



INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

B.Tech V Semester End Examinations (Regular), February – 2021

Regulation: IARE–R18

AIRCRAFT STABILITY AND CONTROL

Time: 3 Hours

(AE)

Max Marks: 70

Answer any Four Questions from Part A

Answer any Five Questions from Part B

PART – A

1. Explain the forward center of gravity (CG) limit restrictions by the ground effect of aircraft. [5M]
2. Discuss in detail about adverse yaw and crosswind landings. [5M]
3. Show the different ways for moving airplane axis system that can be fixed with reference to the airplane. [5M]
4. Outline the small perturbation method used in linear form for rendering equations of motions. How useful is it for EOM linearization? [5M]
5. What is the meaning of first order response? Give example and demonstrate it. [5M]
6. Write the equations of motion of aircraft for force and explain each term with physical application. [5M]
7. What is “Rudder lock” and the use of fins in aircraft. [5M]
8. Explain spiral divergence in dynamic stability. [5M]

PART – B

9. Explain the effect of aircraft wing to get static longitudinal stability. [10M]
10. Write down the expression for the lift coefficient of horizontal tail of an aircraft taking into account influence of wing and deflection of elevator? [10M]
11. Explain about the contribution of rudder in directional stability and write down the rudder requirements. [10M]
12. Describe in detail about the contribution of aircraft components in lateral and directional stability. [10M]
13. Determine the equation of motion of the aircraft and explain about types of moments of inertia applicable in equations of motion. [10M]
14. Illustrate the relationship with roll angle and sideslip angle. Give the mathematical equations and demonstrate with suitable sketch of flow pattern of the wind. [10M]
15. Demonstrate the α derivatives due to change in downward velocity with diagram. Explain the each terms with proper applications. [10M]
16. Find the β derivative for an aircraft at 1km altitude and Mach 0.9 ($U_1 = 267$ m/s, $\rho = 1.383$ kg/m³, $S = 50$ m², $b = 12$ m) if $Cl_\beta = -0.08$. If β is perturbed to 1 deg, find perturbed rolling moment. [10M]
17. Demonstrate the autorotation and show the cause of autorotation by drawing neat force diagram. What are the occasions when pilot execute the autorotation? [10M]
18. “The stability of the aircraft is determined solely by the Eigen values”. What are the three cases which explain the three types of dynamic stability and write their equations? [10M]