Flight Vehicle Design VTU CBCS Question Paper Set 2018

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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 n m = 2778 km, C = 0.5/hr, V = 0.6M (same for both the cruise condition 1st loiter E = 3 hrs, C = 0.4/hr 2nd loiter E = 1/3 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)**

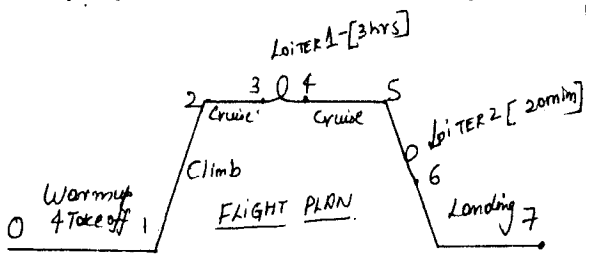

Fig.Q1(b)

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 swap single 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 λ - taper ratio and C_v is root chord and derive value for $\wedge_{x/C}$ and $\wedge_{c/4}$. **(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)**

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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Eighth Semester B.E. Degree Examination, June/July 2015

Flight Vehicle Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain overview of airplane design process. **(08 Marks)**

b. Calculate near exact weight for an airplane from a guess value for the following data, where W_e is the empty weight and W_o is the takeoff weight.

$$\frac{W_e}{W_o} = 0.97\ W_o^{-0.05} \text{ and } W_o = \frac{10{,}500}{1 - 0.4 - \frac{W_e}{W_o}}$$ **(12 Marks)**

2 Explain the effect of wing loading on stall speed, take off distance, catapult take – off, landing distance, cruise, loitter for endurance, instantaneous turn and sustain turn. **(20 Marks)**

3 a. Explain the wing sweep angle selection criteria? **(10 Marks)**

b. Draw layout of a spread sheet for wing design. **(10 Marks)**

4 a. What are engine installed thrust correction? **(10 Marks)**

b. A jet engine performance data is given below :
rpm = 9500
EGT = 450°C
w_f (fuel consumption) = 1850 Kg/hr
w_a = (air consumption) = 91 Kg/Sec
F_n (net thrust) = 4510 Kg
TFSC (thrust specific fuel consumption) = 0.5
The test is carried out at pressure of 102.6 kPa and ambient temperature of 30° C. Correct the test data for ISA conditions (pressure 101.3 kPa and temperature 15° C) **(10 Marks)**

PART – B

5 a. What is balanced field length? **(06 Marks)**

b. Draw spread sheet layout for take – off and landing distance. **(14 Marks)**

6 a. Explain rudder area sizing. **(12 Marks)**

b. What is neutral point, c.g. margin and static margin? **(08 Marks)**

7 a. Explain Alternating current electrical power system for an aircraft. **(10 Marks)**

b. What is Castoring – wheel geometry? **(10 Marks)**

8 a. Explain a typical flight control system. **(12 Marks)**

b. Briefly describe weapon carriage and gun installation on military aircraft. **(08 Marks)**

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Eighth Semester B.E. Degree Examination, June/July 2016
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. Define Design. Briefly explain the design process of an aircraft with a flow chart. **(10 Marks)**

b. Mention the performance parameter for designing an aircraft. **(10 Marks)**

2 a. Derive an expression for wing loading effect on Glide rate. **(10 Marks)**

b. Define Load Factor. Show that the designer can minimize $\frac{D}{W}$ with respect to $\frac{W}{S}$ with the relation $\frac{W}{S} = \frac{q}{n} C_{\left(\frac{L}{D}\right)_{min}}$ **(10 Marks)**

3 a. Write short notes on the following :
(i) Airfoil shape selection
(ii) Base Drag Estimation. **(10 Marks)**

b. Mention and briefly explain the volume consideration mode while designing an aircraft fuselage. **(10 Marks)**

4 a. Discuss the following topics in detail:
(i) Propulsion selection
(ii) Propeller Design for cruise condition **(10 Marks)**

b. Explain the spread shut approach for Turbo-Jet engine sizing. **(10 Marks)**

PART – B

5 a. Derive an expression for aircraft ground roll. **(10 Marks)**

b. Enlist all phases of flight landing with schematic sketch and mention all the expression related to each phase. **(10 Marks)**

6 a. Discuss briefly any two refined weight estimation methods used in aircraft. **(10 Marks)**

b. Explain longitudinal stability effect on performance of the aircraft. **(10 Marks)**

7 a. Sketch and explain three commonly used landing gear arrangements. **(10 Marks)**

b. Explain anti icing and de-icing system in an aircraft. **(10 Marks)**

8 a. Explain a typical flight control system. **(10 Marks)**

b. Write short notes on :
(i) Radio navigation system
(ii) Aircraft weapon system. **(10 Marks)**

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