

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER V • EXAMINATION – WINTER - 2012****Subject code: 150101****Date: 11-01-2013****Subject Name: Flight Mechanics****Time: 02:30 pm to 05:00 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) Derive the equation to obtain range and endurance of Jet aircraft. **07**
 (b) Draw and explain v-n diagram for a typical jet aircraft. **07**
- Q.2** (a) Describe how lift coefficient can be obtained from pressure coefficient for a thin airfoil in Inviscid flow. **07**
 (b) Explain Static and Dynamic Stability with subtypes. **07**
- OR**
- (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) Derive the equation for Steady rate of climb. How does rate of climb vary with flight velocity? **07**
 (b) An aircraft of weight 73000lbs is flying with a velocity of 500ft/s. The density of ambient air is $8.9 \times 10^{-4} \text{ slug/ft}^3$, 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 **07**
 I. Drag divergence Mach number
 II. Absolute and Service Ceilings
 III. Center of pressure
 (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 16.55 m^2 . Find the velocity of the aircraft and the Thrust required for the flight. **07**
 Density of ambient air is 0.819 kg/m^3 ,
 Oswald Span Efficiency factor is 0.81
 Parasite drag coefficient is 0.02
- 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. **07**
 b. Describe how the distance covered during gliding flight is independent of weight of the aircraft.
- OR**
- Q.4** (a) What is the difference between term- “Power required for flight” and “Power Available for flight”. Explain with necessary graphs. **07**
 (b) Explain vector diagram of turning level flight. **07**
- Q.5** (a) Why lift requirement by wing is less than required at cruise while power climbing. Explain with vector diagram. **07**
 (b) What do you understand by lift augmentation system? What are lift augmentation devices are used in aircraft? **07**
- OR**
- Q.5** (a) Their effects regarding location of Geometric Aerodynamic Centre, C.P, Attitude, Change in C.G etc. **07**
 (b) Definitions and vectoring effects of power flaps with neat sketches **07**
