



CBCS SCHEME

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18AE61

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Aircraft Performance

Time: 3 hrs.

Max. Marks: 100

- Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Assume the missing data.

Module-1

- 1 a. Derive the equations of motion of the aircraft considering translational motion of airplane through 3D space over flat earth. (12 Marks)
b. Describe the conditions for unaccelerated cruise performance of an aircraft. Obtain the equations of motion for the same. (08 Marks)

OR

- 2 a. Consider an airplane at steady, level, unaccelerated flight and its function of altitude, velocity and weight. For the above said condition, show that.

$$\left(\frac{L}{D}\right)_{\max} = \frac{1}{\sqrt{4C_{D_0}K}}$$

(14 Marks)

- b. Write a short note on thrust required curve of an airplane with relevant graph and explain its significance. (06 Marks)

Module-2

- 3 For a steady climb flight, derive the expression for maximum rate of climb and maximum climb angle θ_{\max} in terms of fundamental parameters and explain the climb performance with aid of hodograph diagram. (20 Marks)

OR

- 4 a. For a Gulf stream – IV a/c, with the airdata as below, $W = 73000lb$, $K = 0.08$, $C_{D_0} = 0.012$, $S = 950ft^2$. Calculate: i) The sink rate for minimum glide angle ii) The minimum sink rate at 30000ft. Density @ 36000ft = 8.9068×10^{-4} slug/ft³. (10 Marks)
b. Explain the following with relevant graphs: i) Absolute ceiling ii) Service ceiling. (10 Marks)

Module-3

- 5 With the necessary aerodynamic relations, derive an expression to show

$$V_{(CL^{3/2}/CD)_{\max}} < V_{(CL/CD)_{\max}} < V_{(CL^{1/2}/CD)_{\max}}$$

(20 Marks)

OR

- 6 Define range and endurance. Derive an expression for range and endurance for an jet aircraft. (20 Marks)

Module-4

- 7 Explain the phases of take off and landing of an aircraft with relevant graphs indicating the various segments of it. (20 Marks)

OR

- 8 Derive an expression for ground Roll distance indicating various segments of take off and landing performance. (20 Marks)

Module-5

- 9 a. With a neat sketch, explain level turn maneuvers and derive an expression for minimum turn radius and maximum turn rate. (12 Marks)
b. Explain the constraints on load factor and flight velocity V_{∞} with respect to level turn maneuvers. (08 Marks)

OR

- 10 a. Draw the V-n diagram for a typical jet aircraft and explain the silent parameter. (10 Marks)
b. Explain the following with relevant graphs:
i) Pull-up maneuvers
ii) Pull-down maneuvers. (10 Marks)
