



INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

B.Tech VI Semester End Examinations (Regular), November – 2020

Regulation: IARE-R16

AIRCRAF STABILITY AND CONTROL

Time: 2 Hours

(AE)

Max Marks: 70

Answer any Four Questions from Part A

Answer any Five Questions from Part B

PART – A

1. Determine the equation for elevator free factor with required sketches. [5M]
2. How does spoilers aid in directional stability? [5M]
3. Write the equation of motion for a pendulum with mass, m and length, l . [5M]
4. Explain roll helix angle. Show the wing velocity distribution due to roll rate. [5M]
5. What are the causes for sideslip? Explain in detail with force diagram. [5M]
6. Obtain an expression for elevator trim condition [5M]
7. What are the equations of motion for longitudinal motion with free control? [5M]
8. What do you understand by lateral directional perturbed thrust force and moment derivatives? [5M]

PART – B

9. Enumerate the use of hinge moments in determining stick force to be applied by the pilot in unaccelerated flight of the airplane. What does dF/dV indicates? [10M]
10. Explain the terms of equilibrium conditions, static stability and longitudinal static stability. Explain the criteria for longitudinal static stability with equations and graphs. [10M]
11. What are the contributions of the wing to the aircrafts directional stability? Explain with diagram. [10M]
12. Explain the difference between aerodynamic coefficients and aerodynamic derivatives. Give four pairs of examples with explanation. [10M]
13. How is the Earth's axis is related to the body axis of the aircraft and explain how the transformation takes place? Write the mathematical expression for earth to body axis transformation. [10M]
14. Consider a sniper firing a rifle due east at the equator. Ignoring gravity and drag, what are the equations of motion of the bullet? Use the North-East-Up local coordinate system. Muzzle velocity: 1000m/s. Range: 4km. [10M]
15. What do you understand by lateral static stability derivative? Write the formula and explain its importance. [10M]
16. Estimate the pitch damping derivative, C_{mq} , for an aircraft with following characteristics: $CL_h = 0.075/\text{deg}$, $h = 0.98$, $V_h = 0.375$, $(X_h/c) = 3.0$. Where c is mean chord length. [10M]
17. What are the principal modes of disturbances caused to the stability of the aircraft? Explain with diagram. [10M]
18. Explain the term degree of freedom, and state the number of degree of freedom for an aircraft with free aileron. [10M]