Course Type	CourseCode	NameofCourse	L	T	P	Credit
DE	NFMD511	Combustion Science	3	0	0	3

Prerequisites: Basics of Thermodynamics, Fluid Mechanics, Heat & Mass Transfer.

CourseObjective
The course aimstofamiliarize the students with • laminar and turbulent homogenous combustion • liquid fuel combustion, and • solid fuel combustion.
LearningOutcomes
Attheend ofthe course,studentswill be • aware of the additions to be made in thermo-fluid governing equations to address combustion. • able to analyze & comprehend the physicochemical aspects of combustion.

Unit No.	TopicstobeCovered	Lecture Hours	LearningOutcome
1	Introduction to the complexity of combustion, Discussion on the homogenous and heterogenous combustion.	3	Understanding combustion phenomena
2	Stoichiometry, Combustion thermodynamics: First law and Second law, Adiabatic Flame Temperature, Product in Equilibrium and effect on Adiabatic Flame temperature.	5	Thermodynamics of combustion, Maximum temperatures in combustion
3	Combustion kinetics, Governing equations ofmulti-component systems: Constant pressure reactor, Constant volume reactor, Well-stirred reactor, Plug flow reactor.	9	Governing equations of multi-component reactors. Combustion kinetics and approaches to simplify their analysis
4	**Laminar premixed combustion**: Deflagration and Detonation, Premixed flame theories, Variation of laminar flame speed with fuel and preheat temperatures, Flammability limits, Flame stabilization, Ignition. Turbulent premixed combustion regimes.	9	Critical parameters of laminar premixed combustion, Physics of laminar and turbulent premixed combustion
5	**Homogenous non-premixed combustion:**Diffusion flame jets, laminar diffusion-flame length, and flame length correlations.	7	Critical parameters of laminar non-premixed combustion, Physics of laminar and turbulent non-premixed combustion

6	**Solid fuel thermal decomposition:** Single film and Two film combustion models, Analytical combustion models: Fixed core model, Shrinking core model, Random pore model, Devolatilization, Mass transfer during moisture evaporation, Effect of particle size in the thermal decomposition of coal. Droplet evaporation and combustion.	9	Details about solid-fuel's thermal decomposition: moisture-evaporation, pyrolysis, gasification & combustion. Details about droplet combustion.
Total		**42**	

TextBook:

1. An Introduction to Combustion: Concepts and Application, McGraw Hill Education, 3rd Ed., *Author*: Stephen R. Turns.

ReferenceBooks:

1. Principles of Combustion, Wiley India Pvt. Ltd., 2nd Ed., *Authors*: Kenneth Kuo.
2. Combustion,Academic Press, *Authors*: Irvin Glassman