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10AE73

Seventh Semester B.E. Degree Examination, Dec.2017/Jan.2018
Aircraft Stability and Control

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. With neat sketch explain various aerodynamic forces on an airfoil section. **(06 Marks)**

b. Describe and explain with necessary equations contribution of airframe components. **(14 Marks)**

2 a. Derive an expression for elevator effectiveness. **(08 Marks)**

b. Derive and explain elevator required for landing. **(12 Marks)**

3 a. Obtain an expression for (δ_e) free elevator deflection condition for stick free condition. **(06 Marks)**

b. Define stick free neutral and static free static margin and obtain relevant expression. **(14 Marks)**

4 a. Define static directional stability of aircraft and criteria with neat sketches and explain. **(05 Marks)**

b. Explain : i) Adverse Yaw ii) Cross – wind landings iii) Asymmetric power iv) Spin recovery v) Rudder lock and the Dorsal fin. **(15 Marks)**

PART – B

5 a. Explain methods of aileron balancing. **(12 Marks)**

b. Obtain relation for roll control power $C_{L\delta a}$. **(08 Marks)**

6 a. Define longitudinal dynamic stability of aircraft and plat types of modes of motion and discuss Phugoid and short period motion. **(10 Marks)**

b. Develop governing equation for airplane in pure pitching motion and discuss A.O.A time history of pitching model for various developing ratios. **(10 Marks)**

7 a. Obtain the expression $\frac{P_{ss}b}{2U_0} = -\frac{C_{L\delta a}}{C_{Lp}} \cdot \Delta\delta a$. **(12 Marks)**

d. Calculate the roll response of Tejas airplane $\tau, p_{ss}, L_{\delta a}$ to 5° step change in aileron deflection. Assume the airplane is flying at sea level velocity of 87 m/s. Consider the airplane configuration $C_{Lp} = -0.285 rad^{-1}$, $C_{L\delta a} = 0.039 rad^{-1}$, S = 18 m^2, b = 6.7 m. **(08 Marks)**

8 Write short notes on :

a. Wing rock.

b. Roll control reversal.

c. Spring roll approximation.

d. Dutch roll approximation. **(20 Marks)**

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