

**B.Tech. AEROSPACE ENGINEERING
(BTAE)**

Term-End Examination

December, 2017

BAS-017 : FLIGHT MECHANICS

Time : 3 hours

Maximum Marks : 70

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- Note :** (i) *Attempt any seven questions.*
(ii) *All questions carry equal marks.*
(iii) *Use of scientific calculator is permitted.*
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1. Distinguish between the following : 3, 4, 3
- (a) Stability and maneuverability
- (b) Floating and restoring characteristics
- (c) Short period and phugoid mode
2. (a) Define maneuver point. Explain how stick-fixed maneuver point can be estimated experimentally using sketches. 2, 3
- (b) Define elevator control power. Derive expression for elevator control power. 2, 3

3. Calculate C_{m0} (pitching moment coefficient at zero lift) and $C_{m\alpha}$ (pitching moment curve slope) for stick fixed longitudinal case using following data.

$$C_{L0_w} = 0.25$$

$$X_{cg} = 0.3 \bar{C}$$

$$C_{L\alpha_w} = 5 \text{ per rad}$$

$$X_{ac} = 0.25 \bar{C}$$

$$C_{L\alpha_t} = 4.5 \text{ per rad}$$

$$S_w = 30 \text{ m}^2$$

$$C_{mac_w} = -0.09$$

$$S_t = 6 \text{ m}^2$$

$$C_{m0_{fus}} = -0.03$$

$$b_w = 15 \text{ m}$$

$$C_{m\alpha_{fus}} = 0.11 \text{ per rad}$$

$$\lambda = 1 \text{ (taper ratio)}$$

$$i_w = +2 \text{ deg}$$

$$\eta_t = 0.9$$

$$i_t = -2 \text{ deg}$$

$$l_t = 6 \text{ m}$$

Where the notations/symbols have usual meanings.

4. Using data given in Q3, calculate 3, 5, 2
- Stick fixed neutral point
 - Stick free neutral point
(Use $C_{h\alpha} = -0.015$, $C_{h\delta} = -0.021$ and $C_{L\delta} = 0.3$)
 - Calculate stick fixed and stick free static margin.
5. Write notes on the following (use sketch, if required) : 4, 3, 3
- Rudder lock
 - Adverse yaw
 - Weathercock stability
6. 3
- Derive expression for elevator angle to trim 3
 - Sketch C.G. range for static and maneuvering longitudinal cases. 4
 - Explain dihedral effect. 3

7. Write notes on the following : 5, 5
- (a) Methods used for aerodynamic balancing of elevator
 - (b) Wing torsional diversion and its control.
8. (a) Define and distinguish between static and dynamic longitudinal stability using sketches. 4
- (b) Explain the uses of rudder. Derive expression for rudder power. 3, 3
9. Write notes on the following : 4, 3, 3
- (a) Power effects on stability in case of propeller engined aircraft
 - (b) Importance of stick force gradient
 - (c) Aileron control power.
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