Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- V EXAMINATION-SUMMER 2023

Subject Code: 3150107 Date: 27/06/2023

Subject Name: Aerodynamics

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define Airfoil. What are the difference between airfoil and wing?	**03**
	(b)	Define Compressible flow and Incompressible flow.	**04**
	(c)	Explain NACA 6 series airfoil.	**07**
Q.2	**(a)**	Consider an airfoil in a flow at a standard sea level condition with a free stream velocity of 50 m/s. At a given point on the airfoil, the pressure is $0.9*10^5$ n/m^2. Calculate the velocity at this point.	**03**
	(b)	Explain with sketch and equations of Compressibility.	**04**
	(c)	Consider a point in airflow where the local Mach number, static pressure and static temperature are 3.5, 0.3, and 180K respectively. Compute the local values of Stagnation pressure, Stagnation temperature, T^*, a^*, and M* at this point.	**07**
		OR	
	(c)	Consider a Supersonic flow with M=2, p=1atm, and T=288K. This flow is deflected at a compression corner through 20^0. Calculate M, P, T, P_0, and T_o behind the resulting oblique shock wave. Take $\beta=53.4^0$	**07**
Q.3	**(a)**	Explain Normal shock with sketch.	**03**
	(b)	Explain Oblique shock with sketch.	**04**
	(c)	Derive Speed of Sound equation.	**07**
		OR	
Q.3	**(a)**	Explain in short:- Helmholtz's theorem.	**03**
	(b)	What is vortex filament? Explain	**04**
	(c)	Write a note on Delta wing.	**07**
Q.4	**(a)**	Explain in short:- Biot-Savart Law.	**03**
	(b)	Consider a thin flat plate at 5 degree angle of attack. Find out lift coefficient, moment coefficient about the leading edge and trailing edge.	**04**
	(c)	Explain classical thin airfoil theory for unsymmetrical airfoil.	**07**
		OR	
Q.4	**(a)**	Define flow separation.	**03**
	(b)	Write a note on Estimation skin friction drag for Laminar flow with equation.	**04**

	(c)	Explain classical thin airfoil theory for symmetrical airfoil.	**07**
Q.5	**(a)**	Define Lift and Drag with appropriate equation.	**03**
	(b)	Explain Lift curve.	**04**
	(c)	Write a note on kelvin circulation theorem with appropriate sketch and equations.	**07**

OR

Q.5	**(a)**	Write a statement of kutta conditions.	**03**
	(b)	Consider an NACA 2412 airfoil with a chord of 0.64 m in an airstream at standard sea level conditions. The freestream velocity is 70 m/s. the lift per unit span is 1254 N/m. Find out the drag per unit span. Where drag co-efficient is 0.0068.	**04**
	(c)	Draw and explain with neat sketch airfoil nomenclature.	**07**

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