

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER- VI(NEW) – EXAMINATION – SUMMER 2019****Subject Code: 2160101****Date: 10/05/2019****Subject Name: Aerodynamics II****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.

		MARKS
<b>Q.1</b>	(a) Plot Variation of $C_L$ with Re, and aspect ratio.	<b>03</b>
	(b) Define mean aerodynamic chord [MAC] and procedure to find MAC.	<b>04</b>
	(c) Derive expression for classical thin airfoil theory.	<b>07</b>
<b>Q.2</b>	(a) Define:- Turbulent flow, Transition and dihedral.	<b>03</b>
	(b) State Kelvin Circulation Theorem.	<b>04</b>
	(c) Explain The Vortex lattice method.	<b>07</b>
<b>OR</b>		
	(c) Explain Kutta-Joukowski Transformation and details procedure about transformation of circle into symmetric airfoil.	<b>07</b>
<b>Q.3</b>	(a) Write Kutta Condition and explain with sketch.	<b>03</b>
	(b) Differentiate between finite and infinite wing. Derive expression for 'a' ( $C_L$ - $\alpha$ slope) and 'a <sub>0</sub> '	<b>04</b>
	(c) What is Transformation? Explain transformation of a circle into a straight line with a neat sketch.	<b>07</b>
<b>OR</b>		
<b>Q.3</b>	(a) What is bound vortex and Horse shoe vortex?	<b>03</b>
	(b) Explain Numerical Nonlinear Lifting Line Method	<b>04</b>
	(c) Explain Prandtl lifting line theory and derive expression for downwash velocity.	<b>07</b>
<b>Q.4</b>	(a) Explain Prandtl-Glauert Compressibility correction,	<b>03</b>
	(b) Explain formation of primary and secondary vortex on delta wing.	<b>04</b>
	(c) Derive Linearised Supersonic Pressure Coefficient formula.	<b>07</b>
<b>OR</b>		
<b>Q.4</b>	(a) Explain the area rule with neat sketch.	<b>03</b>
	(b) At a given point on the surface of an airfoil, the pressure coefficient is -0.3 at very low speeds. If the free stream Mach Number is 0.6. Calculate $C_p$ at this point.	<b>04</b>
	(c) Derive expression for induced velocity by finite and infinite ,vortex tube	<b>07</b>
<b>Q.5</b>	(a) What is whitcomb airfoil	<b>03</b>
	(b) A straight finite wing has aspect ratio 8 operating at angle of attack $4^\circ$ . calculate $C_{Di}$ (induced drag coefficient) and $C_L$ assume that wing identical to flat plate	<b>04</b>
	(c) Using KJT transform cylinder into symmetrical airfoil	<b>07</b>

**OR**

- Q.5** (a) State Helmholtz's theorem **03**
- (b) Consider flow over the NACA 2412 airfoil where  $Re_x = 3240000$ . Calculate the boundary layer thickness at 1.5 m from leading edge **04**
- (c) Define Critical Mach number and Drag Divergence Mach Number? Explain both the terms in detail with a proper diagram. **07**

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