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10AE81

**Eighth Semester B.E. Degree Examination, June/July 2017**  
**Flight Vehicle Design**

Time: 3 hrs.

Max. Marks:100

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

**PART – A**

- 1 a. Enlist the ten performance parameter considered for designing an aircraft. (10 Marks)
- b. Consider a typical military Bomber of  $L/D = 16$  warm up and take off fuel fraction is 0.97. Climb fuel fraction is 0.985, cruise  $R = 1500 \text{ n m} = 2778 \text{ km}$ ,  $C = 0.5/\text{hr}$ ,  $V = 0.6M$  (same for both the cruise condition 1<sup>st</sup> loiter  $E = 3 \text{ hrs}$ ,  $C = 0.4/\text{hr}$  2<sup>nd</sup> loiter  $E = 1/3 \text{ hrs}$ . Landing fuel fraction is 0.995. Estimate take off to landing fuel fraction  $W_f/W_0$ . From  $W_f/W_0$ . Calculate the value of  $W_0$ . (10 Marks)

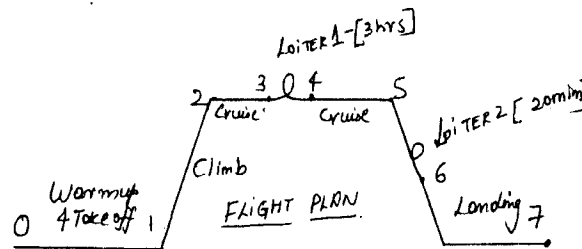


Fig.Q1(b)

- 2 a. Define the term 'Wing Loading'. Briefly explain the consideration for selection of  $\frac{W}{S}$  for an aircraft under design process. (10 Marks)
- b. Derive and explain :  
i) Wing loading effect on range  
ii) Effect of aspect ratio on aircraft performance. (10 Marks)
- 3 a. Explain sweep angle selection criteria. (10 Marks)
- b. Show that for a straight, tapered wing, mean aerodynamic chord(MAC) is  $\bar{C} = \frac{2}{3} C_r \left( \frac{\lambda^2 + \lambda + 1}{\lambda + 1} \right)$ , where  $\lambda$  - taper ratio and  $C_r$  is root chord and derive value for  $\lambda_{x/C}$  and  $\lambda_{c/4}$ . (10 Marks)
- 4 a. Show in a graph the variation of drag due to lift, zero lift drag and total drag with velocity. Also show how power required and power available in a piston engine propeller aircraft varies with velocity. (10 Marks)
- b. Explain engine installed thrust correction. (10 Marks)

**PART – B**

- 5 a. Write the equation of motion of landing roll and obtain an expression for landing ground roll distance. (10 Marks)
- b. Explain three common approaches used for active lift enhancement, with the help of neat sketches. (10 Marks)

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- 6** a. Explain contribution of fuselage using vertical stabilizer towards lateral stability. (10 Marks)  
b. What are neutral point, c.g. margin and static margin? (10 Marks)
- 7** a. Sketch and explain three commonly used landing gear arrangements. (10 Marks)  
b. Explain anti-icing and de-icing systems in an aircraft. (10 Marks)
- 8** a. Explain a typical flight control system. (10 Marks)  
b. Write short note on :  
i) Radio navigation systems  
ii) Aircraft weapon systems. (10 Marks)

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