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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

FIRST SEMESTER M.TECH DEGREE EXAMINATION, JULY 2018

**Electrical Engineering**

**(Guidance and Navigational Control, Control Systems)**

**01EE6203 Introduction Flight**

Answer *any two full* questions from *each* part

Limit answers to the required points.

Max. Marks: 60 Duration: 3 hours

**PART A**

1. a. Derive the expression for the variation of pressure and density in gradient layer. (5)

   b. If the sea level pressure and temperature are 100500N/m$^2$ and 20$^0$ C respectively, while at certain unknown altitude the pressure is 71800 N/m$^2$ and temperature is -10$^0$ C, is the atmosphere between these altitudes stable or unstable? Calculate the height at which the second pair of reading were taken. Assume a linear variation of temperature with altitude? (4)

2. a. What is meant by stable atmosphere? Derive the stability conditions of the atmosphere. (5)

   b. Describe the circulation theory of lift. (4)

3. a. Give a detailed account of aerodynamic flow regimes. How are flight regimes classified based on Mach number? (5)

   b. Consider an airplane flying at some real altitude. The outside temperature and pressure are measured as 220K and 2.65x 10$^4$ N/m$^2$ Compute the pressure and temperature altitudes. Pressure altitude is 10,000 m and temperature altitude is 10503.07 m. (4)

**PART B**

4. a. How lift is generated in an aircraft? What are the various factors that affect lift? Explain their effects. (4)

   b. What is meant by stalling? What are the causes of stall? Explain stall recovery procedure. (5)

5. a. Write a note on dynamic pressure and aerodynamic heating. (5)

   b. Derive the expression for induced drag. (4)

6. a. Draw lift curve, drag curve and lift-drag ratio curve and explain the effect of AoA on them. What is the significance of L/D ratio? (5)

   b. Distinguish between centre of pressure and aerodynamic centre. How do they vary with angle of attack? (4)

## PART C

7. a. What are the various control surfaces used in aircraft? Explain their operation. (6)

   b. Define longitudinal static stability. What are the conditions to be satisfied to ensure the longitudinal static stability of an aircraft? (6)

8. a. What is wind tunnel? What are the different types of wind tunnels?

   b. Explain the working of a typical wind tunnel with suitable sketches.

   c. What is meant by high lift devices? What are different types of high lift devices? (4+4+4)

9. a. Write notes on launch vehicles and UAVs?

   b. Explain the terms swept wing, dihedral angle and canard.

   c. What is the function of flap? Explain the function of any three types of flap. (4+4+4)