



Department of Aeronautical Engineering

AE 6501 / Flight Dynamics

Question Bank for Unit I & II

2 Marks

01. What is meant by steady, straight and level flight of an aircraft?
02. Enumerate the four forces and moments acting in an aircraft?
03. Define absolute and service ceiling.
04. Explain the form and skin friction drag.
05. What is parasite drag?
06. What is drag polar?
07. What are the effects of altitude on thrust and power of an airplane?
08. Assume $W=33099.27$ kg, $S=88.255$ m², $V=152.4$ m/s, $\rho=0.459$ kg/m³, $C_{D,0}=0.015$, $k=0.08$. Calculate Thrust required?
09. What are the conditions required for maximum drag and minimum power?
10. What are the conditions required for minimum drag and minimum power required for an airplane? Mention them in drag coefficients also.
11. Give the conditions for minimum drag.
12. Interpret rate of climb and rate of descent.
13. State range and endurance.
14. Give the condition for steepest climb angle and shallowest glide angle.
15. Give the limitations on turn.
16. Outline the V-n diagram.
17. How load factor is related to Bank angle?
18. Explain the significance of load factor?

16 Marks

01. Derive the equation of motion of a rigid flight vehicle.
02. i) Discuss different types of drag acting on the airplane.
ii) Explain drag polar of vehicles from low speed to high speed.
03. Explain the drag polar.
04. i) Derive the expression for drag polar and explain it with a neat plot.
ii) Draw the power required and power available curve for both jet propelled and propeller driven engine.
05. Derive the thrust and propulsive efficiency of a typical propulsive device.
06. Derive the thrust available equations for Propeller-driven and Jet-propelled airplanes.
07. Derive the power available equations for Propeller-driven and Jet-propelled airplanes.
08. Explain in detail power available and power required curves with its condition.
09. Calculate the minimum power required and velocity. Consider that aircrafts altitude is 9144 m, density is 4.59×10^{-1} kg/m³, weight is 33099.27 kg, span area is 88.255 m², $C_{D,0}=0.015$; $k=0.08$.
10. In straight and level flight, show that velocity corresponding to minimum power required is 0.76 times the velocity corresponding to minimum thrust required.

11. Derive the Brequet Range Equation.
12. Give the Range equation for Jet-propelled airplanes.
13. A steady level flight is flying at 9144 m. Assume a total loss of engine thrust. The span area is 88.255 m^2 and the density at sea level is $4.59 \times 10^{-1} \text{ kg/m}^3$. Assume the $C_{D,0}$ as 0.015 and K as 0.08. Calculate: i) minimum glide path angle. ii) maximum range covered over the ground iii) the corresponding equilibrium glide velocity at sea level
14. Show the Endurance of Propeller-driven and Jet-propelled airplanes.
15. Derive the equation of climb performance and show maximum climb angle.
16. Obtain an expression for the turn rate and give the conditions for its maximum.
17. Derive the expressions for pull up and push over maneuvers of an aircraft?
18. Explain the significance of V-n diagram.