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Total Number of Pages : 02

B.Tech.
PCAE4305

6th Semester Back Examination 2017-18
AIRCRAFT STABILITY AND CONTROL
BRANCH : AERO
Time : 3 Hours
Max Marks : 70
Q.CODE : C329

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right-hand margin indicate marks.

- Q1. Answer the following questions : (2 x 10)**
- a) State three modes of stability.
 - b) Write the types of axis components in aircraft.
 - c) Define static margin?
 - d) State about the stick fixed condition.
 - e) Mention the types of stability derivatives.
 - f) What is control surface flutter?
 - g) Difference between dihedral and anhedral.
 - h) Explain with neat sketch about the rudder lock system.
 - i) What is stability augmentation system? Explain.
 - j) Discuss about closed loop and open loop system.
- Q2. a) Explain the basic concepts of static and dynamic stability with example. (5)**
b) Derive the total longitudinal stability equation for the airplane assuming thrust vector passes through the center of gravity. (5)
- Q3. a) If the airplane came out unstable ($C_{m\alpha}$ positive), would you make the trim gradient $d\delta_s/dC_L$ come out right by hooking up the control backward, so that $C_{m\delta} > 0$? Explain. (5)**
b) Schematically explain the effectiveness of elevator control on longitudinal stability. (5)
- Q4. a) An aircraft has a wing loading of 1450N/m^2 , wing aspect ratio of 8, and tail aspect ratio of 4. The aerodynamic center of the wing-fuselage combination is at 0.24mac from the wing leading edge. The static margin is -0.05 . Using the following data, determine the tab deflection to trim the stick force at a speed of 160km/h in level flight at sea level. (5)**
 $a_w = a_t = 0.1/\text{deg}$, $\alpha_{0L,w} = i_t = i_w = 0$, $\delta_e = -2\text{deg}$, $V_1 = 0.6$, $\epsilon = 0.5\alpha$, $\eta_t = 0.9$, $C_{m,f} = 0.1C_L$, $\tau = 0.5$, $S_c = 1.85\text{m}^2$, $c_e = 0.608\text{m}$, $C_{h\alpha} = -0.003/\text{deg}$, $C_{h\delta_e} = -0.006/\text{deg}$, $C_{h\delta_e} = -0.003/\text{deg}$, and $G_1 = 5.0\text{rad/m}$.
- b) Explain with neat sketch about balance tab. (5)**
- Q5. a) Explain about the pitch damping effect. (5)**
b) What do you mean by Stability quartic? Explain. (5)

- Q6.** a) What do you mean by tail volume ratio? Explain its importance. (5)
b) Discuss about the stability derivatives in longitudinal dynamic stability. (5)
- Q7.** An airplane is making a steady turn at constant altitude at an angle of bank of 60° . If the air-speed indicator reads 320kmph, the altimeter reads 3050 m, and the accelerometer reads 2g, what is the yawing velocity of the airplane in degrees per second? (10)
- Q8.** Write short answer on any TWO : (5 x 2)
a) Aerodynamic balancing
b) Yaw Damper
c) Spiral instability
d) Phugoid Motion