

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- V (New) EXAMINATION – WINTER 2019

Subject Code: 2150107
Date: 29/11/2019
Subject Name: Aerodynamics I
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. Theta and Beta chart is allowed.

		MARKS
Q.1	(a) Define Wash in and Wash Out.	03
	(b) Define Circulation and write mathematical expression of all components of vorticity.	04
	(c) Define drag and explain - form drag, skin friction drag, induced drag.	07
Q.2	(a) Define Lift and draw C_L v/s α plot symmetrical and unsymmetrical airfoil	03
	(b) Derive the expression for speed of sound in term of temperature	04
	(c) Explain NACA 4 digits and 5 digits airfoil.	07
	OR	
	(c) What are the Aerodynamic forces and moments? Derive equations for Lift and drag with a suitable diagram.	07
Q.3	(a) Explain Potential and stream function also express u and v in term of it	03
	(b) Define Vortex flow and Explain Magnus Effect	04
	(c) Explain doublet flow and derive expression of potential and stream function for doublet flow.	07
	OR	
Q.3	(a) Define Potential Flow.	03
	(b) Explain span-wise pressure distribution of flow over wing. What is cause of tip vortex generation?	04
	(c) Derive expression of potential and stream function for source and sink pair flow also draw stream and potential lines	07
Q.4	(a) What is critical Mach number and define critical pressure coefficient	03
	(b) What is Airfoil Stalling? Explain it with a suitable diagram.	04
	(c) Consider an oblique shock wave with a wave angle of 30° . The upstream flow Mach number is 2.4. Calculate the deflection angle of the flow, the pressure and temperature ratios across the shock wave and the Mach number behind the wave.	07
	OR	
Q.4	(a) Write a note on Lifting Flow over a Circular Cylinder.	03
	(b) Explain with figure- reflection and interference of shocks.	04
	(c) Derive Θ - β -M relation.	07
Q.5	(a) Define Incompressible flow and Compressible flow.	03
	(b) Derive Rankine Hugoniot.	04

- (c) Derive relation for mach number upstream (M_1) and downstream (M_2) of oblique shock wave. **07**

OR

- Q.5** (a) Write the applications of airfoil in three different fields **03**
(b) Consider a normal shock wave in air where the upstream flow properties are $u_1 = 680$ m/s, $T_1 = 288$ K and $P_1 = 1$ atm. Calculate the velocity, temperature and pressure downstream of the shock. **04**
(c) Explain expansion and compression wave and derive Prandtl-Meyer relation. **07**

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