

Applied Thermodynamics

5 days
Overview

GCA/ATHERMO

LEVEL

Expert

PURPOSE

This course provides the fundamentals of thermodynamics applied to hydrocarbon processing.

LEARNING OBJECTIVES

Upon completion of the course, participants will be able to:

- recall the physical and chemical properties of the petroleum cuts,
- explain the practical aspects of the hydrocarbon behavior in the vapor-liquid equilibria,
- calculate flashes and thermodynamic properties of fluids in LVE,
- explain the technology of distillation columns,
- describe the operating principle, control scheme and critical variables of a given distillation column.

WAYS AND MEANS

- Participative lecturing.
- Illustrated documentation.
- Numerous applications.

LEARNING ASSESSMENT

Quiz + Exam.

Agenda

PHYSICAL & CHEMICAL PROPERTIES OF HYDROCARBONS

1 d

Hydrocarbons classification, structure and properties.
Main physical and chemical properties of hydrocarbon mixtures (IBP-FBP, sulfur content, specific gravity...).
Others contaminants in relation with hydrocarbons origin (gas fields, crude oils).

FLUID PROPERTIES

1 d

Properties of pure substances, vapor pressure, thermodynamic diagrams (P-t, h-t, h-S, h-P), application to frigorific cycles, boilers.
Fluid properties: ideal gas law, real gas: compressibility factor, corresponding state law, analytical equations of state, mixtures of gases, partial pressures.
Equations of state: conception, uses, examples, selection.

LIQUID-VAPOR EQUILIBRIA OF HYDROCARBON MIXTURES

1 d

Liquid-vapor equilibrium of pure substances: vapor pressure curves, critical point, volatility of pure substances...
Liquid-vapor equilibrium of mixture: bubble and dew curves, critical point, phase envelopes.
Liquid-vapor equilibrium coefficient - Raoult's law.
Behavior of ideal and non-ideal solutions.

SEPARATION PROCESSES USED IN THE PETROLEUM INDUSTRY

0.5 d

Processes based on liquid vapor equilibria selectivity, liquid-liquid equilibria selectivity, adsorption selectivity, liquid-solid equilibria selectivity, permeability...

DISTILLATION PROCESS

1.5 d

Principle of distillation process.

Technology - Internals - Selection criteria.

Operation of distillation columns.

Distillation column control.

Troubleshooting of distillation columns.

Design of distillation columns.