NAME_____ ROLLNO_____

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-2006

III B.TECH I SEMESTER REGULAR EXAMINATIONS

AIRCRAFT PERFORMANCE

(AERONAUTICAL ENGINEERING)

NOVEMBER 2006

TIME-3HOUR

MARK-80

ANSWER ANY FIVE QUESTIONS ALL QUESTIONS CARRY EQUAL MARKS.

1. Explain the term skin friction drag and develop an expression for the same. Now consider a thin circular arc airfoil at a = 00 and 900 (concave face in upstream side) .Compare skin friction drag in these two cases along with respective flow patterns around these two configurations. Does the Reynolds number bear an influence on skin friction drag?

2. Consider an elliptic plan form wing flying with a velocity V. What is the variation of its lift curve slope from that for the airfoil section of the wing for two aspect ratios of the wing namely AR = 8 and 10. Explain the aerodynamics involved.

3. Explain the significance of stalling speed, stalling angle and indicated airspeed. An airplane has a wing loading of 2640 N / sq. m and has drag polar given by CD = 0.016 + 0.055CL 2 Calculate its maximum L / D ratio, V for minimum drag and L / D at a speed of 110 m/s.

4. Develop a condition for minimum sinking speed of an airplane in power off flight. A glider weighing 5000 N with elliptic wing has a gross area of 10 sq. m. It is required to maintain a glide angle of 3 degrees at a fwd. speed of 50 m / s.If the glider has CDO = 0.015, determine its aspect ratio.

5. Explain briefly the climb performance hodograph of an airplane. A piston-prop airplane has the following data; W = 13,000 N, S = 16.2 sq.m, b = 10.9 m, CDO = 0.025, e = 0.8. The single engine supplies a maximum of 245 HP at the propeller efficiency of 0.85.The airplane flies at speed of 61.5 m/s. Determine the rate of climb, angle of climb and load factor of the airplane.

6. Derive expressions for range and endurance of a propeller driven airplane. A pistonprop airplane has the following data; W = 14,500 N, S = 16.2 sq.m, b = 10.9 m, CDO = 0.025, e = 0.8. The single engine supplies a maximum of 350 HP at the propeller efficiency of 0.85. It carries a weight fraction of usable fuel as 14% in oneversion. The engine consumes 0.274 kg mass of fuel per kW per hr. Determine its maximum range and endurance.

7. Show the schematics of the variation of forces acting on a jet driven airplane in the process of landing. A jet executive airplane weighing 90,000 N (of which 33000 N weight is of fuel), has wing area of 30 sq.m and wing span of 16.5 m. Its CDO is 0.02 and e = 0.81. The ground friction coefficient is 0.02.The wings are just 1.85 m above the ground .The two jet engines deliver a total of 35,000 N of thrust. With the deployment of spoilers at touch down (L = 0), the parasite drag coefficient increases by 10% and full flaps down make the CL = 2.5. If 10% of the fuel still remains at the touch down, estimate the landing ground roll distance.

8. Describe the loading and forces occurring on an airplane during the vertical loop of an airplane. Develop relations between load factor and the radius of turns for a push over maneuver. What is the expression for its rate of turn?