Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – WINTER • 2014

Subject Code: 140102 Date: 31-12-2014

Subject Name: Aerodynamics I

Time: 02:30 pm - 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)**	With a neat sketch derive the Navier – Stokes momentum equation in Cartesian coordinates.	**07**
	(b)	Write a short note on vortex flow with neat sketch.	**07**
Q.2	**(a)**	Prove that scalar function velocity potential exist only for potential flow.	**07**
	(b)	Derive Bernoullie's equation.	**07**
		OR	
	(b)	Explain the terms bound vortex, trailing vortex and explain why Prandtl's single horse theory failed.	**07**
Q.3	**(a)**	What is Normal shock wave? Explain with neat sketch.	**07**
	(b)	How the shock waves are generated into the flow field? Difference between Normal shock and Oblique shock.	**07**
		OR	
Q.3	**(a)**	State the assumptions for Kutta theorem and prove Kutta-Joukowsky lift theorem.	**07**
	(b)	Draw and explain the C_L vs α (alpha) curve for symmetrical and unsymmetrical airfoil.	**07**
Q.4	**(a)**	Derive algebraic form of fundamental lift equation using potential flow theory and show that lift is directly proportional to circulation.	**07**
	(b)	Prove that shock is irreversible in nature.	**07**
		OR	
Q.4	**(a)**	Derive Rankine Hugoniot Relations and prove that density down steam the shock is 6 times the upstream density.	**07**
	(b)	Explain with the help of diagram shockwave interaction and reflection.	**07**
Q.5	**(a)**	Explain airspeed measurement in supersonic aircraft. Derive equation for airspeed in supersonic flow.	**07**
	(b)	Derive the Energy equation.	**07**
		OR	
Q.5	**(a)**	Explain flow over a cylinder for subsonic flow with neat sketch.	**07**
	(b)	Explain basic elementary flow in terms of stream function and potential function.	**07**

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