Code No: 07A62101 **R07** **Set No. 3**

III B.Tech II Semester Regular/Supplementary Examinations,May 2010
Flight Mechanics-II
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive an expression for the normal load factor of an airplane in a steady constant speed, constant angular rate pull - up maneuver in a vertical loop when the airplane is at a flight path angle γ in the loop.
   (b) An airplane of mass 1.5 tonnes, flying at 250 kmph pulls up in a vertical circular loop of radius 1.2 km. What is the lift required for this maneuver of the airplane while at a flight path angle $\gamma = 60$ degrees to the horizontal? [8+8]

2. Write a typical Transfer Function for an aircraft and explain. How is it useful in explaining the behaviour of the aircraft for a disturbance? [16]

3. Explain the aerodynamic forces on elevator - stabilizer configuration in the stick free condition of an airplane. [16]

4. The location of the wing on the longitudinal axis of the fuselage is of considerable importance to its destabilizing influence. Multhopp proposed a formula to account for this phenomenon. What is that formula? Derive it with the support of sketches. [16]

5. Starting with the Z force equation, use the small - disturbance theory to determine the linearized force equation. Assume a steady - level flight for the reference flight conditions? [16]

6. (a) Compare the connentional airplane configuration with a canasol-wing-tail combination. Make use of suitable figures.
   (b) Differentiate between swept-back and forward wing configurations. [8+8]

7. If the rudder angle δ_r required to produce the sideslip angle ψ is given by $\delta_r = (\mathrm{d}\ \delta_r\ /\ \mathrm{d}\ \psi\ )\psi$, derive the following equation for the expression for the rate of change of pedal force with the side slip angle,
   $\mathrm{d\ PF}\ /\ \mathrm{d}\ \psi = [\ \{ -\ \mathrm{G\ q\ S_r\ c_r}\ \eta_v\ \mathrm{C}_{\mathrm{h},\ \delta r}\ \}\ /\ \mathrm{C}_{\mathrm{n},\ \delta r}\ ]\ (\mathrm{C}_{\mathrm{n},\ \psi}\ )_{\mathrm{Free}}$ [16]

8. Explain in detail, with sketches, the functioning of the
   (a) Trim tabs
   (b) Servo tabs
   (c) Balance tabs
   (d) Spring tabs . [4+4+4+4]

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