

CBCS SCHEME

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15AE82

Eighth Semester B.E. Degree Examination, Aug./Sept.2020 Flight Vehicle Design

Time: 3 hrs.

Max. Marks: 80

Note: i) For Regular Students: Answer any FIVE full questions irrespective of modules.
ii) For Arrear Students : Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 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 takeoff weight.

$$\frac{W_e}{W_o} = 0.93 W_o^{-0.07}; \quad W_o = \frac{10,800}{1 - 0.314 - \frac{W_e}{W_o}} \quad (08 \text{ Marks})$$

- 2 a. Define thrust to weight ratio. Give the expression for $\frac{T}{W}$ of propeller and jet airplanes. (06 Marks)
b. Derive an expression for wing loading effect on flight ceiling and glide rate. (10 Marks)

Module-2

- 3 a. Explain in detail the steps involved in conic fuselage development using 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)

Module-3

- 5 a. Explain the selection criteria of propulsion system of an aircraft. (08 Marks)
b. Explain installed thrust correction of an aircraft propulsion system. (08 Marks)
- 6 a. Obtain an expression for takeoff ground roll distance and list the minimum takeoff parameters required for commercial aircraft. (08 Marks)
b. Briefly explain about passive and active lift enhancement. (08 Marks)

Module-4

- 7 a. Discuss on lateral stability criterion on aircraft design. (08 Marks)
b. Obtain control surface sizing for longitudinal control. (08 Marks)

15AE82

- 8 a. Write the selection criteria for rudder area sizing to provide directional control. (08 Marks)
b. Explain Cooper-Harper rating scale. (08 Marks)

Module-5

- 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 notes on:
(i) Flight control systems (08 Marks)
(ii) Navigation systems (08 Marks)
b. Briefly explain the selection criteria of materials to an aircraft. (08 Marks)
