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

M.Code : 60531

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

Q.1 Answer the following terms :

(a) What do you mean by asymmetric flight?

(b) List the various assumptions taken into consideration while deriving equations of motion of an aircraft?

(c) Define 'stick force gradient' and explain its importance.

(d) Define elevator power. How elevator power can be increased?

(e) Define static stability. Mention the criteria for an aircraft to be statically stable.

(f) Define neutral point with the help of a sketch.

(g) What is trim tab. Explain its function.

(h) Define 'maneuver margin'.

(i) Explain the importance of damping.

(j) Explain the importance of 'Frise' aileron with the help of sketch(s).

SECTION-B

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

Q.3 Derive the expression for elevator angle for trim condition, Show using sketches, how trim condition of an aircraft can be varied? (4,1)

Q.4 What do you mean by coupling of lateral and directional effects? Explain. (5)

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

Q.6 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 $C_L = 3$? (5)

SECTION-C

Q.7 Calculate C_{mo} and $C_{m\alpha}$ 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}	$X_{cg} = 0.3c$	$X_{ac} = 0.25c$
$S_W = 20$m^2	$b = 11$m	$i_w = 1.5$ deg	m.a.c. = 1.82m
$S_{HT} = 4$ m^2	$l_t = 5.5$ m	$i_t = -1.5$ deg	$\eta = 0.9$
$(C_{L_o})_W = 0.3$	$(C_{L_\alpha})_W = 5.1$ rad^{-1}	$(C_{m_{ac}})_W = -0.12$	$(C_{m_{ac}})_t = 0.0$
$(C_{L_\alpha})_{Tail} = 4.5$ rad^{-1}	$(C_{m_\alpha})_f = 0.12$ rad^{-1}	$(C_{m_o})_f = -0.025$	$I_y = 2000$ kg-m^2
$X_u = -0.045$	$Z_u = -0.369$		

Q.8 Explain short period and phugoid modes. Using data given in Q.7, find the Roots, Period, $t_{1/2} / t_{double}$ and $N_{1/2} / N_{double}$ for Phugoid approximation. (4,3,1,1,1)

Q.9 Write notes on the following : (6,4)

(i) Explanation of airplane dynamics using spring mass system

(ii) In flight measurement of stick free neutral point.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.