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10AE62

Sixth Semester B.E. Degree Examination, June / July 2014
Aircraft Performance

Time: 3 hrs.

Max. Marks:100

**Note: Answer FIVE full questions, selecting
at least TWO questions from each part.**

PART – A

- 1** a. Define drag polar and sketch the plot. (04 Marks)
 b. Sketch the following plots:
 i) $\left(\frac{L}{D}\right)$ Vs angle of attack.
 ii) T_R Vs V_∞ .
 iii) P_R Vs V_∞ . (12 Marks)
 c. Define hodograph and sketch a typical hodograph for climb performance at a given altitude. (04 Marks)
- 2** a. Write down the equations of motions for steady, level flight. (02 Marks)
 b. Consider an airplane at steady, level flight and it's a function of altitude, velocity and weight. For the above said condition show that,

$$\left(\frac{L}{D}\right)_{\max} = \frac{1}{\sqrt{4C_{D_0} K}} \quad (10 \text{ Marks})$$

 c. By analytical approach show that the minimum power required occurs when the airplane is flying such that $\left(\frac{C_L^3}{C_D}\right)$. (08 Marks)
- 3** a. For a propeller-driven airplane show that,

$$\left(\frac{R}{C}\right)_{\max} = \frac{n_{pr} P}{W} - \frac{2}{P_\infty} \sqrt{SC_{D_0}} \left(\frac{W}{S}\right)^{\frac{1}{2}} \frac{1.155}{\left(\frac{L}{D}\right)_{\max}}. \quad (10 \text{ Marks})$$

 b. Explain service and absolute ceilings in detail. (10 Marks)
- 4** a. What are high lift devices, how they increases the performance of airplane? (10 Marks)
 b. Write short notes on:
 i) $\left(\frac{T}{W}\right)$ ratio.
 ii) $\left(\frac{L}{D}\right)$ ratio. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – B

- 5 a. For a jet-propelled airplanes, derive the Breguet range equation. (10 Marks)
b. State the conditions for maximum endurance for a jet propelled airplane. (05 Marks)
c. Derive the general equation for endurance of airplane. (05 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. Sketch the typical variation of forces acting on an airplane during landing. (05 Marks)
b. Estimate the landing ground roll distance at sea level for airplane at the given conditions. No thrust reversal is used, however spoilers are employed such that $L = 0$. The spoilers increases the zero-lift, drag co-efficient by 10%. The fuel tanks are essentially empty, so neglect the weight of any fuel used by the airplane. The maximum lift co-efficient, when flaps fully employed at touch down is 2.5. (15 Marks)
- 8 a. Explain V-n diagram for a typical jet trainer aircraft. (10 Marks)
b. Explain the pull-up and push-down maneuvers with necessary equations. (10 Marks)

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