

MTPE3002 FUELS AND REFRACTORIES (3-0-0)

Course Objectives:

This course helps students understand different types of fuels and heat-resistant materials used in industries. It teaches how to select and use them efficiently in furnaces and high-temperature processes.

Module-I: (06 hours)

Classification of fuels – solid, liquid, gaseous. Primary and secondary fuels. Characteristics of fuels. Fuel selection in metallurgy. Proximate and ultimate analysis of coal. Calorific value, caking, swelling index.

Module-II: (06 hours)

Types and ranks of coal. Coal washing – principle, washability curve. Carbonisation – high and low temperature. Metallurgical coke – preparation, properties, testing. Formed coke, dry quenching.

Module-III: (06 hours)

Petroleum and fuel oils. Coke oven gas, blast furnace gas, producer gas, water gas. Natural gas, LPG, CNG. Combustion reactions, air-fuel ratio. Flame temperature, flue gas analysis. Combustion problems, fuel storage safety.

Module-IV: (06 hours)

Classification of refractories – acidic, basic, neutral. Raw materials used in refractories. Bonding types in refractories. Manufacturing processes of refractories. Properties: porosity, bulk density, mechanical strength, thermal conductivity. Thermal properties: Refractoriness Under Load (RUL), spalling resistance, slag resistance. Testing methods as per ASTM/IS standards.

Module-V: (06 hours)

Heavy and special refractories: silica, silicide, sialon, high alumina, magnesite, chrome-magnesite, carbon, and insulating refractories. Castable and ramming masses. Selection of refractories for metallurgical applications: coke oven, iron blast furnace, copper converter, immersion reheating furnaces, heat treatment furnaces, and electric arc furnace. Overview of modern refractory developments and sustainability.

Course Outcomes:

After completing this course, the student should be able to:

- CO1: Learn about Fundamentals of Fuels
Students will be able to classify different types of fuels and analyze their properties for metallurgical applications.
- CO2: Learn about Coal and Coke
Students will be able to explain coal processing methods and evaluate the quality and applications of metallurgical coke.
- CO3: Learn about Liquid and Gaseous Fuels
Students will be able to describe various liquid and gaseous fuels and analyze their combustion behavior and safety aspects in metallurgical processes.
- CO4: Learn about Refractory Basics and Properties
Students will be able to classify refractories, understand their manufacturing and bonding, and evaluate their properties through standard testing methods.
- CO5: Learn about Refractory Applications and Safety
Students will be able to identify special refractories and select suitable materials for various metallurgical furnaces considering performance and sustainability.

Books:

1. Fuels, Furnaces and Refractories by J.D. Gilchrist.
2. Fuels, Furnaces and Refractories by O.P. Gupta, Khanna Publishers
3. Industrial Furnace, Vol –I & II, by Trinks & Mawhinney
4. Refractories manufacture properties and uses by M.L.Mishra

Reference Books:

1. Fuels, Furnaces and Refractories by O.P. Gupta, Khanna Pulishers
2. Fuels and Combustion by Samir Sarkar, Orient Longman Ltd., Mumbai.
3. Refractories manufacture properties and application by A.R.Chesti
4. Steel Plant Refractories by Chester
5. Refractories by Norton