CBCS SCHEME

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17AE73

Seventh Semester B.E. Degree Examination, July/August 2022
Aircraft Stability and Control

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the terms of Equilibrium conditions , Static stability , Longitudinal static stability and Stability criteria with relevant equations and graph. **(10 Marks)**

b. Derive Aircraft Wing Contribution to M_{cg}. **(10 Marks)**

OR

2 a. Discuss Stick Fixed Neutral Control. Write down the expression for Stick Fixed Neutral Point and discuss the effect of Cg shift on Pitching moment. **(06 Marks)**

b. Briefly explain about Longitudinal Control and how Elevator power affects the longitudinal. **(14 Marks)**

Module-2

3 a. Explain Elevator Hinge Moment and Trim tabs. **(12 Marks)**

b. Derive an equation for Stick Free Neutral Point. **(08 Marks)**

OR

4 a. Describe Rudder Lock Mechanism and the Dorral fin. **(06 Marks)**

b. What is Static Directional Stability of an Airplace and requirement of Directional control? **(06 Marks)**

c. Elaborate on contribution of Aircraft Airframe Components on Directional Stability. **(08 Marks)**

Module-3

5 a. What is Dihedral Effect? Estimate it and explain the effect on Wing Sweeps flaps on Stability. **(12 Marks)**

b. Obtain the relation for Roll Control Power. **(08 Marks)**

OR

6 a. Explain the following terms :
i) Adverse Yaw Effects ii) Asymmetric Power Condition. **(10 Marks)**

b. Brief on Aileron Control methods. **(10 Marks)**

Module-4

7 a. Bring differences in Lateral , Longitudinal and Directional Static and Dynamic Stability. **(10 Marks)**

b. With the help of neat sketch, explain how Aircraft Stability is going to be balanced to equilibrium position after a disturbance. **(10 Marks)**

OR

8 a. Bring an equation for an Aircraft on pure pitching motion and discuss the angle of attack time history of a pitching model for various damping ratios. (10 Marks)

b. Obtain the below expression for a pure dynamic rolling motion of an Airplane and draw the typical response due to Aileron deflection

$$\frac{P_{SSb}}{2U_0} = -\frac{C_{\ell S_a}}{C_{\ell_P}} \cdot \Delta S_a.$$ (10 Marks)

Module-5

9 a. Describe the following with relevant sketches :
i) Phugoid Mode ii) Short Period Mode. (10 Marks)

b. Considering the rudder free care describe the Dynamic Lateral Stability. (10 Marks)

OR

10 a. Briefly explain Dutch Roll and Spiral Instability with relevant sketches. (10 Marks)

b. Elaborate on Routh's criteria and Cooper – Harper Scale. (10 Marks)

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