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Question Paper Code : 52529

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fifth Semester

Aeronautical Engineering

AE 6501 — FLIGHT DYNAMICS

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Draw the lift curve for symmetric airfoil and cambered airfoil.
2. Define center of pressure.
3. How do you locate the neutral point in an aircraft?
4. Define Specific fuel consumption.
5. Mention the role of flaps during takeoff of an aircraft.
6. What is meant by 'degree of freedom' and how much many does an Aircraft have?
7. Define side slip angle.
8. Differentiate stability from controllability.
9. What is Dutch roll?
10. Define load factor.

PART B — (5 × 13 = 65 marks)

11. (a) An airplane is flying straight and level at a speed which is 'n' times the minimum power speed. Show that the Power ratio $P/P_{min} = (3+n^4)/4n$, where P is the power required corresponding to flight speed and P_{min} is the minimum power required at the altitude. (13)

Or

(b) (i) Derive power available and power required curve for piston and jet powered Aircraft. (8)

(ii) Classify the types of aircraft. (5)

12. (a) (i) Prove that $\frac{\text{Thrust power for climbing}}{\text{Thrust power for level flight}} = \left(1+\frac{L}{D}\tan\theta\right)\cos^{3/2}\theta$. (8)

(ii) Derive condition for minimum drag and power required in straight and level flight. (5)

Or

(b) (i) For steep angles of glide, show that the rate of descent (sinking speed) of an airplane in powerless glide is given by

$$v = (W/1/2\ \rho S)^{\frac{1}{2}}\left[C_D/(C_L^2+C_D^2)^{\frac{3}{4}}\right].$$ (8)

(ii) Derive the Brequet Range and endurance equation for a jet aircraft. (5)

13. (a) (i) Write down the expression hr neutral point and static margin and explain. (8)

(ii) Using a neat sketch, explain the terms geometric angle of attack, absolute angle of attack, trimmed angle of attack and zero lift line of an aircraft. (5)

Or

(b) Discuss the criteria of longitudinal static stability of an aircraft with a suitable graph. (13)

14. (a) (i) Discuss briefly the construction of various components of aircraft towards lateral stability. (5)

(ii) A twin jet engine has the following data: thrust per engine = 100000 N, span wise distance between the engine = 10 m, wing area = 50m², rudder effectiveness = –0.001/deg, and maximum rudder deflection = +20 deg. Determine the rudder deflection to maintain zero side slip at 100 m/s in level flight at sea level with one engine completely out. (8)

Or

(b) Derive the yawing moment coefficient equation of an aircraft. (13)

15. (a) Derive the rolling moment coefficient equation of an aircraft. (13)

Or

(b) Discuss the following: (13)

(i) Cross wind landing

(ii) One engine inoperative condition

(iii) Adverse yaw and

(iv) Spin.

PART C — (1 × 15 = 15 marks)

16. (a) Flight dynamics mainly covers Range, endurance, Rate of climb, time to climb, Absolute ceiling and service ceiling of an aircraft with detail description. Tabulate the entire above performance factor with proper equation as engineering point of view. Also note down the deciding parameters for each case. (15)

Or

(b) (i) List the various types of stabilities considered in aircraft. Suggest the suitable methods available to control instability and bring the aircraft to equilibrium condition. (10)

(ii) Mention any two types of fighter aircraft used in Indian army with its specification. (5)
