Hall Ticket No | | | | | | | | | | | Question Paper Code: AAE011

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech V Semester End Examinations(Regular) - November, 2019

Regulation: IARE – R16

AIRCRAFT PERFORMANCE

Time: 3 Hours **(AE)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Define the meaning of off standard atmosphere. Explain briefly about design atmosphere model with suitable sketch. **[7M]**

   (b) Describe with the help of a diagram the mission profile of a civil transport aircraft. What is involved in performance estimation? **[7M]**

2. (a) Obtain expression for maximum lift to drag ratio (L/D) with respect to the coefficient of drag (C_{D_0}) at zero angle of attack. **[7M]**

   (b) Explain international standard atmosphere with suitable plot. **[7M]**

UNIT – II

3. (a) Elaborate the cruise technique of constant angle of attack and constant altitude **[7M]**

   (b) "The maximum range, in the presence of wind, is not obtained at E_m but at a different L/D". Discuss this issue and give your opinion on this statement with necessary formula and plot. **[7M]**

4. (a) Discuss the effect of Mach number on lift and drag coefficient with relevant graphs. **[7M]**

   (b) Highlight the effect of weight, altitude and temperature on cruise performance. **[7M]**

UNIT – III

5. (a) Explain briefly about limit load factor and ultimate load factor with relevant diagram. **[7M]**

   (b) Given an airplane of mass 50000 kg, lift/drag ratio 10, thrust per engine 60,000N, assume g=10 m/s^2. For a straight, steady, wings level climb of a twin engine airplane, calculate the all engine climb gradient.

   [7M]

6. (a) Explain in detail, with relevant formulae climb rate, climb gradient, thrust producing engines and minimum fuel climbs. **[7M]**

   (b) Consider the Gulfstream IV flying at 30,000 ft. Assume a total loss of engine thrust. Calculate
   i) The minimum glide path angle
   ii) The maximum range covered over the ground
   iii)The corresponding equilibrium glide velocity at 30,000 ft and at sea level.
   (ρ_{3000}= 1.5455 X 10^{-5} Ns/m^2) **[7M]**

UNIT – IV

7. (a) Discuss with the help of a diagram the airspeed boundaries for maneuver envelope. **[7M]**

   (b) Determine the load factor for the following

   i) Level flight

   ii) Free fall

   iii) In a turn of radius 200 m at a speed of 100 m/s

   iv) At the bottom of a loop of radius 200 m at a speed of 100 m/s. **[7M]**

8. (a) Describe the equations of motion of an aircraft undergoing lateral maneuver or level turn and obtain an expression for radius of turn. **[7M]**

   (b) Determine the stall speed of a utility aircraft with mass 4500 kg, a wing area of 19.5 m^2 and the maximum lift coefficient of 2.5. Perform this analysis at sea level for the following two flight condition.

   i) Cruising flight

   ii) Turning flight with a 30^0 bank angle **[7M]**

UNIT – V

9. (a) Explain the following:

   i) Trip fuel

   ii) Diversion fuel

   iii) Reserves

   iv) Tankering **[7M]**

   (b) Give the position of the flight controls during take off and landing of the aircraft. Explain effects of each controls with neat diagram. **[7M]**

10. (a) Illustrate the effects on the take off distances of the below flight variables.

    i) Aircraft weight

    ii) Head wind

    iii) Atmosphere effects

    iv) Runway conditions **[7M]**

    (b) Deduce the expressions for ground run and airborne distances for the landing performance. **[7M]**