Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – IV • EXAMINATION – WINTER 2012

Subject code: 140104 **Date: 31/12/2012**

Subject Name: Institute Elective: Fundamentals of Aeronautics

Time: 02.30 pm - 05.00 pm **Total Marks: 70**

Instructions:

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

Q.1	**(a)**	Derive the equation to obtain range and endurance of Jet aircraft.	**07**
	(b)	Draw and explain operation of turbojet and turbofan engines.	**07**
Q.2	**(a)**	Describe NACA 4-digit, 5-digit and 6 series nomenclatures with proper examples.	**07**
	(b)	Derive the equation for Steady rate of climb. How does rate of climb vary with flight velocity? **OR**	**07**
	(b)	An aircraft with mass 4000kg and wing area of 27.5 m^2 is flying at an altitude where the air density is 0.819 kg/m^3. If Aspect ratio of its wings is 7, Oswald efficiency factor is 0.9 and Parasite drag coefficient is 0.03, calculate the thrust required to maintain a steady level flight with velocity of 350 km/h.	**07**
Q.3	**(a)**	What is the basic mechanism that generates Aerodynamic forces on a wing? Derive the equations for those forces.	**07**
	(b)	An aircraft of weight 73000lbs is flying with a velocity of 500ft/s. The density of ambient air is $8.9X10^{-4}$ $slug/ft^3$, wing area and Aspect ratio are 950 ft^2 and 5.92 respectively. Parasite drag coefficient is 0.015 and efficiency factor is 0.9. If the aircraft has two turbojet engines with 8000 lbs of thrust provided by each, what is the maximum rate of climb?	**07**
		OR	
Q.3	**(a)**	Define the following I. Drag divergence Mach number II. Absolute and Service Ceilings III. Center of pressure	**07**
	(b)	An aircraft of weight 5000 kg flying in a steady level flight under the minimum power requirement condition. Wing span of the aircraft is 9.2 m and the wing area is 16.55m^2. Find the velocity of the aircraft and the Thrust required for the flight. Density of ambient air is 0.819 kg/m3, Oswald Span Efficiency factor is 0.81 Parasite drag coefficient is 0.02	**07**
Q.4	**(a)**	Write a short note on finite wing and downwash. Mention effects of downwash.	**07**
	(b)	a. Show how the value of lift coefficient varies with angle of attack for symmetric and cambered airfoil and hence explain stalling of airfoil.	**04**
		b. Describe how the distance covered during gliding flight is independent of weight of the aircraft.	**03**

OR

Q.4	**(a)**	Explain the following a. Relationship between load factor and Aircraft design b. Aircraft category system with limit load factors. c. Loads exerted on aircraft.	**07**
Q.4	**(b)**	Explain types of fuselages with figure and stresses acting on aircraft structural member with example.	**07**
Q.5	**(a)**	Describe fuselage structure of transport aircraft in details, section with components in brief with figures.	**07**
	(b)	Show requirements of passenger's compartment windows, their structural construction with components and figure.	**07**

OR

Q.5	**(a)**	Explain aircraft landing gear classification, configuration and disadvantages of tail wheel arrangement with figure.	**07**
	(b)	What is the use of doublers on aircraft structure? Show location with usage. Define semi cantilever wings with applications, control surfaces, firewall and empennage.	**07**

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