



Mechanical Engineering

Combustion Principles and Applications

Course Introduction

This training course on Combustion Principles and Applications is designed to provide participants with a comprehensive understanding of combustion processes, systems, and technologies. Whether working with industrial burners, boilers, or gas turbines, combustion plays a critical role in achieving energy efficiency and operational safety. Through this course, participants will gain foundational knowledge of combustion principles, the types and behavior of fuels, and the operational requirements for efficient and clean burning.

In addition to theoretical concepts, the course includes practical applications such as burner classification, troubleshooting techniques, and emission control strategies. By exploring fire tube boilers, gas turbine combustion chambers, and modern emission mitigation methods, the course equips participants with the skills needed to enhance system performance, troubleshoot problems effectively, and comply with environmental standards. This training is ideal for engineers, technicians, and professionals involved in energy systems, process industries, and environmental compliance.

Target Audience

This course is intended for engineers, technicians, and industry professionals involved in combustion systems, energy production, and environmental compliance.

Learning Objectives

1. Understand the fundamental principles and components involved in combustion processes.
2. Identify different types of burners and their operational characteristics for various fuels.
3. Analyze and troubleshoot common issues related to oil, gas, and combination burners.
4. Evaluate the design and operation of fire tube boilers and gas turbine combustion chambers.
5. Explore combustion-related emissions and apply methods for emission control and environmental protection.

Course Outline

• 01 DAY ONE

Module 1: Combustion basics

- Definition of combustion.
- Fuels
- Types of Combustion.
- Requirements of complete combustion
- Products of combustion.
- Gross and net calorific values
- Primary and secondary air.
- Natural and forced draft.
- Calculation of stoichiometric and excess air.

• 02 DAY TWO

Module 2 : Burners.

- Classification of burners.
- Requirements of successful burning.
- Oil burners and atomizers types.
- Rotating cup or pressure jet
- Steam jet atomizer.(external and external mix)
- Air Atomizer.
- The fundamental process.
- How a Nozzle works.
- Viscosity of fuel.
- Fuel-oil supply and distribution systems
- Gas burners and types.
- Diffusion flame burners
- Premixed flame burners
- Typical Excess air values
- Flame length
- Combination burners.
- Burner gun
- The Air register
- Lighters and Pilots
- Flame detectors
- The main design features of burners.

• 03 DAY THREE

Module 3 Burner Troubleshooting

- Flame lift.

- Flame flashback.
- Trouble Shooting For Oil Burners.
- Trouble Shooting For gas burners
- Trouble shooting for gas-oil combination burner.
- Excessive noise.
- Excessive operating cost.
- Heat delivered by the burner not adequate or excessive.
- Fouling on the burner tip.
- Safety precautions.

Module 4 Fire Tube boilers

- Basic components.
- Two pass and three pass boilers.
- Safety equipment on boilers.
- Basic fuel system
- Basic water -steam system.
- Limits of fire tube boiler
- Comparison between fire tube and water tube boilers

• 04 DAY FOUR

Module 5: Gas Turbine combustion Chambers

- Definitions and glossary
- Gas turbine Components
- Can combustor

- Annular combustor.
- Can –Annular Combustor.
- Liquid Fuel system.
- Natural gas fuel system.
- Fuel purge system.
- Spark plugs and flame detectors.
- Outer combustion chambers and flow sleeves.
- Cross fire tubes.
- The thermodynamics of combustion chamber
- Typical stability loop
- Performance requirements
- Effect of operating variables on burner performance
- Flame regimes as a function of fuel –oxygen ratio
- Diffusion and premixed combustors
- Hybrid chambers
- Methods of NO_x control
- Dry low NO_x burners DLN
- Case study on fuel operation on DLN Combustors

• 05 DAY FIVE

Module 6 Combustion Emissions and methods of protection

- Gaseous Pollutants
- Nitrogen Compounds
- Fuel NO_x and Thermal NO_x
- Sulfur compounds

- Flue gas desulfurization System
- Carbon monoxide
- Particle matter
- Volatile organic compounds
- NOx control technology
- Combustion control
- Post combustion control

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
May 12, 2025	May 16, 2025	5 days	4250.00 \$	UAE - Dubai
Aug. 11, 2025	Aug. 15, 2025	5 days	4250.00 \$	UAE - Dubai
Dec. 7, 2025	Dec. 11, 2025	5 days	4250.00 \$	KSA - Jeddah