Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2023

Subject Code:3160113 Date:12-07-2023

Subject Name:Advance 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)**	Enlist the applications of hypersonic flow.	**03**
	(b)	Define aero thermodynamics and its need to study in the aviation.	**04**
	(c)	With a neat sketch explain the important physical phenomena associated with hypersonic flight	**07**
Q.2	**(a)**	What is Mach number independence?	**03**
	(b)	Derive the expression of pressure ratio following Basic hypersonic shock relations.	**04**
	(c)	What are the characteristics of supersonic airfoils? Draw and explain the variation in linearized pressure coefficient with Mach number varies from subsonic to supersonic range.	**07**
		OR	
	(c)	What is Newtonian flow model? How the centrifugal force corrections are applied to the basic Newtonian theory.	**07**
Q.3	**(a)**	What is aerodynamic heating? What are its aerodynamic effects during the flight?	**03**
	(b)	Explain the shock over a blunt body at hypersonic speed.	**04**
	(c)	Derive the hypersonic shock relation in terms of hypersonic similarity parameters.	**07**
		OR	
Q.3	**(a)**	What is the importance of Rayleigh flow and Fanno flow?	**03**
	(b)	Write a shot note on shock expansion method for in a view of hypersonic flow over a body.	**04**
	(c)	What are compressibility corrections? When they are applied to the flow?	**07**
Q.4	**(a)**	Apply the Prandtl-Glauert Compressibility correction and derive the expression of Cp.	**03**
	(b)	What is the difference between the subsonic airfoils, supersonic airfoils and supercritical airfoils?	**04**
	(c)	Write a short note on Newtonian sine-squared law.	**07**
		OR	
Q.4	**(a)**	What is the basic difference between tangent-wedge method and tangent-cone method when applied to the 2-D body?	**03**
	(b)	Derive linearized supersonic pressure coefficient formula.	**04**
	(c)	With neat sketch explain Area Rule.	**07**
Q.5	**(a)**	Define critical Mach number and drag divergence angle.	**03**
	(b)	Discuss in short “wave rider”.	**04**

	(c)	Consider a supersonic and hypersonic flow over a sharp pointed body where attached shock is formed. Draw and explain shock reflection pattern over the body following shock expansion theory.	**07**

OR

Q.5	**(a)**	State and explain modified Newtonian law.	**03**
	(b)	What is entropy layer and what are its effect on the body?	**04**
	(c)	Derive L/D = Cotα equation for flat plate using aerodynamic forces.	**07**

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