

ASE305:FLIGHT MECHANICS

L:3 T:1 P:0 Credits:4

Course Outcomes: Through this course students should be able to

- CO1 :: Understand the basic aircraft performance parameters
- CO2 :: Explain the aircraft performance in steady un-accelerated and accelerated flight.
- CO3 :: Determine the complex problems on aircraft performance in accelerated flight.
- CO4 :: List the performance of aircraft under various maneuvering condition
- CO5 :: Analyze the performance of aircraft in accelerated flight
- CO6 :: Categorize the concept of static stability, dynamic stability and control

Unit I

Steady Unaccelerated Flight : Introduction, Four forces of flight, General equation of motion, Power available and power required curves., Thrust available and thrust required curves., The fundamental Parameters: Thrust – to – weight ratio, Wing loading, Drag polar, and lift-to – drag ratio., Minimum velocity, Aerodynamic relations associated with lift-to-drag ratio.

Unit II

Performance of Level Flight, Climb & Glide : Performance: Equation of motion for Rate of climb- graphical and analytical approach, Absolute ceiling, Service ceiling, Time to climb – graphical and analytical approach, climb performance graph (hodograph diagram), maximum climb angle and rate of climb, Gliding flight, Range during glide, minimum rate of sink and shallowest angle of glide.

Unit III

Range And Endurance : Propeller driven Airplane: Physical consideration, Quantitative formulation, Breguet equation for Range and Endurance, Conditions for maximum range and endurance., Jet Airplane: Physical consideration, Quantitative formulation, Equation for Range and Endurance, Conditions for maximum range and endurance, Effect of head wind tail wind

Unit IV

Maneuver Performance : Turning performance: Level turn, load factor, Constraints on load factor, Minimum turn radius, Maximum turn rate., Pull-up and Pull-down maneuvers: (Turning rate, turn radius)., Limiting case for large load factor., The V-n diagram., Limitations of pull up and push over.

Unit V

Aircraft Performance in Accelerated Flight : Take-off Performance: Calculation of Ground roll, Calculation of distance while airborne to clear obstacle, Balanced field length, Landing Performance Accelerated Climb: Calculation of approach distance, Calculation of flare distance, Calculation of ground roll, ground effects., Acceleration in climb.

Unit VI

Concepts of stability and control : Basic concepts – static stability, dynamic stability,, longitudinal, lateral and directional stability,, control fixed and control free stability., Rudder lock, Dorsal fin. One engine inoperative condition., Weather cocking effect., Adverse yaw effects. Aileron reversal., Types of modes of motion: long or phugoid motion, short period motion.

Text Books:

1. AIRCRAFT PERFORMANCE by MAIDO SAARLAS, WILEY

References:

1. AIRCRAFT PERFORMANCE & DESIGN by ANDERSON, JR., J.D., M.G.Hills
2. FLIGHT STABILITY AND AUTOMATIC CONTROL by NELSON, R.C., M.G.Hills

