

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V(New) • EXAMINATION – WINTER 2016

Subject Code:2150101

Date:24/11/2016

Subject Name:Flight Mechanics

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
Q.1	Short Questions	14
	1 Why is drag produced?	
	2 Does coefficient of lift vary with Reynolds number? Why?	
	3 In which part of the airfoil is maximum lift produced?	
	4 Write the equation of Pressure Coefficient	
	5 Is Prandtl-Glauert Rule valid for near supersonic speeds? Why?	
	6 Why supersonic airfoils are selected to be relatively thin?	
	7 Whether the thrust requirement of an aircraft decreases/increases with velocity? Why?	
	8 When thrust required is minimum, _____ is maximum?	
	9 List types of static stability.	
	10 What happens when an aircraft is trimmed?	
	11 List the necessary criteria for longitudinal balance and stability.	
	12 List the range of Mach numbers in subsonic, transonic, supersonic and hypersonic categories.	
	13 Define streamlines.	
	14 Is the behavior of flow past a needle shaped body and a wedge shaped body same/different? Why?	
Q.2	(a) Distinguish between Infinite and Finite wings.	03
	(b) How does thickness of airfoil affect Critical Mach number? Explain with a neat sketch.	04
	(c) Discuss types of drag and explain Induced Drag in detail.	07
	OR	
	(c) Derive equation to calculate Rate of Climb.	07
Q.3	(a) Discuss Wave Drag.	03
	(b) Explain Gliding Flight.	04
	(c) With neat sketch explain V-n diagram.	07
	OR	
Q.3	(a) How does tail plane plays an important role in the stability of the airplane?	03
	(b) How do you define Static and Dynamic Stability?	04
	(c) Write a note on Neutral Point.	07
Q.4	(a) Explain Prandtl-Glauert rule.	03
	(b) A wing-body model is tested in a subsonic wind tunnel The lift is found to be zero at a geometric angle of attack of -1.5° . At an angle of attack of 5° , the lift coefficient .52. Also at angle of attack of 1° & 7.88° the moment coefficients about the center of gravity are measured as -0.01 & 0.05 respectively. The center of gravity is located at 0.35c. Calculate the location of the aerodynamic center and the value of $C_{M,ac}$ of wing-body combination.	04

- (c) Write a note on Directional Stability. **07**
- OR**
- Q.4** (a) Distinguish between Infinite and Finite wings. **03**
- (b) Derive formula to Calculate Thrust required for level, unaccelerated flight. Also derive aerodynamic condition for minimum thrust required. **04**
- (c) Write a note on Lateral Stability. **07**
- Q.5** (a) How does thickness of airfoil affects Critical mach number? **03**
- (b) What is Lift Augmentation? Explain its significance. **04**
- (c) Derive formula to calculate Lift off distance. **07**
- OR**
- Q.5** (a) Write a short note on Drag Divergence Mach number **03**
- (b) Derive formula to Calculate Power required for level, unaccelerated flight. Also derive aerodynamic condition for minimum power required. **04**
- (c) Derive Breguet Range formula. Also list out important points to maximize the range for reciprocating engine, propeller driven airplane. **07**
