature ratios across the shock wave and the Mach number behind the wave.	**07**

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