

Eighth Semester B.E. Degree Examination, July/August 2021

Flight Vehicle Design

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

1. a. Explain the phases of design of an aircraft with the help of a flow chart. (08 Marks)
 b. Calculate near exact weight of an aircraft from a guess value for the following data: where W_e is the empty weight and W_o is the take off weight.

$$\frac{W_e}{W_o} = 0.93W_o^{-0.07}; W_o = \frac{10,800}{1 - 0.314 - \frac{W_e}{W_o}}$$
 (08 Marks)
2. a. Define thrust to weight ratio. Give the expression for $\frac{T}{W}$ for propeller and Jet airplanes. (06 Marks)
 b. Derive an expression for wing loading effect on flight ceiling and glide rate. (10 Marks)
3. a. Explain in detail the steps involved in conic fuselage development by conic lofting technique. (08 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 is taper ratio and C_r is root chord. (08 Marks)
4. a. Give justification for the placement of tail stabilizers in a conventional tail for maximum stall and spin control. (08 Marks)
 b. Write a typical spread sheet for vertical tail stabilizer sizing. (08 Marks)
5. a. Explain the selection criteria of propulsion system of an aircraft. (08 Marks)
 b. Explain installed thrust correction of an aircraft propulsion. (08 Marks)
6. a. Obtain an expression for take off ground roll distance and list the minimum take off parameters required for commercial aircraft. (08 Marks)
 b. Briefly explain passive and active lift enhancement. (08 Marks)
7. a. Discuss on lateral stability criterion on aircraft design. (08 Marks)
 b. Obtain control surface sizing for longitudinal control. (08 Marks)
8. a. What are the criteria for rudder area sizing to provide directional control? (08 Marks)
 b. Explain Cooper-Harper rating scale. (08 Marks)
9. a. Explain the characteristics of fuel system of an aircraft. (08 Marks)
 b. Explain the selection criteria of anti-icing and de-icing systems in an aircraft. (08 Marks)
10. a. Write short note on:
 - (i) Flight control systems
 - (ii) Navigation systems. (08 Marks)
 b. Explain the criteria for selection of materials of an aircraft. (08 Marks)

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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.

