

AIRPLANE PERFORMANCE

IV Semester								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5AE13	PCC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
COURSE OBJECTIVES: Upon the completion of course students should understand <ol style="list-style-type: none"> 1. Demonstrate competence in evaluating lift and drag of airplanes, and installed thrust of their engines 2. To familiarize with the concepts of Flight performance 3. To understand the parameters effecting the performance 4. To familiarize with the concept of Stability and control of Aircraft 5. To familiarize with the concept of dynamic stability of Aircraft 6. Ability to understand and apply the governing equations related to longitudinal and lateral static stability and control of an aircraft 7. Effects of the aerodynamic design, center of gravity location and moments of inertia on static and dynamic stability and control of an aircraft 								
UNIT-I	INTRODUCTION TO AIRCRAFT PERFORMANCE							
The role and design mission of an aircraft specification of the performance requirements and mission profile. Importance of performance analysis, estimation and measurements .Scheduled performance and operational performance of aircraft. The international standard Atmosphere. Off - design atmosphere. Measurements of air data. Air data computers.								
UNIT-II	THE FORCE SYSTEM OF THE AIRCRAFT, CRUISE PERFORMANCE							
The aircraft force system. The lift force, side force the drag force. Total airplane drag- drag estimation - drag reduction methods. The propulsive forces the thrust producing engine, power and specific fuel consumption with altitude and flight speed. The minimum drag speed, minimum power speed. Aerodynamic relationships for a parabolic drag polar. The maximum & minimum speeds in level flight -Range and Endurance of aircraft with thrust producing engines and with power producing engines. Cruise techniques: constant angle of attack, constant Mach number, constant Mach number methods, comparison of performance. The effect alternative fuel flow laws, the effect of weight, altitude and temperature on cruise performance.								
UNIT-III	CLIMB AND DESCENT PEROFRMANCE,AIRCRAFT MANEUVER PERFORMANCE							
Importance of climb and descent performance- safety considerations. Climb and descent techniques, generalized performance analysis for thrust producing, power producing and mixed power plants, maximum climb gradient, climb rate. Energy height and specific excess power, energy methods for optimal climbs, minimum time climbs, minimum fuel climbs, Measurements of climb performance. Descent performance in aircraft operations. Effect of wind on climb and descent performance.								
UNIT-IV	TAKE-OFF AND LANDING PERFORMANCE PLANNING, AIRCRAFT PERFORMANCE MESUREMENTS AND DATA HANDLING							

Flight safety criteria. Performance classification civil. Flight plans, performance planning and fuel planning Estimation of take off distances. The effect on the take – off distance, of weight wind runway conditions, ground effect. Take off performance safety factors. Estimation of landing distances, the discontinued landing baulked landing air safety procedures and requirements on performance. Fuel planning fuel requirements trip fuel, fuel reserves, tankering. Purpose of performance measurements in flight. Flight testing Principle performance variables weight, altitude and ambient temperature (WAT).

UNIT-V THE APPLICATION OF PERFORMANCE DATA

The performance summary and fleet selection-the block performance,payload – range diagram. Route analysis and optimization. Operational analysis procedure. Operational performance data for flight planning, take off field performance runaway correction chart, aircraft datum performance (WAT) chart, determination of the maximum takeoff weight

Text Books:

1. Eshelby M. E (2000), *Aircraft performance: Theory and Practice*, AIAA Education Series, USA.
2. Anderson J. D. (2011), *Aircraft Performance and Design*, international edition, McGraw Hill, New Delhi.

Reference Books:

1. Mc Cormic B. W.(2010), *Aerodynamics, Aeronautics and Flight Mechanics*, 2nd edition, Wiley India Ltd. India
2. Yethout (2003), *Introduction to Aircraft Flight Mechanics*, AIAA Education Series, USA

COURSE OUTCOMES:

Students should be able to:

1. Compare and contrast between the performance parameters for civil transport and military aircrafts
2. Calculate the range and endurance of a fixed-wing aircraft with either a jet or a propeller-driven propulsion system in straight and level flight and analyze the various types of cruise techniques
3. Evaluate the performance of an aircraft during its climb and descend
4. Evaluate the factors effecting the take-off and landing performance of the aircraft
5. Apply flight mechanics analytical concepts and aircraft performance data to the preliminary design of a new aircraft to meet defined performance requirements