AEROSPACE PROPULSION - I

V Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AE20	PCC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

The course is intended to build up necessary background for understanding the basics of propulsion.
1. To understand the application of various experimental fluid mechanics correlations in propulsion.
2. To understand the basic concepts of compressible fluid flow

UNIT-I FUNDAMENTALS OF GAS TURBINE

Introduction-Working Of Gas Turbine Engines- P-v and T-s Diagram, Characteristics of Turboprop, Turbojet, Turbofan, Ramjet, Scramjet, Advantages, Disadvantages, Thrust Equation, Installed and Uninstalled- thrust, TSFC, SFC, Mass Flow rate Numerical Problems

UNIT-II INLETS & NOZZLES

Subsonic Inlets: Flow Characteristics, Governing Equations of Inlets, Stall in Subsonic inlets, Relation between minimum area ratio and external deceleration ratio. Diffuser performance. Supersonic Inlets
Nozzles: Nozzle Types, Area-Mach relationship and Nozzle Throat Conditions. Nozzle Efficiency, Losses In Nozzles. Nozzle Expansion Process Ejector And Variable Area Nozzles, Thrust Reversal, Thrust Vectoring, Noise reduction methods.

UNIT-III COMPRESSORS

Axial Flow Compressors: Elementary theory of axial flow compressor, Velocity triangles, Degree of reaction. Flow through an Axial flow Compressor stage; Losses in axial flow compressor stage; Compressor blade design, Stage losses, Characteristics of Blade - single and multi-stage Axial compressor, Characteristics of HPC,LPC. Design Pressure & Velocity compounding (Curtis &Rateau Staging)

UNIT-IV COMBUSTION CHAMBER, BURNERS AND PERFORMANCE

Classification of combustion chambers – Important factors affecting combustion chamber design – Combustion process – Combustion chamber performance – Effect of operating variables on performance – Flame tube cooling – Flame stabilization – Use of flame holders – After Burner-Numerical problems.

UNIT-V TURBINES

Axial Flow Turbines: Introduction; Turbine stage; Turbine Blade 2-D (cascade) analysis Work Done; Degree of Reaction; Losses and Efficiency; Flow Passage; Subsonic, transonic and supersonic turbines, Multi-staging of Turbine, Turbine Cooling; Turbine Blade design & Profiles, Airfoil Data and Profile construction.
Radial Turbine: Introduction, Thermodynamics and Aerodynamics of radial turbines; Radial Turbine Characteristics; Losses and efficiency

Text Books:

1. Elements of Gas Turbine Propulsion, Mattingly,: TMCH
2. V. Ganesan (2010), Gas Turbines, Tata McGraw-Hill, New Delhi, India.

Reference Books:

1. Gas Turbines and Jet & Rocket Propulsion, Mathur, M.L.
2. H. I. H. Saravanamuttoo, Cohen H. Rogers (2009), Gas Turbine Theory, 6th edition, Pearson Education, New Delhi, India.
3. Ahmed F EL Sayed 2008 —Aircraft Propulsion and Gas Turbine Enginesǁ, CRC Press LLC
4. Royce (2005),Jet Engine, 6th edition, Rolls - Royce Ltd, USA.

COURSE OUTCOMES:

1. Analyze principles of various engines and thermodynamic cycles
2. Analyze the characteristics and performance of various types of jet engines
3. Examine the various types of inlets and principle of axial flow compressors
4. Evaluate the performance of combustion chamber
5. Analyze the characteristics of turbine and nozzles