Seventh Semester B.E. Degree Examination, Dec.2015/Jan.2016
Aircraft Stability and Control

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1 a. Derive an expression for tail contribution $\left(\dfrac{C_M}{C_L}\right)_{tail}$ for the static longitudinal stability of an airplane and discuss the downwash at the tail. **(10 Marks)**

    b. Define the following terms with equation and graphs:
      i) Equilibrium condition   ii) Dynamic stability
      iii) Stability criteria   iv) Static stability   **(10 Marks)**

2 a. Write the expression for stick-fixed neutral point and discuss the C.G. range on the aircraft. **(10 Marks)**

    b. Explain longitudinal control and derive the equation for elevator angle versus equilibrium lift coefficient. **(10 Marks)**

3 a. With a help of diagram and expression, explain the control surface floating characteristics and aerodynamic balance. **(10 Marks)**

    b. Derive the equation for stick-free neutral point. **(10 Marks)**

4 a. Briefly explain the effect of wing sweep, flaps and power on dihedral effect. **(10 Marks)**

    b. Derive the equation for aileron control force. **(10 Marks)**

PART – B

5 a. Define directional stability and explain static directional stability with rudder fixed. **(10 Marks)**

    b. Explain rudder lock and one engine in operative condition. **(10 Marks)**

6 a. Derive the equation for longitudinal motion. **(14 Marks)**

    b. Briefly explain the following with relevant sketch:
      i) Phugoid mode
      ii) Short period mode   **(06 Marks)**

7 a. Describe the aerodynamic response to Aileron with adverse yaw effect with required equation and graphs. **(10 Marks)**

    b. Derive an expression for change in forward velocity. **(10 Marks)**

8 a. Explain Routh's criteria and factors affecting period and damping of oscillation. **(10 Marks)**

    b. Explain the following:
      i) Dutch Roll
      ii) Spiral instability
      iii) Auto-rotation and spin stability   **(10 Marks)**

* * * * *