Roll No. Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (ANE) (Sem.–6)

AIRCRAFT STABILITY AND CONTROL

Subject Code : ANE-322

Paper ID : [A1228]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

Q1 Answer the following terms :

a) Elevator power.

b) Dynamic stability.

c) Aerodynamic balancing.

d) Elevator angle per g.

e) Restoring characteristics.

f) Neutral point (stick fixed case).

g) Trim tab.

h) Maneuver margin.

i) Damping-in-yaw.

j) Frise aileron.

SECTION-B

Q2 Explain the uses of rudder. Derive expression for rudder power. (2,3)

Q3 Derive the expression for elevator angle for trim condition. (5)

Q4 What is 'Rudder Lock'? How it can be taken care of? (4,1)

Q5 Define 'Dihedral Effect' with the help of a sketch. How different parts of an airplane contribute to dihedral effect? (5)

Q6 If the slope of the pitching moment curve for a given airplane is $(dC_m/dC_L) = -0.15$ and the pitching moment coefficient at zero lift is 0.10, at what lift coefficient the airplane will be in trim? How much pitching moment coefficient must be supplied to achieve trim at C_L. =1.5? (5)

SECTION-C

Q7 Calculate C_{m_o} and C_{m_a} for complete aircraft from the following geometric and aerodynamic characteristics of an aircraft at Sea Level. Also find stick fixed neutral points. (4,4,2)

W = 25000 N	V = 80 ms^{-1}	$X_{cg} = 0.3c$	$X_{ac} = 0.25c$
$S_w = 18$ m^2	b = 12 m	$i_w = 1.94$deg	m.a.c. = 1.5m
$S_{HT} = 4$ m^2	$l_t = 4.1$ m	$i_t = -1.5$deg	$\eta = 0.9$
$(C_{L_o})_w = 0.3$	$(C_{L_a})_w = 5.1$ rad^{-1}	$(C_{m_{ac}})_w = -0.12$	$(C_{m_{ac}})_t = 0.0$
$(C_{L_a})_{Tail} = 4.5$ rad^{-1}	$(C_{m_a})_f = 0.12$ rad^{-1}	$(C_{m_o})_f = -0.025$	$I_y = 2000$ kg-m^2
$X_u = -0.045$	$Z_u = -0.369$		

Q8 Using data given in Q.7, find the Roots, Period, $t_{1/2}$ / t_{double} and $N_{1/2}$ /N_{double} for Phugoid approximation. (4,2,2,2)

Q9 Explain various longitudinal and lateral modes with the help of sketches. (5,5)