

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V • EXAMINATION – WINTER 2013****Subject Code: 150101****Date: 27-11-2013****Subject Name: Flight Mechanics****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) Derive the condition for Optimum power requirement during steady level flight. **07**
 (b) Derive the equation for liftoff distance. **07**

- Q.2** (a) Derive the condition for Optimum thrust requirement during steady level flight. **07**
 (b) An aircraft of mass 5000 kg is flying at an altitude of 4.5 km where air density is 0.77 Kg/m³. If the aircraft is flying with minimum Thrust requirement condition what would be the velocity of the aircraft? The aspect ratio of aircraft is 6.5, wing area is 13 m², Efficiency factor is 0.9 and parasite drag coefficient is 0.015. Calculate the value of Induced Drag. **07**

OR

- (b) An aircraft of mass 5000 kg is flying at an altitude of 4.5 km where air density is 0.77 Kg/m³. If the aircraft is flying with minimum power requirement condition what would be the velocity of the aircraft? The aspect ratio of aircraft is 6.5, wing area is 13 m², Efficiency factor is 0.9 and parasite drag coefficient is 0.015. Calculate the value of Induced Drag. **07**

- Q.3** (a) 1. Define Absolute ceiling and Service Ceiling. **02**
 2. Explain Drag divergence Mach number and Critical Mach number. **02**
 3. Mention the condition for the maximum Endurance and Maximum Range for a Jet aircraft and Propeller driven aircraft. **03**
 (b) What is International standard atmosphere? Explain the variation of temperature with altitude in standard model of atmosphere. **07**

OR

- Q.3** (a) 1. Explain how “time to climb” can be graphically calculated. **05**
 2. Define pressure altitude and Geometric altitude. **02**
 (b) What is geo-potential altitude? Derive its relation with geometric altitude. **07**

- Q.4** (a) 1. Define pressure coefficient and derive the relation to obtain lift coefficient from C_p . **05**
 2. Define Stick fixed static stability **02**
 (b) 1. Explain Drag polar with the necessary relation between the two quantities involved in it and its importance. **05**
 2. Mention the conditions on static margin for a statically stable configuration. **02**

OR

- Q.4** (a) 1. Draw the lift curve for a symmetrical airfoil and hence explain the stalling of an airfoil with the reasons responsible for stalling. **05**
 2. Mention the condition for location of Neutral point for a statically stable configuration. **02**
 (b) 1. Explain gliding flight. Derive its equation of motion and explain how the glide distance is independent of the weight of the glider. **05**
 2. Define Neutral Point and Static Margin. **02**

- Q.5** (a) An aircraft of mass 4500 kg is flying at sea level where air density is 1.23 Kg/m³. If the aircraft has two turbojet engines with thrust rating of 4KN each, What would be the Rate of climb at the flight velocity of 90 m/s? The aspect ratio of aircraft is 6, wing area is 11 m², Efficiency factor is 0.81 and parasite drag coefficient is 0.02. **07**
- (b) An airplane has a mass of 1500 Kg. It is turning on a horizontal circle of radius 100 m at airspeed of 41 m/s. The altitude of flight is 4.5 Km (density = 0.77 kg/m³). Calculate the centripetal force responsible for the turn, acceleration of the airplane, correct bank angle and lift produced during the turn. **07**

OR

- Q.5** (a) An aircraft of mass 4500 kg is flying at sea level where air density is 1.23 Kg/m³. If the aircraft has two turbojet engines with thrust rating of 4KN each, What would be the maximum Rate of climb of the aircraft? The aspect ratio of aircraft is 6, wing area is 11 m², Efficiency factor is 0.81 and parasite drag coefficient is 0.02. **07**
- (b) Explain V-N Diagram. **07**
