Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2024

Subject Code:3150107 **Date:02-12-2024**

Subject Name:Aerodynamics

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

			Marks
Q.1	**(a)**	Define Kutta Condition.	**03**
	(b)	Discuss the effect of flow Separation on characteristics of an airfoil.	**04**
	(c)	Draw with nomenclature: Suction type subsonic wind tunnel	**07**
Q.2	**(a)**	State and explain: Kelvin's Circulation Theorem	**03**
	(b)	Describe how Bernoulli's principle helps generate lift on an airplane wing.	**04**
	(c)	Consider an airplane flying at a velocity of 250m/s. Calculate its Mach number if it is flying at a standard altitude of sea level and 10 km. Take Temperature at 10 km is 223K.	**07**
		OR	
	(c)	Explain Prandtl's classical lifting line theory.	**07**
Q.3	**(a)**	Define Vortex filament with suitable diagram.	**03**
	(b)	Differentiate between Symmetrical and Cambered Airfoil.	**04**
	(c)	Define Compressible flow. Explain "when is a flow Compressible?" with suitable example.	**07**
		OR	
Q.3	**(a)**	What are the main differences between normal and oblique shock waves?	**03**
	(b)	Explain detached shockwave in front of a blunt body.	**04**
	(c)	Draw schematics of a supersonic flow over a concave and convex corner.	**07**
Q.4	**(a)**	Differentiate between finite and infinite wing.	**03**
	(b)	Explain the importance of the angle of attack in relation to an aircraft's lift.	**04**
	(c)	Write continuity, momentum, and energy equation for a normal shock.	**07**
		OR	
Q.4	**(a)**	Discuss the aerodynamic characteristics of a delta Wing.	**03**
	(b)	Derive Speed of Sound equation.	**04**
	(c)	Analyze the factors that lead to stall and describe how it can be prevented.	**07**
Q.5	**(a)**	Write a note on Rarefaction wave.	**03**
	(b)	Explain supersonic flow over a corner.	**04**
	(c)	Explain 5 digit of NACA family with appropriate example.	**07**
		OR	

Q.5	**(a)**	What is the Biot-Savart law?	**03**
	(b)	Write a short note on Development of a shockwave with diagram.	**04**
	(c)	Consider a supersonic flow with $M = 2$, $p = 1\ atm$ and $T = 288\ K$. This flow is deflected at a compression corner through $20°$. Calculate M, p and T behind the resulting oblique shock wave. Take $\beta = 53.4°$.	**07**

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