AEROSPACE PROPULSION

(CORE COURSE-III)

I Semester: AEROSPACE ENGINEERING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
B27603	CC	3	-	-	3	30	70	100
Contact Classes: 60	Tutorial Classes:	Practical Classes: Nil				Total Classes: 60		

COURSE OBJECTIVES:

The students will be exposed to advanced topics in the aerospace propulsion

COURSE OUTCOMES:

1. The students will come to know different types of aircraft power plants, combustion chamber design, compressors and rocket propulsion.

UNIT-I	**ELEMENTS OF AIRCRAFT PROPULSION**	**Classes: 12**

Classification of power plants - Methods of aircraft propulsion – Propulsive efficiency – Specific fuel consumption - Thrust and power- Factors affecting thrust and power- Illustration of working of Gas turbine engine - Characteristics of turboprop, turbofan and turbojet , Ram jet, Scram jet – Methods of Thrust augmentation

UNIT-II	**PROPELLER THEORY**	**Classes: 12**

Momentum theory, Blade element theory, combined blade element and momentum theory, propeller power losses, propeller performance parameters, prediction of static thrust- and in flight, negative thrust, prop fans, ducted propellers, propeller noise, propeller selection, propeller charts.

UNIT-III	**NLETS, NOZZLES AND COMBUSTION CHAMBERS**	**Classes: 12**

Subsonic and supersonic inlets – Relation between minimum area ratio and external deceleration ratio – Starting problem in supersonic inlets –Modes of inlet operation, jet nozzle – Efficiencies – Over expanded, under and optimum expansion in nozzles – Thrust reversal. Classification of Combustion chambers - Combustion chamber performance – Flame tube cooling – Flame stabilization.

UNIT-IV	**AXIAL FLOW COMPRESSORS, FANS AND TURBINES**	**Classes: 12**

Introduction to centrifugal compressors- Axial flow compressor- geometry- twin spools- three spools- stage analysis- velocity polygons- degree of reaction – radial equilibrium theory- performance maps- axial flow turbines- geometry- velocity polygons- stage analysis- performance maps- thermal limit of blades and vanes.

UNIT-V	**ROCKET AND ELECTRIC PROPULSION**	**Classes: 12**

Introduction to rocket propulsion – Reaction principle – Thrust equation – Classification of rockets based on propellants used – solid, liquid and hybrid – Comparison of these engines with speCIEl reference to rocket performance – electric propulsion – classification- electro thermal – electro static – electromagnetic thrusters- geometries of Ion thrusters- beam/plume characteristics – hall thrusters.

Text Books:

1.Hill,P.G. and Peterson, C.R. Mechanics and Thermodynamics of Propulsion, Addison – Wesley Longman Inc. 1999

2. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H, Gas Turbine Theory, Longman,1989

3. G.C. Oates, "Aerothermodynamics of Aircraft Engine Components", AIAA Education Series, 1985.

Reference Books:

1. G.P.Sutton, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5th Edition, 1986.

2 W.P.Gill, H.J.Smith& J.E. Ziurys, "Fundamentals of Internal Combustion Engines as applied to Reciprocating, Gas turbine & Jet Propulsion Power Plants", Oxford & IBH Publishing Co., 1980.