

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
M. Tech. in Thermal Engg.	Theory of Combustion and Emission	MET 513	SM+MT+ET 25+25+50
Semester	Credits	L-T-P	Exam.
I	3	3-0-0	3 Hours

Unit - I

Introduction: Importance of combustion; Combustion equipment; Hostile fire problems; Pollution problems arising from combustion; Thermodynamics of Combustion: Enthalpy of formation; enthalpy of reaction; Heating values; First and second law analysis of reacting systems; Chemical equilibrium; Equilibrium composition; Adiabatic and equilibrium flame temperature. **(08 Hours)**

Unit - II

Kinetics of Combustion: Law of mass action; Reaction rate; simple and complex reactions; Reaction order and molecularity; Arrhenius law; Activation energy; Chain reaction steady state and partial equilibrium approximations; Chain explosion; Explosion limits and oxidation characteristics of hydrogen; Carbon monoxide and hydrocarbons. **(08 Hours)**

Unit - III

Flames: Premixed flames structure and propagation of flames in homogeneous gas mixtures; Simplified Rankine Hugoniot relations; properties of Hugoniot curve; Analysis of deflagration and detonation branches; Properties of Chapman Jouguet wave; Laminar flame structure; Theories of flame propagation and calculation of flame speeds; Flame speed measurements; Stability limits of laminar flames; Flammability limits and quenching distance; Burner design; Mechanisms of flame stabilization in laminar and turbulent flows; Flame

quenching; Diffusion flames; Comparison of diffusion with premixed flame; Combustion of gaseous fuel jets Burke and shumann development. **(10 Hours)**

Unit - IV

Burning of Condensed Phase: General mass burning considerations; Combustion of fuel droplet in a quiescent and convective environment; Introduction to combustion of fuel sprays. **(06 Hours)**

Unit - V

Ignition: Introduction of basic ignition process and systems; Concepts of ignition; Chain ignition; Thermal spontaneous ignition; Forced ignition; Examples and problems. **(05 Hours)**

Unit - VI

Combustion Generated Pollution and Control: Introduction; Nitrogen oxides thermal fixation of atmospheric nitrogen prompt NO; Mechanism of formation of NO_x; Fuel NO_x and control; Post-combustion destruction of NO_x; Nitrogen dioxide; Mechanism of formation of CO; Quenching; Formation of hydrocarbons and sulphur oxides. **(08 Hours)**

Recommended Books:

1. Combustion; I. Glassman and R. A. Yetter; Academic Press; 4th Edition; 2008.
2. Introduction to Combustion Phenomenon; A. Murty Kanury; Gordon and Breach Publications; 1st Edition; 1995.
3. Combustion Fundamentals; R. A. Strehlow; Mc Graw Hill; 1st Edition; 2007.
4. Combustion and Flames; Roland Borghi; Michel Destriau; Gérard De Soete; Editions Technip Publications; 1st Edition; 1995.
5. Combustion Phenomena: Selected Mechanisms of Flame Formation; Propagation and Extinction; Jozef Jarosinski; Bernard Veyssiere; CRC Press; 1st Editions; 2009.