KUMARAGURU
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Register Number: ……..

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Sixth Semester

AERONAUTICAL ENGINEERING

AER115: Flight Dynamics

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Flight in which thrust is equal to zero is _____
   a) gliding flight b) steady flight
   c) symmetric flight d) straight flight
2. _____ drag is an inevitable consequence of lift.
   a) skin friction drag interference drag
   c) induced drag form drag
3. Breguet equation is used to find _____
   a) endurance b) mach number
   c) Angle of attack d) range
4. In propeller aircraft thrust decrease as velocity _____
   a) decrease b) constant
   c) increases d) fluctuates
5. V-n diagram is a plot of _____
   a) velocity Vs normal force b) velocity Vs load factor
   c) volumetric flow Vs load factor d) volumetric flow Vs normal force
6. The ratio of _____ is called load factor.
   a) drag to weight b) thrust to drag
   c) drag to lift d) lift to weight
7. In _____ motion large amplitude variation of airspeed, pitch angle and altitude happens.
   a) spiral divergence b) dutch roll
   c) phugoid d) spin

8. _____ stability of an aircraft refers to the aircraft's stability in pitching plane.

a) lateral stability b) directional stability

c) Static directional stability d) Longitudinal stability

9. The component of airplane whose size and geometric parameters are very critical to lateral stability is _____

a) wing b) aileron

c) horizontal stabilizer d) rudder

10. Aileron reversal is associated with _____

a) Magnus effect b) Kutta condition

c) Aero elastic effect d) Biot – savart law

PART B (10 x 2 = 20 Marks)

11. What is the need to define ISA?
12. What are the factors which decide the flying path of an airplane as a rigid body?
13. What are the conditions for minimum drag and minimum power required for an airplane?
14. Define range and endurance of an airplane.
15. How load factor (L/W) is related to bank angle?
16. What is adverse yaw?
17. Distinguish between stability and controllability.
18. What is the need for aerodynamic balancing?
19. What are the requirements of directional control?
20. Why the rudder is designed to suit one engine inoperative condition?

PART C (5 x 14 = 70 Marks)

21. a) (i) Briefly explain the variation of pressure, temperature and density with altitude in troposphere. (10)

(ii) Find out the geometric altitude corresponding to 25km geometric altitude (Take radius of earth = 6300km). (4)

(OR)

b) Derive the expression for drag polar and explain it with a neat plot.

22. a) An aircraft weighing 2, 50,000N has a wing area of $80m^2$ and its drag equation is $C_D = 0.016 + 0.04\ C_L^2$. Calculate minimum thrust required (T_{min}) and minimum power required (P_{req}) for straight and level flight and the corresponding true air

speeds (V_{md} and V_{mp}) at sea level and at an altitude where $(\sigma)^{1/2} = 0.58$. Assume sea air level air density to be 1.226 kg/m^3.

(OR)

b) A glider weighing 4905N has a wing area of 25m^2, $C_{DO} = 0.012$, A = 16 and e = 0.87. Determine the minimum angle of glide, minimum rate of sink and corresponding speed under sea level standard conditions. Neglect the changes in density during glide.

23. a) Explain in detail the significance of V – n diagram with a neat plot.

(OR)

b) Obtain the expression for turn radius and turn rate for pull up and push over maneuvers.

24. a) Discuss in detail about aerodynamic balancing of control surfaces with neat sketches.

(OR)

b) Estimate nominal and velocity stability derivatives in longitudinal dynamics.

25. a) Write short notes on

(i) Weather cock effect

(ii) Dihedral effect

(OR)

b) Explain adverse yaw and spin and procedure for recovery from these situations.

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