Hall Ticket No | | | | | | | | | | | Question Paper Code: AAEB09

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular/Supplementary) - July, 2021

Regulation: R18

FLIGHT MECHANICS

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

Answer FIVE Questions choosing ONE question from each module
(NOTE: Provision is given to answer TWO questions from any ONE module)
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) What is the off standard and design standard atmosphere? How these two are differed from each other? Explain with suitable examples. **[7M]**
   (b) Calculate pressure, temperature, density of the air at geopotential altitude of 18 kms. Assume sea level conditions at 0 km. **[7M]**

2. (a) What are the parameters that are measured by air data system? Name the techniques to measure these data in aircraft. **[7M]**
   (b) Explain how total drag of an airplane is estimated. Give mathematical equation and explain it with diagram. **[7M]**

MODULE – II

3. (a) Derive the expression for range and endurance for aircraft with thrust producing engines. Explain each term. **[7M]**
   (b) Explain the constant altitude cruise techniques and compare it with the other cruise techniques. **[7M]**

4. (a) Describe the effect of altitude and temperature on cruise performance. **[7M]**
   (b) Explain the cruising method of constant angle of attack and constant mach number and explain about the effect of alternative fuel flow laws. **[7M]**

MODULE – III

5. (a) Explain the equations of motion of an aircraft with thrust producing engines in a climb. Derive the expressions for climb gradient and climb rate. **[7M]**
   (b) At sea level, the total drag of an aircraft of mass 6500 kg is 7.0 kN at a speed of 195 knots. Calculate the rate of climb and angle of climb at an indicated airspeed of 170 knots at 12000 ft, if the power available is 980 kW and the relative air density is 0.859. **[7M]**

6. (a) Derive the equation of motion for a climbing and accelerated flight. In addition, simplify it for steady and level flight condition. Use the appropriate diagram. **[7M]**

(b) An aircraft with wing loading of 1500N/sqm is gliding from an altitude of 4 km. What is the glide angle corresponding to minimum rate of descent. If zero lift drag coefficient is 0.2? what is the equilibrium glide velocity associated with the descent? **[7M]**

MODULE – IV

7. (a) Derive the expression for turning velocity during maneuvering flight of an airplane. **[7M]**

   (b) Explain about the transport aircraft maneuver performance and military aircraft maneuver performance. **[7M]**

8. (a) Derive the expression for maximum turn radius and maximum turn rate. **[7M]**

   (b) Determine the load factor, bank angle and turn radius for an aircraft in a level turn at a true speed of 120 km/hr and a turn rate of 15deg/s. **[7M]**

MODULE – V

9. (a) Discuss briefly the space available and space required for take-off of an aircraft. **[7M]**

   (b) Explain baulked landing and elaborate air safety procedures and requirements on landing performance. **[7M]**

10. (a) Derive the ground run and airborne distances for the landing performance. Explain about each parameters and its importance. **[7M]**

    (b) Consider an airplane patterned after the Fairchild Republic A-10, a twin-jet attack aircraft. The airplane has the following characteristics: wing area = 47 m^2, aspect ratio = 6.5, Oswald efficiency factor = 0.87, weight = 103.047 N. and parasite drag coefficient = 0.032. The airplane is equipped with two jet engines with 40,298 N of static thrusts each at sea level. Assume a paved runway also, during the ground roll, the angle of attack is restricted by the requirement that the tail not drag the ground. Hence, assume CLmax during the ground roll is limited to 0.8. Also, when the airplane is on the ground, the wings are 5ft above the ground. Estimate the sea-level lift-off distance for the airplane. **[7M]**

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