Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(New) • EXAMINATION – WINTER 2016

Subject Code:2150107 **Date:30/11/2016**

Subject Name:Aerodynamics I

Time:10:30 AM to 01:00 PM **Total Marks: 70**

Instructions:

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

			MARKS
Q.1		**Short Questions**	**14**
	1	What do you mean by Aerodynamic Centre?	
	2	Would you define Mach number?	
	3	Explain different types of flow based on Mach number.	
	4	What do you mean by Centre of Pressure?	
	5	Write D'Alembert's Paradox.	
	6	What is Angle of Attack?	
	7	What is the purpose of the study of Aerodynamics?	
	8	What do you mean by Drag?	
	9	What is the purpose of flaps and slats in subsonic aircraft?	
	10	What is Sound?	
	11	Would you write the difference between aerodynamics for a symmetrical airfoil and a cambered airfoil?	
	12	Is lift and drag related to each other? How?	
	13	As an Aerodynamicist while designing a fighter jet wing, I select a NACA 0016. Am I correct in making this decision? Why?	
	14	In which type of flight vehicle you can use symmetrical airfoil?	
Q.2	**(a)**	How is lift produced over a wing?	**03**
	(b)	What do you mean by Stream Function and Velocity Potential? Explain.	**04**
	(c)	What is Airfoil? Explain NACA 4-digit Series, 5-digit Series and 6 series with suitable diagram.	**07**
		OR	
	(c)	Write a note on Rankine Oval Body.	**07**
Q.3	**(a)**	Explain Vortex flow with a neat sketch. Derive Stream function and Velocity potential for vortex flow.	**03**
	(b)	Derive Bernoulli's equation for incompressible flow.	**04**
	(c)	Explain Doublet Flow and derive an equation of Circulation and Vorticity for doublet flow.	**07**
		OR	
Q.3	**(a)**	Explain different types of Elementary Flows.	**03**
	(b)	What is the function of Pitot Tube? How does it work?	**04**
	(c)	Write a note on Lifting Flow over a Circular Cylinder.	**07**
Q.4	**(a)**	What is Oblique Shock? Explain with a neat sketch.	**03**
	(b)	Write a note on Vorticity and Circulation.	**04**
	(c)	Derive a relation between an Actual Mach number (M) and Characteristic Mach Number (M*).	**07**
		OR	

Q.4	**(a)**	What happens to the properties of flow when shock wave occurs? Explain for each property of flow.	**03**
	(b)	What is Airfoil Stalling? Explain it with a suitable diagram.	**04**
	(c)	Explain Prandtl-Meyer expansion waves.	**07**
Q.5	**(a)**	What is Shock Wave? Explain Different types of Shock with the help of diagram.	**03**
	(b)	When is a flow Compressible? Explain in brief.	**04**
	(c)	Derive Θ-β-M relation.	**07**
		OR	
Q.5	**(a)**	Write applications of Aerodynamics in various fields.	**03**
	(b)	State Kutta Joukowsky Theorem. Derive an equation for it with a suitable diagram.	**04**
	(c)	What are the Aerodynamic forces and moments? Derive equations for Lift and drag with a suitable diagram.	**07**

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