Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2020

Subject Code:3150101 Date:27/01/2021

Subject Name:Flight Mechanics

Time:10:30 AM TO 12:30 PM Total Marks: 56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			Marks
Q.1	**(a)**	Define: Geometric Altitude, Absolute Altitude, Geo-potential Altitude	**03**
	(b)	What is ISA? Why it is required?	**04**
	(c)	Derive equations of motion for an airplane in steady level flight.	**07**
Q.2	**(a)**	Define: Pressure altitude, Temperature altitude and Density altitude.	**03**
	(b)	With neat sketch explain the effect of altitude on power required and power available.	**04**
	(c)	Show that Thrust required for steady level flight is inversely proportional to Aerodynamic efficiency (Lift to drag ratio). Also show that zero lift drag is equal to induced drag for minimum thrust requirement condition.	**07**
Q.3	**(a)**	Solve the following: What is the minimum glide angle and maximum range measured along the ground for the airplane having maximum lift to drag ratio 16.9 and power-off glide starts at an altitude of 3048 m?	**03**
	(b)	Define: Static and Dynamics Stability.	**04**
	(c)	Develop an expression to determine the range and endurance for propeller driven airplane.	**07**
Q.4	**(a)**	What is Static Margin? Explain.	**03**
	(b)	What is Neutral point? Explain.	**04**
	(c)	Estimate lift-off distance for the CJ-1 (data given below) at sea level. Assume μ_r=0.02. During the ground roll, the angle of attack of the airplane is restricted by the requirement that the tail do not drag the ground. Assume that C_{Lmax} during ground roll is limited to 1. When the airplane is on the ground, the wings are 1.83 m above the ground. **Data for the CJ-I:-** **Wing Span: 16.25 m**	**07**

Wing area: 29.54 m^2

Normal gross weight: 81767.5 N

Power plant: Two turbofan engines of 16242.5 N thrust *each*

$C_{D,0}$=0.02

e=0.81

Q.5	**(a)**	Define Absolute and Service Ceilings.	**03**
	(b)	What is Neutral point? Explain.	**04**
	(c)	State and explain the criteria for airplane's longitudinal static stability. Justify role of Horizontal stabilizer.	**07**
Q.6	**(a)**	What is Hinge Moment? How it varies with tail deflection angle?	**03**
	(b)	What do you mean by Elevator effectiveness? Explain.	**04**
	(c)	Explain steady pull-up and elevator deflection required for it.	**07**
Q.7	**(a)**	Compare Stick free and Stick fixed stability.	**03**
	(b)	Explain Stick Force and force gradient.	**04**
	(c)	Show that stick free neutral point is always ahead of stick fixed neutral point.	**07**
Q.8	**(a)**	Explain role of dihedral angle in Lateral stability.	**03**
	(b)	Explain Directional Control.	**04**
	(c)	Write a note on Directional stability.	**07**