



CBCS SCHEME

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15AE73

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020 Aircraft Stability and Control

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Prove that elevator angle required to vary lift co-efficient varies inversely with elevator power. (08 Marks)
- b. Explain with appropriate derivation and equation that contribution of tail depends on wake region (or) downwash of wing. (08 Marks)

OR

- 2 a. With proper graphs and equation elaborate how a running propeller has an effect on stability and equilibrium equation. (08 Marks)
- b. Derive the equation for elevation deflection required for landing. (08 Marks)

Module-2

- 3 a. Derive the appropriate equation for stick force Neutral point and the effect of floating tendency. (08 Marks)
- b. Explain in detail about control surface floating characteristics and effect of Aerodynamic balance. (08 Marks)

OR

- 4 a. How trim tabs are hinged to the control surface to produce moment about hinge line. (08 Marks)
- b. Explain in detail about Weather docking effect. (08 Marks)

Module-3

- 5 a. Estimate the Rolling velocity, Angle of attack due to rolling velocity and roll rate for a stick force for lateral control. (08 Marks)
- b. Derive the equation for Aileron control surface which pilot has to apply for deflection of control surface. (08 Marks)

OR

- 6 a. Given the general Aviation Airplane with following details Gross weight = 2750kg, Velocity = 176m/s $X_{cg} = 0.295 \bar{C}$, span = 33.4m, $\bar{C} = 5.7m$, Tail area = 16m, $\eta = 0.8$
 $\frac{\delta e}{\delta t} = 0.3$ $C_{L_{\alpha_1}} = 3.9 \text{ rad/sec}$, $C_{m_{cg}} = -0.20 - 0.035 \alpha$ @ forward most C_g position estimate elevator effectiveness, since of elevator to trim the Aircraft @ landing angle of attack 10° ; Assume elevator angle is between 20° and -25° . (08 Marks)
- b. Brief in detail with graph about phugoid and short period motion. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-4

- 7 a. Derive and show that the derivatives due to change in forward speed depends on Mach no and Aero elastic property. (08 Marks)
b. Derive the derivatives due to time rate of change of Angle of attack. (08 Marks)

OR

- 8 a. With the help of derivatives show that changes in pitching moment co-efficient is due to the change in pitch velocity q . (08 Marks)
b. How do you derive the rolling rate "P" caused derivatives? (08 Marks)

Module-5

- 9 a. Explain the context of spiral instability of Aircraft and its effects. (08 Marks)
b. Explain the factors affecting period and damping of oscillation. (08 Marks)

OR

- 10 a. What is meant by Dutch roll and briefly describe how is caused. (08 Marks)
b. Explain the effect of wind shows on Aircraft. (08 Marks)
