

**End Semester Examinations - 2015-16 Even Semester - May 2016**

**14AE2015 Aircraft Stability and Control**

**Set A**

**Time : 3 hrs**  
**Total Marks: 100**

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1.                   a. In directional DOF, translation and rotation are along which axis? (1 Mark)  
                      b. The method for obtaining downwash angle “ $\epsilon$ ” is by \_\_\_\_\_ (1 Mark)  
                      c. What are the major criteria for Longitudinal Static Stability? (2 Marks)  
                      d. Give an expression for total pitching moment about CG of an Aircraft? (2 Marks)  
                      e. Derive an equation for the neutral point in both the Stick Free and Stick Fixed conditions? (14 Marks)
- OR**
2.                   a. Number of degree of freedom for an aircraft motion is \_\_\_\_\_ (1 Mark)  
                      b. The coefficient of moment at the trim point of longitudinal static stability is \_\_\_\_\_ (1 Mark)  
                      c. Explain the different flight stability with its graphical representation? (2 Marks)  
                      d. For the stable condition of an aircraft, “CG is aft of AC”, TRUE or FALSE, justify your answer? (2 Marks)  
                      e. Explain and derive an equation for Moment @ CG with the Wing contribution and Aircraft tail contribution? (14 Marks)
3.                   a. What is tail volume ratio of an aircraft? (1 Mark)  
                      b. Define gearing ratio of the control forces? (1 Mark)  
                      c. Explain briefly the stick force gradient? (2 Marks)  
                      d. Explain the elevator hinge moment of an aircraft? (2 Marks)  
                      e. Explain graphically the change in lift coefficient curve and  $C_{M_{cg}}$  with the change in elevator deflection? Derive an equation for calculating elevator angle of trim? (14 Marks)
- OR**
4.                   a. What is bank angle of an Aircraft? (1 Mark)  
                      b. What is restoring hinge moment? (1 Mark)  
                      c. Explain how to obtain the turn radius and turn rate on a pull up maneuver? (2 Marks)  
                      d. What are the common factors for obtaining maximum turn rate and minimum turn radius for a pull up maneuver? (2 Marks)  
                      e. Derive an equation for elevator angle and stick force per g during pull-up maneuver? (14 Marks)
5.                   a. Define gearing ratio of the control forces? (1 Mark)  
                      b. Explain the term  $\Delta\alpha_t^{\wedge}$ ? (1 Mark)  
                      c. Explain how to obtain the turn radius and turn rate on a horizontal turn flight? (2 Marks)  
                      d. What are the common factors for obtaining maximum turn rate and minimum turn radius for a horizontal turn flight? (2 Marks)  
                      e. Derive an equation for elevator angle and stick force per g during turn flight? (14 Marks)
- OR**
6.                   a. Apart from ailerons, what is the other device which controls roll stability? (1 Mark)  
                      b. A negative dihedral angle is commonly called as \_\_\_\_\_ (1 Mark)  
                      c. What is dihedral effect in lateral stability? (2 Marks)  
                      d. Explain graphically the criteria for static roll stability? (2 Marks)  
                      e. Explain in detail various factors associated with the dihedral effect of an Aircraft and how they are developed? (14 Marks)
7.                   a. What is Yaw angle? (1 Mark)  
                      b. What is vertical tail efficiency? (1 Mark)  
                      c. Explain the directional Stability and weather cocking effect? (2 Marks)

- d. Graphically explain the criteria for directional stability? (2 Marks)
- e. Explain briefly the various situations of rudder requirements? (14 Marks)

**OR**

- 8.
  - a.  $H_x, H_y, H_z$  are \_\_\_\_\_ in the equation of aircraft motion (1 Mark)
  - b. The angular velocities  $p, q$  and  $r$  are about \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_ axes respectively (1 Mark)
  - c. Define Dynamic Stability of an Aircraft? (2 Marks)
  - d. In a dynamic system, show graphically the different modes of motion? (2 Marks)
  - e. Derive the equations of motion of the aircraft relative to moving axes under dynamic stability? (14 Marks)
  
- 9.
  - a. Explain in detail the evaluation of stability derivatives. (8 marks)
  - b. Explain the solution of Dynamic equations of motion under stick fixed case?(10 Marks)
  - c. What is Routh's discriminant? (2 Marks)

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**Wishing you All the Best**

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