GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2022

Subject Code:3150107   **Date:11-01-2023**
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.**

Q.1	**(a)**	What is the application of Airfoils?	**03**
	(b)	What is Airfoil Stalling? Explain it with a suitable diagram.	**04**
	(c)	Name the different types of Wind Tunnel and explain any one in detail.	**07**
Q.2	**(a)**	Define Incompressible flow and Compressible flow.	**03**
	(b)	Explain Airfoil Nomenclature and its characteristics.	**04**
	(c)	Explain Classical Thin Airfoil Theory for Symmetrical Airfoil.	**07**
		OR	
	(c)	Explain Flow over an airfoil real case.	**07**
Q.3	**(a)**	Define Kelvin's Circulation Theorem	**03**
	(b)	Write a short note on Delta Wing	**04**
	(c)	Explain the kutta condition with suitable diagram.	**07**
		OR	
Q.3	**(a)**	Explain Biot-Savart Law.	**03**
	(b)	Define Downwash and Induced drag with suitable diagram.	**04**
	(c)	Explain Prandtl's classical lifting-line Theory.	**07**
Q.4	**(a)**	Define Vortex flow with suitable diagram.	**03**
	(b)	Define Compressible flow. Explain "when is a flow Compressible?" with suitable example.	**04**
	(c)	Derive an equation of Speed of Sound.	**07**
		OR	
Q.4	**(a)**	What is critical Mach number and define critical pressure coefficient.	**03**
	(b)	What is Shock Wave? Write a note on Normal Shock with a suitable diagram.	**04**
	(c)	Derive Governing equation for inviscid compressible flow	**07**
Q.5	**(a)**	Consider an airplane flying at a velocity of 250 m/s. Calculate its Mach number if it is flying at a standard altitude of (a) sea level (T=288 k), (b) 5 km (T=255.7 k) and (c) 10 km (T=223.3 k). Take R=287, γ=1.4	**03**
	(b)	Explain with figure- reflection and interference of shocks.	**04**
	(c)	Explain Prandtl-Meyer relation in flow with normal shock waves	**07**
		OR	
Q.5	**(a)**	What is Oblique Shock? Explain with a neat sketch	**03**
	(b)	Consider a point in an airflow where the local Mach number, static pressure, and static temperature are 3.5, 0.3 atm, and 180 K, respectively. Calculate the local values of p_0, T_0, T^*, a$*$, and M^* at this point. Take $p0/p$ = 76.27 and $T0/T$ = 3.45, R=287, γ=1.4	**04**
	(c)	Derive Rankine-Hugoniot equation for flow with Oblique shock wave.	**07**

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