

**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 :**

- Explain the term 'Elevator Power' and its importance.
- List the various assumptions taken into consideration while deriving equations of motion of an aircraft?
- Define 'Stick Force Gradient' and explain its importance.
- Define elevator effectiveness.
- Define static stability. Mention the criteria for an aircraft to be statically stable.
- Define neutral point with the help of a sketch.
- Define tab. Classify tabs and explain its their function.
- Define 'Maneuver Margin' and explain its importance.
- Define 'Damping-In-Yaw' and explain its importance.
- Explain the importance of 'Frise' aileron with the help of sketch(s).

### SECTION-B

2. Explain the uses of rudder. Derive expression for rudder power.
3. Derive the expression for elevator angle for trim condition.
4. What is 'Rudder Lock'? How it can be taken care of?
5. Define 'Dihedral Effect' with the help of a sketch. How different parts of an airplane contribute to dihedral effect?
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  $C_L = 2$ ?

### SECTION-C

7. Calculate  $C_{m_0}$  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.

$W = 25000 \text{ N}$	$V = 80 \text{ ms}^{-1}$	$X_{cg} = 0.3c$	$X_{ac} = 0.25c$
$S_w = 20\text{m}^2$	$b = 11\text{m}$	$i_w = 1.5 \text{ deg}$	$\text{m.a.c.} = 1.82\text{m}$
$S_{HT} = 4\text{m}^2$	$l_t = 5.5\text{m}$	$i_t = -1.5 \text{ deg}$	$\eta = 0.9$
$(C_{L_0})_w = 0.3$	$(C_{L_\alpha})_w = 5.1 \text{ rad}^{-1}$	$(C_{m_{ac}})_w = -0.12$	$(C_{m_{ac}})_t = 0.0$
$(C_{L_\alpha})_{\text{Tail}} = 4.5 \text{ rad}^{-1}$	$(C_{m_\alpha})_f = 0.12 \text{ rad}^{-1}$	$(C_{m_0})_f = -0.025$	$I_y = 2000 \text{ kg-m}^2$
$X_u = -0.045$	$Z_u = -0.369$		

8. Using data given in Q.7, find the Roots, Period,  $t_{1/2}/t_{\text{double}}$  and  $N_{1/2}/N_{\text{double}}$  for Phugoid approximation.
9. Explain various longitudinal and lateral modes with the help of sketches.

**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.**