COURSE CODE	COURSE TITLE	L	T	P	C
1152AE131	Propellants and fuel technology	3	0	0	3

Course Category:

Programme elective

a. Preamble:

The course provides an introduction to fuels and propellants with a greater emphasis on aviation fuels. The course gives an overview of various solid, liquid and gaseous fuels and their characteristics. Rocket propellants and their characteristics forms the second half of the course. In a nutshell, the course aims at giving a detailed description of fuels and propellants that must be known to an aerospace engineer

b. Prerequisite Courses:

- Engineering Chemistry

c. Related Courses:

- Aircraft Gas Turbine Propulsion
- Propulsion Lab
- Heat Transfer
- Rocket and space Propulsion

d. Course Educational Objectives:

- To develop understanding of various kinds of fuels and their physical, chemical and thermal properties
- To analyse various solid and liquid propellants and their applications in specific launch vehicles
- To discuss in detail, the description, specification and characterization of aviation fuels

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	Apply the knowledge of fuel and to identify different classes of fuels	K2
CO2	Discuss in detail the types and characteristics of liquid and gaseous fuels	K3
CO3	Investigate the performance of various solid propellants in specific aerospace applications	K3
CO4	Investigate the performance of various liquid and hybrid propellants in specific aerospace applications.	K3
CO5	Understand the chemical kinetics of aviation fuels and to perform theoretical fuel analysis of aviation fuels	K3

f. Correlation of COs with POs:

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

H- High; M-Medium; L-Low

g. Course Contents:

UNIT-I INTRODUCTION TO FUEL L-9

Introduction to Fuels- Properties of Fuel oil, Coal and Gas- Overview of solid fuels, characteristics and origin-Methods of characterizing solid fuels- Physical and chemical properties of the solid fuels- Overview of solid fuel combustion technologies

UNIT-II LIQUID AND GASEOUS FUEL L-9

Description of fuels, Fuel specifications/test methods/quality assurance/additives, Fuel properties, Fuels and distribution systems issues, spectral characterization

UNIT III INTRODUCTION TO PROPELLANTS, SOLID PROPELLANTS

General features of rocket propellants, Solid Propellants, Combustion of solid Propellants, burn rate of double base and composite propellants, Propellant grain configurations,Ignition of solid propellant rockets, ignition problems and solutions

UNIT IV LIQUID AND HYBRID PROPELLANTS L-9

Liquid Propellant properties- Fuels, oxidizers and monopropellants- Liquid Propellants theoretical performance- Hybrid Propellants- Description, properties, advantages and disadvantages, Combustion of liquid Propellants

UNIT V AEROSPACE FUELS SCIENCE L-9

History of aviation fuels with relevant engine details, Drivers for evolution in fuels, Jet fuel composition, Thermal stability of fuels, Chemical kinetics overview, Autoxidation and pyrolysis of fuels, Fuel additives, Fuel analysis techniques, Aircraft fuel systems and thermal management

Total Periods: 45

f. Learning Resources

i. Text Books:

1. Maximilian Lackner (Editor), Franz Winter (Editor), Avinash K. Agarwal (Editor), "Handbook of Combustion" volume-3&4 Solid fuels, Liquid and Gaseous fuels, wiley publications, ISBN: 978-3-527-32449-1
2. Handbook of aviation fuel properties, CRC co, third edition, 2004

ii. References:

1. Paul J von Doehren, "Propellant Handbook", USAF
2. Combustion Engineering and Fuel Technology, Oxford & IBH Publishing Company - A.K.Shaha