

COURSE CODE	COURSE TITLE	L	T	P	C
1152AE111	COMBUSTION IN JET AND ROCKET ENGINES	3	0	0	3

Course Category:

Programme Elective

a. Preamble :

This course deals with the combustion process in jet and rocket engines. It gives an understanding of chemical-thermal energy conversions in jet and rocket engines

b. Prerequisite Courses:

Aero Engineering Thermodynamics

Aircraft Gas Turbine propulsion

c. Related Courses:

- Rocket and space propulsion
- Ramjets and Scramjet propulsion

d. Course Educational Objectives :

- To learn about the Thermodynamics, Physics and Chemistry of Combustion.
- To understand the chemical thermal energy conversions in combustion chambers

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	Understand the Thermodynamics of combustion	K2
CO2	Understand the basic chemical kinetics of combustion process	K2
CO3	Analyze the role of Premixed and diffused flames in combustion process	K3
CO4	Analyze the combustion characteristics of Gas Turbines, Ramjets and Scramjets	K3
CO5	Understand the combustion process in chemical rockets	K2

f. Correlation of COs with POs :

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

H- High; M-Medium; L-Low

g. Course Content :

UNIT I THERMODYNAMICS OF COMBUSTION 8

Stoichiometry – absolute enthalpy- enthalpy of formation- enthalpy of combustion- laws of thermo chemistry- pressure and temperature effect on enthalpy of formation, adiabatic flame temperature, chemical and equilibrium products of combustion.

UNIT II PHYSICS AND CHEMISTRY OF COMBUSTION 9

Fundamental laws of transport phenomena, Conservations Equations, Transport in Turbulent Flow. Basic Reaction Kinetics, Elementary reactions, Chain reactions, Multistep reactions, simplification of reaction mechanism, Global kinetics..

UNIT III PREMIXED AND DIFFUSED FLAMES 12

One dimensional combustion wave, Laminar premixed flame, Burning velocity measurement methods, Effects of chemical and physical variables on Burning velocity, Flame extinction, Ignition, Flame stabilizations, Turbulent Premixed flame. Gaseous Jet diffusion flame, Liquid fuel combustion, Atomization, Spray Combustion, Solid fuel combustion.

UNIT IV COMBUSTION IN GAS TURBINE , RAMJET AND SCRAMJET 8

Combustion in gas turbine chambers, recirculation, combustion efficiency, flame holders, subsonic combustion in ramjet, supersonic combustion in scramjet. Subsonic and supersonic combustion controlled by decision mixing and heat convection.

UNIT V COMBUSTION IN CHEMICAL ROCKET 8

Combustion in liquid propellant rockets. Combustion of solid propellants- application of laminar flame theory to the burning of homogeneous propellants, Combustion in hybrid rockets. combustion instability in rockets.

Total : 45 Hrs

Learning Resources

i. Text Books :

1. Stephen.R.Turns, Principles of Combustion

ii. Reference:

1. Kuo K.K. “Principles of Combustion” John Wiley and Sons,2005.
2. D. P. Mishra .“ Fundamentals of Combustion”, Prentice Hall of India, New Delhi, 2008.
3. H. S. Mukunda, “Understanding Combustion”, 2nd edition, Orient Blackswan,2009.
4. Warren C. Strahle , “An Introduction to Combustion”, Taylor & Francis, 1993..