PRN:		Course Code :	UAE501

Third Year **B. Tech** End Semester Examination Winter 2024

High speed Aerodynamics

000106

Day and Date: Sat 30 Nov 2024 Max Marks: **100**

Time : 10:30AM To 01:30PM Duration: **03** hrs

Instructions: All questions are compulsory.

			Marks	Bloom's Level	CO
Q.1		**Attempt the following**			
	a)	What is a perfect gas? Give an example and What is the formula for internal energy in a perfect gas?	08	2	1
	b)	State the First Law of Thermodynamics in your own words	08	2	1
		OR			
	b)	What is a shock wave, and how does it affect airflow? And Explain what a normal shock wave is	08	3	1
Q.2		**Attempt the following**			
	a)	What are the basic equations used to analyze normal shock waves?	08	2	1
	b)	How is the speed of sound defined in compressible flow?	08	3	2
		OR			
	b)	Write the special form of the energy equation applicable to normal shock waves.	08	3	2
Q.3		**Attempt any two from the following**			
	a)	derive oblique shock wave relation, and how does it differ from a normal shock wave?	08	1	2
	b)	derive Prandtl-Meyer expansion wave relation, and when does it occur?	08	3	3
	c)	What is a detached shock wave, and where is it typically found?	08	3	3
Q.4		**Attempt any two from the following**			
	a)	What is compressible flow, and how does it differ from incompressible flow?	08	3	3
	b)	What is the primary function of a nozzle in a compressible flow system?	08	3	4
	c)	derive quasi-one-dimensional flow in compressible fluids?	08	2	4

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Q.5	**Attempt any Two of the following**				
	a)	What is the critical Mach number, and why is it significant in aerodynamics?	09	3	4
	b)	What is the drag-divergence Mach number, and how does it relate to the sound barrier?	09	2	4
	c)	What is the Prandtl-Glauert compressibility correction, and how is it applied in aerodynamic calculations?	09	3	5
Q.6	**Attempt any Two of the following**				
	a)	What are the primary factors contributing to drag in supersonic airfoils?	09	2	5
	b)	derive the linearized pressure coefficient formula for supersonic flow?	09	3	5
	c)	What is linearized supersonic flow, and how does it differ from subsonic flow?	09	3	5

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