

# ONE TIME EXIT SCHEME

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10AE73

Seventh Semester B.E. Degree Examination, April 2018

## Stability and Control

Time: 3 hrs.

Max. Marks: 100

**Note:** Answer any FIVE full questions, selecting atleast TWO questions from each part.

### PART – A

- 1 a. Define Static Stability and dynamic stability. Explain with a figure a statically stable, statically unstable and statically neutrally stable system. (06 Marks)  
b. Derive the expression for wing Contribution to longitudinal static stability. (07 Marks)  
c. Explain the power effects of a rear fuselage mounted Jet Engine on longitudinal static stability with suitable figure and assumptions. (07 Marks)
- 2 a. How is control different from stability? What is longitudinal control in a conventional tail plane aircraft? Explain how the graph depicting the variation of  $\delta_e$ ,  $V_s$ ,  $C_L$  is obtained. (10 Marks)  
b. On a figure depicting Mean Aerodynamic Chord (MAC). Show the position of forward most C of G in free flight and with Ground effect. Also mark the relative positions of Neutral Point for : with power , with no power and with wind milling propeller. Mark the CG margin in this figure. Comment at least two sentences on each of these points marked on the MAC. (10 Marks)
- 3 a. Explain Elevator Trim Tab with a neat sketch. Derive the expression for coefficient of hinge moment due to tab deflection. (15 Marks)  
b. Explain hinge moment parameters  $C_{h\delta}$  and  $C_{h\dot{\delta}}$ . (05 Marks)
- 4 a. Explain Weather cock stability with a suitable figure. (05 Marks)  
b. Explain the contribution of Wing , Fuselage and Vertical Tail to directional stability with suitable figures. (15 Marks)

### PART – B

- 5 a. What is Dihedral stability? Explain it with suitable figure. (04 Marks)  
b. Explain with suitable figures, the contribution of the following to lateral stability :  
i) Wing Dihedral Angle ii) Wing Sweep back Angle iii) Nose mounted Propeller engine iv) Conventional rear mounted vertical tail. (16 Marks)
- 6 a. What are the six degrees of freedom for a fixed wing aircraft? (02 Marks)  
b. Derive the six equations of motions of an aircraft. (18 Marks)
- 7 a. In dynamic longitudinal stability explain Phugoid and Short Period Pitch Oscillations for a conventional fixed wing aircraft. Show the roots of these oscillations on an Argand diagram. (14 Marks)  
b. What is Small Disturbance Theory when we discuss aerodynamic derivatives? Briefly explain the factors that are considered for the force acting along the longitudinal axis of an aircraft. (06 Marks)
- 8 a. What is Cooper Harper Scale? Explain the three levels and 10 ratings used by a pilot in the Cooper Harper Scale. (12 Marks)  
b. Briefly explain any two of the following :  
i) Routh's Criterion ii) Auto rotation iii) Roll – Yaw Coupling. (08 Marks)

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