Register Number: ………………..

B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2009)

Sixth Semester

AERONAUTICAL ENGINEERING

AER125: Helicopter Dynamics

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The aeroplane drag in straight and level flight is lowest when the
    a) parasite drag equals twice the induced drag
    b) parasite drag is equal to the induced drag
    c) induced drag is equal to zero
    d) induced drag is lowest

2. Most helicopter rotors have symmetrical airfoils because
    a) they produce more lift than cambered airfoils
    b) they can produce both upward and downward lift
    c) they do not develop pitching moments
    d) All of the above

3. The lift theory most often used in helicopter aerodynamics is
    a) Gyroscopic precession theory
    b) Momentum theory
    c) Bernoulli's theory
    d) power theory

4. A helicopter can hover near the ground with less power than it can hover away from the ground because
    a) the air is denser near the ground
    b) a high-pressure air ''bubble'' is produced below it
    c) the rotor blades have less induced drag
    d) Both (a) and (b)

5. The primary stress in rotor blades in flight is
    a) tension
    b) bending
    c) torsion
    d) shear

6. In what way do (l) induced drag and (2) parasite drag alter with increasing speed in straight and level flight
    a) (1) increases and (2) increases
    b) (1) decreases and (2) increases
    c) (1) decreases and (2) decreases
    d) (1) increases and (2) decreases

7. The hughes NOTAR balances fuselage torque reaction by

   a) Using a cambered tail fin   b) Hydraulic assistance

   c) Low pressure air ducts   d) High pressure air ducts

8. What is the major difference between the operation of the main rotor and the tail rotor?

   a) The tail rotor has no cyclic pitch   b) The main rotor has no cyclic pitch control
      control

   c) The tail rotor has no collective pitch   d) The tail rotor is always slower that the main
      control   rotor

9. Why do rotor blades lead as the disc cones upwards?

   a) Hookes Joint Effect   b) Coriolis Effect

   c) Less rotor drag   d) The blades do not lead as the disc cones
                                         upwards

10. The axis about which a main rotor blade is able to change pitch angle is known as

    a) The normal axis   b) The feathering axis

    c) The axis of rotation   d) The lateral axis

PART B (10 x 2 = 20 Marks)

11. What is meant by fully articulated rotor?

12. What are NOTAR and Compound Helicopter?

13. What is Rotor Figure of Merit and how it decides the performance of a rotor?

14. Define the terms: Ideal twist and Hovering

15. Define induced and profile power of helicopter

16. Classify the stability. What is the condition of TRIM?

17. What is coanda effect?

18. List out the high lift configurations and high speed rotorcrafts

19. What is ground effect?

20. Differentiate between Open plenum theory and Momentum curtain theory

PART C (5 x 14 = 70 Marks)

21. a) (i)   Discuss in detail various Helicopter control methods with neat sketches   (6)

       (ii) Write short notes on: (i) Translating tendency, (ii) Dissymmetry of lift   (8)

             (iii) Autorotation, and (iv) Gyroscopic precession

   (OR)

   b) (i)   Sketch the various configurations of helicopter and explain in detail.   (10)

       (ii) Explain hover Out-of-Ground Effect (OGE) and In-Ground Effect (IGE).   (4)

22. a) From blade element theory, by using Rotor Figure of Merit, estimate the performance of a rotor

(OR)

b) (i) By using momentum theory, show that   b=2a   and induced velocity   (8)

$$v = \sqrt{\frac{T}{2\rho\pi R^2}}$$

(ii) Explain the following a) Tip Losses b) Performance of ideally twisted and   (6)
constant chord blades.

23. a) (i) Explain the concept of Longitudinal Static Stability of the helicopter in forward   (7)
flight.

(ii) Discuss the following parameters governing the static directional stability of the   (7)
helicopter. (i) Directional stability, and (ii) Dihedral effect

(OR)

b) (i) Explain in detail about the induced, profile and parasite power requirements in   (7)
forward flight

(ii) Explain the performance curves with effects of altitude   (7)

24. a) (i) Describe briefly the performances of VTOL and STOL Aircraft in hover,   (10)
transition and forward motion.

(ii) Discuss briefly on features and applications of V/STOL Aircraft?   (4)

(OR)

b) Describe in detail various V/STOL Aircraft configurations with neat sketches

25. a) Explain the working of Hovercraft system with neat sketch and also derive an expression which gives minimum power (power to weight ratio) necessary for sustentation.

(OR)

b) (i) Discuss the methods of calculating drag forces on Ground effect machines   (8)

(ii) Explain the assumptions and applications of ACV?   (6)

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