Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI • EXAMINATION – WINTER 2013

Subject Code: 160101 **Date: 27-11-2013**

Subject Name: Aerodynamics - II

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 wing fuselage interference in incompressible flow	**07**
	(b)	1. What are the basic principles of vortex behavior? (Helmholtz's theorem) 2. What is the valid range of linearized velocity potential equations. 3. What is Downwash? 4. What is trailing vortex? 5. Define Profile drag with equation. 6. What is the Need of vortex sheet and vortex filament in the wing? 7. What is effective angle of attack?	**07**
Q.2	**(a)**	Explain the vortex sheet and the vortex panel numerical method	**07**
	(b)	Write a short on Flow over an airfoil for real case.	**07**
		OR	
	(b)	Write a short note on Airfoil drag for viscous flow case.	**07**
Q.3	**(a)**	Write notes on aerodynamics of airfoil, infinite wing and finite wing	**07**
	(b)	Consider the NACA 2412 airfoil; The data are given for two values of the Reynolds number based on chord length. For the case where $Re_c = 3.1*10^6$, estimate (a) the laminar boundary layer thickness at the trailing edge for a chord length of 1.5m and (b) the net laminar skin friction drag coefficient for the airfoil.	**07**
		OR	
Q.3	**(a)**	Explain steps for exact Joukowsky transformation process and its numerical solution.	**07**
	(b)	Explain in details with procedure about transformation of circle into symmetric airfoil	**07**
Q.4	**(a)**	State and prove Kelvin's circulation theorem. Also explain how circulation and starting vortex can be generated?	**07**
	(b)	Prove the Elliptical lift distribution equations for inviscid, incompressible flow with the help of prandtl's classical lifting line theory.	**07**
		OR	
Q.4	**(a)**	Prove the linearized velocity potential equation for linear theory.	**07**
Q.4	**(b)**	State Helmholtz's laws for vortex. Also explain how these laws are useful in finite wing theory?	**07**
Q.5	**(a)**	Explain and derive suitable mathematical equation Prandtl-Glauert compressibility correction.	**07**
	(b)	Explain application of linearized to supersonic airfoil	**07**
		OR	
Q.5	**(a)**	Derive lift and wave-drag coefficient for linearized supersonic flow.	**07**
	(b)	Explain critical Mach number, drag divergence Mach number, sound	**07**

barrier, Area rule and super critical airfoil. Is there any relation among the parameters or phenomenon mention? Explain.

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