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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

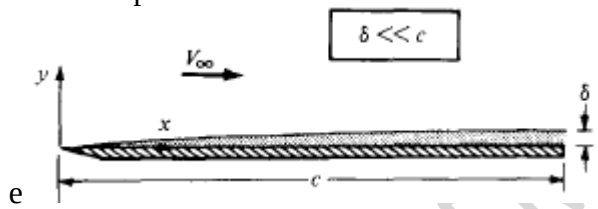
September / October 2023 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 22AS4PCBAD **Max Marks: 100**
Course: Basic Aerodynamics

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	Derive the equations for stream function ψ and velocity potential ϕ for a uniform flow superimposed with source and a sink flow.	CO1	PO1	**10**
	b)	Find the expression for stream function for lifting flow over a cylinder and give the lift per unit span and drag for the same?	CO1	PO1	**10**
		UNIT - II			
2	a)	Identify and explain the salient features of an airfoil with a neat sketch.	CO2	PO1	**06**
	b)	Explain the types and working of different high lift devices used on airplanes/aircrafts with neat sketches.	CO2	PO1	**08**
	c)	Describe the significance of Kutta condition and prove that the velocities on the top and bottom surface at the trailing edge of an airfoil are equal.	CO2	PO1	**06**
		OR			
3	a)	List the principal aerodynamic characteristics of an airfoil. Explain the variation of the aerodynamic characteristics of the airfoil subjected to fluid flow for a wide range of angle of attacks. Illustrate the same with neat sketches.	CO2	PO1	**08**
	b)	Derive the fundamental equation of thin airfoil theory which states that camber line to be a streamline of the flow.	CO2	PO1	**12**
		UNIT - III			
4	a)	Explain Kelvin's circulation theorem and the effect of starting vortex on the circulation over an airfoil.	CO3	PO1	**06**
	b)	Derive the fundamental equation of classical thin airfoil theory for a symmetric airfoil.	CO3	PO1	**10**

		c)	Illustrate the Biot Savart law by using vortex filament.	*CO3*	*PO1*	**04**
			UNIT - IV			
	5	a)	Describe how Kutta-Joukowski transformations are used for understanding the principles of airfoil design.	*CO4*	*PO1*	**10**
		b)	Explain the wing body interferences in aerodynamics.	*CO4*	*PO1*	**10**
			UNIT - V			
	6	a)	Explain thermal boundary layer and derive the displacement thickness.	*CO5*	*PO1*	**08**
		b)	Consider the incompressible, two-dimensional flow over a flat plate at 0° angle of attack, such as sketched in figure below. For the flow with $\rho = \mu = \frac{dp_e}{dx} = 0$, derive the equations for boundary layer over the flat plate. 	*CO5*	*PO2*	**12**
			OR			
	7	a)	Describe what is meant by boundary layer in fluid mechanics. Discuss the differences between the laminar and turbulent boundary layers and explain with illustration, how does the thickness of the boundary layer change as flow velocity increases?	*CO5*	*PO1*	**10**
		b)	Explain the important properties of boundary layer, with neat sketches and equations.	*CO5*	*PO1*	**10**

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