

COURSE CODE	COURSE TITLE	L	T	P	C
1151AE111	ROCKET AND SPACE PROPULSION	3	0	0	3

Course Category:

Programme core

a. Preamble:

This course provides an introduction to the basic concepts of chemical, nuclear and electrical rockets. It introduces students to cognitive learning in Aerospace Propulsion and develops problem solving skills with both theoretical and engineering oriented problems.

b. Prerequisite Courses:

- Aircraft Gas Turbine Propulsion

c. Related Courses:

- Electric Propulsion
- Propellants and Fuel Technology
- Rockets and Missiles

d. Course Educational Objectives:

- To teach basic principles of rocket propulsion.
- To teach and apply physical and mathematical methods used in analyzing engineering applications involving rockets.
- To familiarize the students about the various space propulsion techniques used in spacecraft applications

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	Discuss the basic concepts of chemical rocket propulsion	K2
CO2	Explain the concepts involved in solid rocket propulsion	K2
CO3	Describe the concepts of liquid rocket propulsion	K3
CO4	Explain the concepts involved in hybrid rocket propulsion	K3
CO5	Select the suitable space propulsion system for a prescribed spacecraft mission	K2

f. Correlation of COs with POs:

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

H- High; M-Medium; L-Low

g. Course Contents:

UNIT-I FUNDAMENTALS OF CHEMICAL ROCKET PROPULSION L- 9

Operating principle – specific impulse of a rocket – internal ballistics – performance considerations of rockets – types of igniters- preliminary concepts in nozzle-less propulsion – air augmented rockets – pulse rocket motors – static testing of rockets & instrumentation –safety considerations

UNIT-II SOLID ROCKET PROPULSION L- 9

Salient features of solid propellant rockets – selection criteria of solid propellants – estimation of solid propellant adiabatic flame temperature - propellant grain design considerations – erosive burning in solid propellant rockets – combustion instability – strand burner and T-burner – applications and advantages of solid propellant rockets

UNIT-III LIQUID ROCKET PROPULSION L- 9

Salient features of liquid propellant rockets – selection of liquid propellants – various feed systems and injectors for liquid propellant rockets -thrust control and cooling in liquid propellant rockets and the associated heat transfer problems – combustion instability in liquid propellant rockets – peculiar problems associated with operation of cryogenic engines.

UNIT-IV HYBRID ROCKET PROPULSION L- 9

Introduction to hybrid rocket propulsion – standard and reverse hybrid systems- combustion mechanism in hybrid propellant rockets – applications and limitations

UNIT-V ADVANCED PROPULSION TECHNIQUES L- 9

Electric rocket propulsion– types of electric propulsion techniques - Ion propulsion – Nuclear rocket –comparison of performance of these propulsion systems with chemical rocket propulsion systems –future applications of electric propulsion systems - Solar sail

Total Periods: 45

h. Learning Resources

i. Text Books:

1. Anderson, Sutton, G.P., “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 5th Edition, 1993.
2. Mathur, M.L., and Sharma, R.P., “Gas Turbine, Jet and Rocket Propulsion”, Standard Publishers and Distributors, Delhi, 1988

ii. References:

1. Hill, P.G. & Peterson, C.R., Mechanics and Thermodynamics of Propulsion, Pearson India, 2nd Edition 2009.