GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. Sem. - V - Examination – June- 2011
Subject code: 150101
Subject Name: Flight Mechanics

Date:20/06/2011   **Time: 10:30 am – 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.**

Q.1	**(a)**	With help of sketch explain working principles of Pitot static tube used for air speed measurement for incompressible, subsonic compressible and supersonic flow.	**07**
	(b)	Explain any two high lift devices and their working principles with the help of neat sketches	**07**

Q.2	**(a)**	For International Standard Atmosphere, explain variation of temperature, pressure variation with altitude with the help of neat and proper diagram. Also define lapse rate, stratosphere and troposphere	**07**
	(b)	Derive expression for coefficient of lift and coefficient of drag from the pressure coefficient.	**07**

OR

	(b)	Explain Coefficient of lift versus angle of attack curve. What is stalling of an airfoil? What is deep stall?	**07**

Q.3	**(a)**	Explain the various techniques for increasing the lift with the help of suitable diagrams and examples?	**07**
	(b)	Consider the Gulfstream IV twin-turbofan executive transport flying at an altitude of 30,000 ft, assuming a weight of 73000 lb. Airplane data : wing area = 950 ft^2, aspect ratio = 5.92, C_{D0} = 0.015 and K = 0.08. Calculate thrust required, minimum thrust required and the velocity at which it occurs. Assume drag polar as $C_D = 0.015 + 0.08C_L^2$	**07**

OR

Q.3	**(a)**	Explain static stability, dynamic stability and control	**07**
	(b)	Consider the Gulfstream IV twin-turbofan executive transport flying at an altitude of 30,000 ft, assuming a weight of 73000 lb. Airplane data : wing area = 950 ft^2, aspect ratio = 5.92, C_{D0} = 0.015 and K = 0.08. Calculate the maximum values of $C_L^{3/2}/C_D$, C_L/C_D and $C_L^{1/2}/C_D$ as well as the flight velocities at which they occurs. Assume drag polar as $C_D = 0.015 + 0.08C_L^2$	**07**

Q.4	**(a)**	Explain neutral point and static margin	**07**
	(b)	For the Gulfstream IV twin-turbofan executive transport flying at an altitude of 30,000 ft, assuming a weight of 73000 lb. Airplane data are as follows: wing area = 950 ft^2, aspect ratio = 5.92, C_{D0} = 0.015 and K = 0.08. Using the appropriate analytical expressions, calculate directly the	**07**

values of $\theta_{max}, V_{\theta_{max}}, \left(R/C\right)_{max}$ and $V_{(R/C)_{max}}$. Assume drag polar as $C_D = 0.015 + 0.08C_L^2$

OR

Q.4	(a)	Calculate elevator angle for trim	07
	(b)	A blunt nose Pitot tube is placed in supersonic wind tunnel to estimate the flow Mach number. The stagnation pressure at the entrance to the Pitot tube is 2 bar. The free stream static pressure ahead of the shock wave is measured by a static pressure tap in the wall of the tunnel and is 0.15 bar. Estimate the Mach number in tunnel	07

Q.5	(a)	Explain induced drag and wave drag	07
	(b)	Explain swept back wing with neat and proper sketch	07

OR

Q.5	(a)	What is compressibility correction and why it is necessary?	07
	(b)	Explain absolute and service ceilings. Also explain geopotential and geometric altitudes	07

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