Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – IV • EXAMINATION – WINTER 2012

Subject code: 140102 Date: 29/12/2012

Subject Name: Aerodynamics - I

Time: 02.30 pm - 05.00 pm Total Marks: 70

Instructions:

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

Q.1	**(a)**	Define the terms: aspect ratio, taper ratio, angle of incidence, upwash, downwash, lift and drag.	**07**
	(b)	Explain how the lift generated over the surface and prove that lift is directly proportional to the circulation.	**07**
Q.2	**(a)**	Write a short note on measurement of air speed at low speeds and high speeds.	**07**
	(b)	Explain the concept of continum and derive the continuity equation for the Cartesian coordinates.	**07**
		OR	
	(b)	Derive the energy equation for the Cartesian coordinates.	**07**
Q.3	**(a)**	Define the terms: chord, camber, pressure surface, suction surface, maximum thickness and zero lift angle.	**07**
	(b)	How normal shock, oblique shock and expansion waves are generated? Compare the flow properties behind the shock waves and expansion waves.	**07**
		OR	
Q.3	**(a)**	Classify the NACA series standard airfoils.	**07**
	(b)	What is doublet flow? With a neat sketch derive the expression for Velocity potential and stream function for doublet flow.	**07**
Q.4	**(a)**	Draw and explain the $C_L \rightarrow \propto$ curve with the importance for the same. Also define the performance coefficients for the aircraft.	**07**
	(b)	Define the forces and moments acting on an aircraft? Derive the expressions for aerodynamic coefficients	**07**
		OR	
Q.4	**(a)**	Derive Rankine-Hugoniot relations for oblique shock waves.	**07**
Q.4	**(b)**	State the Kutta Zukowsky theorm and With a neat sketch explain the significance of Kutta Zukowsky theorm.	**07**
Q.5	**(a)**	What is vortex flow? With a neat sketch derive the expression for Velocity potential and stream function for vortex flow.	**07**
	(b)	Derive the expression for Prandtl Mayer function for the expansion waves.	**07**
		OR	
Q.5	**(a)**	A gas at pressure of 3 bar, temperature of 350K and Mach number is 1.5 is to be isentropicaly expanded to 1.38bar. Determine the deflection angle, final Mach number, temperature and pressure of the gas.	**07**
	(b)	The stream of gas upstream of a normal shock wave is given by the following data: M_x=2.5, p_x=2 bat, T_x= 275 K. Calculate the Mach number, pressure, temperature and velocity of the gas downstream of the shock.	**07**

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