

CBCS SCHEME

USN

18AE61

Sixth Semester B.E. Degree Examination, June/July 2024 Aircraft Performance

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Derive the necessary equations which describes the translational and rotational motion of an airplane. (10 Marks)
- b. With neat graph derive an expression for power required and condition for minimum power required. (10 Marks)

OR

- 2 a. With neat graph derive an expression for thrust required and condition for minimum thrust required. (12 Marks)
- b. The Bede BD-5J is a very small single seat home built jet airplane which became available in the early 1970's. The data for BD-5J are as follows :
Wing span 17ft,
Wing plan form area = 37.8ft²,
Gross weight at takeoff = 960lb,
fuel capacity = 55 gal,
Power plant = one French – built micro-turbo TRS 18 turbojet engine with maximum thrust at sea level of 202 lb and specific fuel consumption of 1.3 lb/ lb.h. The drag polar is $C_D = 0.02 + 0.62C_L^2$. Calculate the maximum velocity at sea level. [Take $E_\infty = 0.002377$ slug/ft³]. (08 Marks)

Module-2

- 3 a. Deduce an expression for equation of motion for rate of climb. (10 Marks)
- b. With the graphical approach, derive an expression for time to climb, and also draw the hodograph diagram. (10 Marks)

OR

- 4 a. By using force and velocity diagram of gliding flight, obtain the equilibrium velocity also the flight path. (10 Marks)
- b. Consider the Gulfstream IV flying at 30,000ft. Assume a total loss of engine thrust. Calculate the minimum glide path angle, maximum range covered over the ground, corresponding equilibrium glide velocity at 30,000ft and at sea level. (10 Marks)

Module-3

- 5 Derive the three aerodynamic relations which are important for static performance of aircraft and deduce as following statement :

$$V(C_L^{3/2}/C_D)_{\max} : V(C_L/C_D)_{\max} : V(C_L^{1/2}/C_D)_{\max} = 0.76:1:1.32 \quad (20 \text{ Marks})$$

OR

- 6 a. Derive Brequet Range equation and state that the maximum range for jet airplane occurs when airplane is flying at $(C_L^{1/2} / C_D)_{\max}$. (12 Marks)
- b. Derive the endurance for propeller driven airplane and state the maximum conditions. (08 Marks)

Module-4

- 7 a. Obtain an expression for S_g and S_a in the takeoff performance analytically. (14 Marks)
- b. With a neat diagram theoretically describe the intermediate segments of ground roll take off performance. (06 Marks)

OR

- 8 a. What is the touchdown zone of a runway? How do you calculate the approach distance and flare distance during landing. (10 Marks)
- b. What is meant by ground effects? How do you calculate the ground roll distance in landing performance? (10 Marks)

Module-5

- 9 a. Obtain an expression for minimum turn radius. (13 Marks)
- b. Obtain the turning rate of an aircraft during pull-up and pull-down maneuver. (07 Marks)

OR

- 10 a. With the help of neat diagram, explain v-n diagram. (13 Marks)
- b. Explain the limitations of pull-up and push-over. (07 Marks)
