No. of Printed Pages : 3

BAS-017

01341

B.TECH. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

December, 2012

BAS-017 : FLIGHT MECHANICS

Time : 3 Hours *Maximum Marks : 70*

Note : *(1) Answer **any five** questions.*

(2) Use of non-programmable calculators is permitted.

1. Explain the following terms briefly : **14**

(a) Static stability

(b) Dynamic stability

(c) Static margin

(d) Neutral point

(e) Directional stability

(f) Aerodynamic balancing

(g) Control surface flutter

2. How does the wing dihedral affect stability ? Explain with diagrams. **14**

3. A wing body and Tail model are tested in a wind tunnel. The C_m ac wb = 0.032 and slope of $C_{L-\alpha}$ for airplane is 0.08. The lift at a geometric angle of attack of $-1.5°$ is zero. The area and chord of wing are 0.1 m^2 and 0.1 m respectively. The distance from the airplane's centre of gravity to the tail's aerodynamic centre is 0.17 m, the tail area is 0.02 m^2, the tail setting angle is 2.7°, the tail lift slope is 0.1/degree, $\epsilon_0 = 0$ and $\frac{\partial \epsilon}{\partial \alpha} = 0.35$. If the geometric angle of attack $\alpha = 7{\cdot}88°$, calculate C_{mcg} for the airplane. Comment on the stability of aircraft. **14**

4. (a) What are the factors which improve rolling stability in an aircraft ? **3**

(b) The stalling speed of an aircraft during level flight is 31 m/s. Find stalling speeds for turning with bank angles of **4**

(i) 60° and (ii) 84°.

(c) Determine the radius for level turn, pull up and pull down from the above data. **4**

(d) What is the significance of manoeuvre point in an aircraft ? **3**

5. An aircraft of 10,000 kg mass is designed with the line of thrust 0.9 m above the line of drag. In normal flight the drag is 18.2 kN and the centre of pressure on the main plane is 150 mm behind the CG. If the center of pressure of the tail plane is 10 m behind the CG, what is the load on the tail plane in trim condition ? **14**

6. Derive the pitching moment equation for stick free longitudinal stability of aircraft. **14**

7. (a) Why does an aircraft need to be statically stable ? Discuss condition for static stability. **4**

   (b) What is pitching moment and how is it controlled ? **4**

   (c) Explain with $C_{m-\alpha}$ graph the conditions for stable, unstable and neutrally stable aircrafts. **6**

8. (a) Explain with figures how the neutral point for a stick fixed flight of aircraft is determined. **7**

   (b) What is weather cock stability ? What is the purpose of vertical tail ? **7**