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10AE62

**Sixth Semester B.E. Degree Examination, June/July 2015**  
**Aircraft Performance**

Time: 3 hrs.

Max. Marks:100

*Note: Answer any FIVE full questions, selecting  
atleast TWO questions from each part.*

**PART – A**

- 1 a. What is drag polar? Derive the drag polar equation for an airplane. Show graphical representation. (10 Marks)
- b. Define the terms aerodynamic center and center of pressure and derive an expression to locate the aerodynamic center. (10 Marks)
  
- 2 a. Consider an airplane at steady, level flight and it's a function of altitude, velocity and weight. For the above said condition show that:  

$$\left(\frac{L}{D}\right)_{\max} = \frac{1}{\sqrt{4C_{D,O}k}} \quad (10 \text{ Marks})$$
- b. A single engine propeller driven airplane have following characteristics:  
 $b = 10.91\text{m}$ ,  $s = 16.16\text{m}^2$ ,  $w = 1340\text{kg}$ ,  $e = 0.8$ ,  $C_{D,O} = 0.022$ .  
 Calculate the thrust required at sea level of flight velocity of 100m/s. (10 Marks)
  
- 3 a. For a propeller-driven airplane show that  

$$\left(\frac{R}{C}\right)_{\max} = \frac{\eta_{pr}P}{W} - \frac{z}{\rho_{\infty}} \sqrt{\frac{k}{sC_{D,O}}} \left(\frac{w}{s}\right)^{1/2} \frac{1.155}{(L/D)_{\max}} \quad (12 \text{ Marks})$$
- b. Explain service and absolute ceilings. (08 Marks)
  
- 4 a. By analytical approach show that aerodynamic relations associated with different lift to drag ratio that is  $\left(\frac{C_L^{3/2}}{C_D}\right)_{\max}$ . (10 Marks)
- b. An aircraft is flying at an altitude of 9km where  $\rho = 0.467 \text{ kg/m}^3$  has the following characteristics:  $W = 33000\text{kg}$ ,  $S = 90\text{m}^2$ ,  $C_{D,O} = 0.015$ ,  $K = 0.08$ . Find the maximum values of  $\frac{C_L^{3/2}}{C_D}$ ,  $\frac{C_L}{C_D}$  and  $\frac{C_L^{1/2}}{C_D}$ . (10 Marks)

**PART – B**

- 5 a. For a propeller driven airplane, derive the Breguet range equation. (10 Marks)
- b. A light single engine, propeller driven airplane have the following characteristics:  
Wing span = 10.912m, wing area = 16.165m<sup>2</sup>  
Normal gross weight = 13127.5N  
Fuel capacity of 65 gallons of aviation gasoline  
Power plant = one piston engine of 230hp at sea level  
Specific fuel consumption of  $7.456 \times 10^{-7}/\text{m}$   
Parasite drag coefficient  $c_{D,0} = 0.025$   
Oswald efficiency factor = 0.8  
Propeller efficiency is 0.8  
Estimate the maximum range for the above aircraft. (10 Marks)
- 6 a. Explain the various phases of take-off of an airplane with neat sketch. (10 Marks)
- b. Explain in detail about the calculation of distance while airborne to clear an obstacle. (10 Marks)
- 7 a. Obtain an expression for calculating the approach distance and flare distance. (15 Marks)
- b. Write a short note on ground effect. (05 Marks)
- 8 a. With the help of neat sketch, explain the v-n diagram. (10 Marks)
- b. Derive an expression for minimum turning radius. (10 Marks)

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