COURSE CONTENT

FUNDAMENTALS OF COMBUSTION								
III Semester: AE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BAEE28	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Aerodynamics								

I. COURSE OVERVIEW:

Combustion is an interdisciplinary field with the interaction of thermodynamics, chemistry, fluid mechanics, and heat transfer, and, consequently, difficult to describe in simple terms and in a balanced manner between the different basic sciences. The course emphasize the basics of fuels, stoichiometry, chemical kinetics and equilibrium, mass transfer, and different types of combustion process

II. COURSE OBJECTIVES:

The students will try to learn:

I. The fundamental concepts of fluid dynamics and compressible flow theory.
II. The behavior of high-speed jet flows, including supersonic and hypersonic regimes.
III. The facilities within an airport terminal that facilitate the transfer of passengers and baggage to and from aircraft.
IV. The various jet flow control techniques.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1 Identify the properties of compressible turbulent jets for assessing their application in aerospace.
CO 2 Analyze the characteristics of submerged and co-flowing jets for their control.
CO 3 Classify the types of compressible jet flows for assessing their application in aerospace.
CO 4 Select suitable active control technique for their efficient diffusion into the surrounding environment.
CO 5 Make use of suitable passive control technique for their efficient diffusion into the surrounding environment.
CO 6 Examine the acoustic characteristics of compressible jet flow for suppressing jet noise.

IV. COURSE CONTENT:

MODULE-I: THERMODYNAMICS OF COMBUSTION (09)
Introduction: Introduction to combustion, Applications of combustion, Types of fuel and oxidizers, Characterization of fuel, various combustion mode, scope of combustion.
Thermodynamics properties, Laws of thermodynamics, Stoichiometry, Thermochemistry, adiabatic temperature, chemical equilibrium.

MODULE-II: JETS (09)
Chemistry of Combustion: Basic Reaction Kinetics, Elementary reactions, Chain reactions, Multistep reactions, simplification of reaction mechanism, Global kinetics.
Physics of Combustion: Fundamental laws of transport phenomena, Conservations Equations, Transport in Turbulent Flow.

MODULE-III: PREMIXED FLAME (09)
Laminar Premixed flame: Physical description, Rankine-Hugonoit relations, Flame propagation and flame speed, Determination of flame speed, Factors effecting flame speed, Flame quenching and ignition, Limit phenomena – flammability limits, ignition, and flame stabilization.

Laminar Non-premixed flames: Physical description, analysis of diffusion controlled systems, Shvab-Zeldovich Formulation, Analysis of typical laminar non-premixed flames, Partially premixed flames, Effect of jet velocity on jet flames..

MODULE-IV: DIFFUSION FLAME (09)
Gaseous Jet diffusion flame, Liquid fuel combustion, Atomization, Spray Combustion, Solid fuel combustion. Combustion and Environment: Atmosphere, Empirical Correlations for Laminar Flame Height Condensed Fuel Fires, Turbulent Jet Flames.

MODULE-V: ROLE OF COMBUSTION IN PROPULSION (09)
Basics of composite solid propellant deflagration, Principal ideas of combustion in liquid propellant rockets, Combustion in boundary layers and hybrid rockets, Combustion process in combustor of gas turbine engines and types of flame holders.

V. TEXT BOOKS:

1. D.P. Mishra, Fundamentals of Combustion, Prentice Hall of India, New Delhi, 2008.
2. Kuo K.K.“Principles of Combustion” John Wiley and Sons, 2005.

VI. REFERENCE BOOKS:

1. Strehlow R A., “Fundamentals of combustion” McGraw Hill Book Company, 1984.
2. Shapiro, AH, “Dynamics and Thermodynamics of Compressible Fluid Flow, Vols. I & II”, Ronald Press, New York, 1953.

VII.ELECTRONICS RESOURCES:

1. http://memberfiles.freewebs.com/94/47/55224794/documents/airport%20planning%20and%20management.pdf
2. https://books.google.co.in/books?id=RYR6cu4YSBcC&dq=Planning%20and%20Design%20of%20Airports&source=gbs_similarbooks

VIII. MATERIALS ONLINE

1. Course template.
2. Assignments.

3. Tutorial question bank.
4. Model question paper – I.
5. Model question paper – II.
6. Lecture notes.
7. Power point presentations.