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.

$$\frac{W_e}{W_o} = 0.93\, W_o^{-0.07}; \quad W_o = \frac{10{,}800}{1 - 0.314 - \frac{W_e}{W_o}}$$ **(08 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 $\overline{C} = \frac{2}{3} C_r \left(\frac{\lambda^2 + \lambda + 1}{\lambda + 1} \right)$, 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)**

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

(ii) Navigation systems **(08 Marks)**

b. Briefly explain the selection criteria of materials to an aircraft. **(08 Marks)**

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