

COURSE CODE	COURSE TITLE	L	T	P	C
1151AE109	AIRPLANE PERFORMANCE	3	0	0	3

Course Category:

Programme core

a. Preamble :

This course deals with performance of airplanes under various flight conditions like take off, cruise, landing, climbing, gliding, turning etc.

b. Prerequisite Courses:

- Incompressible flow Aerodynamics
- Engineering Mechanics

c. Related Courses:

- Airplane stability and control
- Aircraft Design

d. Course Educational Objectives:

- To understand basic concepts of ISA and compute various airspeeds
- To familiarize the concepts of drag polar and aircraft flight performance

e. Course Outcomes:

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Describes the International standard atmosphere and fundamentals of airplane performance	K2
CO2	Examine effects of altitude and Mach number on drag polar	K3
CO3	Estimate steady level flight performance	K3
CO4	Estimate Gliding and climbing flight performance	K3
CO5	Estimate accelerated flight performance	K3

f. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H			H			M	H				
CO2	H			H			M	H				
CO3	H			H			M	H				
CO4	H			H			M	H				
CO5	H			H			M	H				

H- High; M-Medium; L-Low

g. Course Contents:

UNIT-I GENERAL CONCEPTS: L-9

International Standard atmosphere, IAS, EAS, TAS, Propeller theory- Blade element theory, Propeller co-efficient, Use of propeller charts, Performance of fixed and variable pitch propellers, Effect of power plant on aircraft performance - variation of thrust and SFC with altitude, velocity & Mach number, High lift devices, Thrust augmentation.

UNIT-II DRAG POLAR: L-9

Streamlined and bluff body, Types of drag, Effect of Reynold's number on skin friction and pressure drag, Drag reduction of airplanes, Drag polar, Effect of Mach number on drag polar, NACA Airfoils, Effect of Aspect ratio and sweep angle on lift and drag.

UNIT-III STEADY LEVEL FLIGHT L-9

Steady level flight, thrust required and Power required, thrust available and Power available for propeller driven and jet powered aircraft, Effect of altitude, maximum level flight speed, conditions for minimum drag and minimum power required, Effect of drag divergence on maximum velocity, Range and Endurance of Propeller and Jet airplanes.

UNIT-IV GLIDING AND CLIMBING FLIGHT: L-9

Shallow and steep angles of climb, Rate of climb, Climb hodograph, Maximum Climb angle and Maximum Rate of climb- Effect of design parameters for propeller and jet aircrafts, Absolute and service ceiling, Cruise climb, Gliding flight, Glide hodograph.

UNIT-V ACCELERATED FLIGHT: L-9

Estimation of take-off and landing distances, Methods of reducing landing distance, level turn, minimum turn radius, bank angle and load factor, Constraints on load factor, pull up and pull down maneuvers, maximum turn rate, V-n diagram.

Total Periods: 45

h. Learning Resources

i. Text Books:

1. Anderson, J.D., Aircraft Performance and Design, Mc Graw-Hill International Edition 1999
2. Clancy, L.J., Aerodynamics, Pitman, 1986

ii. References:

1. PerPerkins, C.D., and Hage, R.E., Airplane Performance and Stability and Control, Wiley Toppan, 1974