PRN:		Course Code :	PAS105

000465

First Year M. **Tech** End Semester Examination Winter 2024

Advanced Aerodynamics

Day and Date: Wed 11 DEC 2024 Max Marks: **100**

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

Instructions:All questions are compulsory.

		Attempt the following questions	Marks	Bloom's Level	CO
Q.1	a)	Derive the general x-momentum equation for an unsteady 3-D in viscid flow in partial differential form using a control volume approach.	08	3	1
	b)	Define angular velocity, strain rate, vorticity and dilatation of a fluid element.	08	3	1
		OR			
	b)	Derive the expressions for stream function and velocity potential function.	08	3	1
Q.2		**Attempt the following question**			
	a)	Explain how the Joukowski's transformation is used to obtain a circular are aerofoil.	08	2	2
	b)	Explain Blasius theorem for a steady two dimensional irrotational flow.	08	2	2
		OR			
	b)	Enumerate the limitations and applications of Joukowski'saerofoil.	08	2	2
Q.3		**Attempt any two from the following**			
	a)	Derive the small perturbation equation for subsonic, transonic and supersonic flow.	08	2	3
	b)	Write short notes on "Elements of the Method of Characteristics". High light the internal points and wall points	08	2	3
	c)	Calculate theoretical lift co-efficient for above airfoil is in an incompressible flowis$c_l=2.\pi.a$ for$M_\infty=0.8$.	08	2	3
Q.4		**Attempt any two from the following**			
	a)	Describe the super-critical airfoils with the neat sketch and list the applications of super-critical airfoils	08	2	4
	b)	Explain about whitcombs transonic area rule.	08	2	4
	c)	Briefly explain the sound barrier and swept wings at transonic speed.	08	2	4

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Q.5		**Attempt any two of the following**			
	a)	Give a brief outline of operation of supersonic wind tunnels employing convergent -divergent nozzles?	09	2	5
	b)	Briefly explain the Impulse-Type Tunnels and Free Piston shock Tunnel with the neat sketch.	09	2	5
	c)	Write about supersonic wind tunnel operation and fluid properties along the flow direction	09	2	5
Q.6		**Attempt any Two of the following**			
	a)	Write about UAV aerodynamics of drone and its principle.	09	3	5
	b)	Calculate the lift and drag estimation of 1kg weight RC aircraft.	09	3	5
	c)	Explain the stability calculations for any unmanned aerial vehicles.	09	3	5

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