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203AE003

Ph.D./M.S. (Engg.) by Research Degree Examination, April/May 2024
Aircraft Performance and Flight Mechanics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Describe steady and level flight with neat sketches and relevant equation. Explain the principle of flight. **(10 Marks)**

b. Derive an expression for variation of thrust and drag with usual notation for a steady level flight. **(10 Marks)**

OR

2 a. Derive an expression for power required with speed and attitude using analytical approach. **(10 Marks)**

b. Describe maximum and minimum level flight speeds of an aircraft. **(10 Marks)**

Module-2

3 a. Describe Range and endurance of piston prop airplane with relevant sketches and equation. **(10 Marks)**

b. Illustrate steady climbing, gliding flights and minimum rate of sink and range. **(10 Marks)**

OR

4 a. Elucidate the characteristics of takeoff and landing of an aeroplane. **(10 Marks)**

b. With the help of neat relevant sketches explain pull-up and pull-down maneuver. **(10 Marks)**

Module-3

5 a. Define static stability and longitudinal static stability. Describe the contribution of various airframe components towards stability. **(10 Marks)**

b. Explain the power effects of a propeller airplane and Jet airplane with relevant sketches. **(10 Marks)**

OR

6 a. Describe the variation of elevator angle versus equilibrium lift–with relevant graphs. **(10 Marks)**

b. Explain : i) Hinge moment parameters ii) Stick free neutral point. **(10 Marks)**

Module-4

7 a. Define directional stability. Describe rudder fixed static directional stability. **(10 Marks)**

b. Explain the condition of one engine inoperative condition in directional stability. **(10 Marks)**

OR

8 a. Define roll stability and derive an estimation of dihedral effect with usual notation . **(10 Marks)**

b. Explain the aileron control force of static lateral roll stability of an aircraft. **(10 Marks)**

Module-5

9 a. Define dynamic longitudinal stability. Explain the types of modes of motion. **(10 Marks)**

b. Derive rigid body equation of motion for dynamic longitudinal stability of an aircraft. **(10 Marks)**

OR

10 a. Explain Routh's criteria for dynamic lateral and directional stability. **(10 Marks)**

b. Describe the factors affecting period and damping of oscillation. **(10 Marks)**

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