Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – WINTER 2013

Subject Code: 140102 **Date: 26-12-2013**

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)**	Derive momentum equation in cartesian coordinate system	**07**
	(b)	Explain airspeed measurement in supersonic flow and derive airspeed equation for the same.	**07**
Q.2	**(a)**	Define (1) angular rotation, (2) vorticity, (3) circulation, (4) stream function (5) velocity potential, (6) irrotational flow and (7) rotational flow	**07**
	(b)	Show that free vortex is an example of irrotational motion	**07**
		OR	
	(b)	Define doublet and derive equation for stream function and velocity potential for doublet.	**07**
Q.3	**(a)**	Explain flow past circular cylinder and show pressure distribution around cylinder	**07**
	(b)	Show that the potential function $\phi = ax \big/ \left(x^2 + y^2\right)$ represents the flow generated by doublet. In which direction is the doublet oriented?	**07**
		OR	
Q.3	**(a)**	Explain flow past rotating circular cylinder and show pressure distribution around cylinder	**07**
	(b)	A cylinder of radius 4cm is held with its centre at the point (0,0) in a fluid stream. At large distances from the cylinder the fluid velocity is constant at 30 ms^{-1} parallel to the *x* axis and in the direction of *x* increasing. Calculate the components of the fluid velocity at the point x = - 4cm and y = 1 cm.	**07**
Q.4	**(a)**	Explain pressure distribution on an airfoil with respect to various angles of attack.	**07**
	(b)	Explain shock expansion theory	**07**
		OR	
Q.4	**(a)**	Explain various types of drags on an airfoil	**07**
	(b)	What is a stagnation point and stagnation property? Derive equations for stagnation temperature, pressure and density	**07**
Q.5	**(a)**	Explain how shock wave generated? Explain oblique shockwave, normal shock wave, expansion wave and Mach wave.	**07**
	(b)	Prove that shockwave is irreversible and Mach number downstream the normal shockwave is always less than unity	**07**
		OR	
Q.5	**(a)**	Explain supersonic flow past wedge. Also explain variation of wedge angle and Mach number on shock strength and shock angle.	**07**
	(b)	Write notes on shock interaction and reflection	**07**

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