INTRODUCTION TO JETS AND ROCKETS

VI Semester: OPEN ELECTIVE -II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5AE64	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

The course is intended to serve as an introduction to air breathing propulsion systems and Rocket Propulsion Systems.

1. Illustrate an overview of aerospace propulsion system.
2. Identify the foundation in fundamentals of thermodynamics.
3. Compare the ideal components and characteristics of jet engine
4. Interpret the performance of nozzles
5. Simplify the ideal performance analysis of rocket engines.
6. Select appropriate fuel for aerospace application.

UNIT-I INTRODUCTION TO AEROSPACE PROPULSION

Propulsion system, Propulsive Systems – Evolution, Development, Growth and Challenges. Fundamentals of Thermodynamics – Variables, Thermodynamic Process, Introduction to IC Engines and Reciprocating Engines, Propellers and Working of Propellers.

UNIT-II PRINCIPLES OF JET PROPULSION

Fundamentals of jet propulsion, Working Principle, Analysis of Ideal Jet Engine cycle, Engine components- merit- significance- ideal component characteristics, Classification – turbo jet, turbo fan, turbo prop and Ramjet engines. Basic Problems based on Engine Cycle.

UNIT-III RAMJET, SCRAMJET ENGINES AND NOZZLES

Speed limitations of gas turbines, Basics of Ramjets, Combustors for liquid fuel ramjet engines, Combustion Instability and its Suppression, Solid fuel Ramjet Engines, SCRAM jet engines, Applications of RAM Jet and SCRAM Jet Engines to Missiles with Examples, Nozzles- Types of Nozzles, Converging-Diverging Nozzle, Variable Nozzle and Effects of Pressure Ratios on Engine Performance.

UNIT-IV ROCKET THEORY

Applications of Rockets, Types of Rockets, Basics of Thermal Rocket Engine-Thermodynamics and Ideal Performance Analysis, Equations of motion-Rocket Motion in free space, Tsiokovsky‘s equation, Rocket Parameters, Burnout range, Burnout Velocity. Practical Problems

UNIT-V PROPELLANT ROCKETS

Solid Propulsion-Solid Propellant Rockets, Basic Configuration and Performance, Propellant Grain and Configuration, Propellant Characteristics Combustion Chamber, Ignition Process Liquid Propulsion - Design consideration of liquid rocket combustion chamber, injector, and propellant feed lines, valves, propellant tank outlet and helium pressurized and turbine feed systems-.BIO Fuels and Impact on the Atmosphere, Aviation turbine fuels - Requirements of aviation fuels of kerosene type.

Text Books:

1. Mechanics and Thermodynamics of Propulsion – Philip G Hill & Carl R Peterson , Pearson Publication – 2ndEdt
2. Rocket Propulsion Elements, Sutton, G.P., John Wiley, 1993.

Reference Books:

1.The Jet Engine – Rolls Royce
2. Gas Turbines and Jet and Rocket Propulsion, M. L. Mathur, R. P. Sharma, Standard Publishers Distributors.

COURSE OUTCOMES:

At the end of the course the students are able to:

1 Explain the complexity in working of various engines
2 Interpret the elementary principles of thermodynamic cycles as applied to propulsion analysis
3 Analyze the process involved in individual components
4 Compare the nozzles with various operating conditions.
5 Determine Equations of motion in free space, Tsiokovsky‘s equation.
6 Classify the types of fuel in aviation and aerospace engineering.