

## BASICS OF CHEMICAL ENGINEERING 2 FIELD\_10 ECTS

### Introducing

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### Description

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### Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

### Practical info

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### Location(s)

 Toulouse

## Heat Transfer

# Introducing

## Description

### Common Section :

The student should be able, for plan, cylindrical, and spherical systems in steady-state conditions, with or without heat generation, to:

- Establish and solve the energy balance equations in steady-state conditions to calculate heat fluxes and characterize temperature gradients,
- Calculate heat fluxes, thicknesses of materials composing walls, pipes, spherical tanks in steady-state conditions,
- Calculate temperatures at interfaces.

### Section GP3E:

The student should be able to:

- Explain the different heat fluxes
- Establish energy balances on reactive or non-reactive systems
- Integrate differential equations to determine temperature profiles and assess heat fluxes
- Know how to transmit a given amount of heat between two systems
- Know how to limit heat losses through a surface
- Study cases applicable to processes.

### Section GB:

The student should be able to:

- Choose a technology and configuration of heat exchanger according to its uses
- Calculate heat exchange between fluids within a heat exchanger based on steady-state configurations
- Calculate the efficiency of a heat exchanger based on steady-state configurations
- Size the heat exchange surface of a heat exchanger

according to its steady-state configuration

- Calculate the performance of heat exchangers based on flow rates and inlet and outlet temperatures of fluids
- Solve, in transitional regime, the energy balance equations on a perfectly stirred tank to calculate heating and cooling times according to the implemented technologies (coil, double-wall, external heat exchanger) with or without thermal loss

## Objectives

### Common Section :

At the end of this common teaching section, the student should have understood and be able to explain (main concepts):

- The general equation of energy conservation,
- The different modes of heat transfer and the associated laws into the phenomena of conduction (Fourier's law) and forced and natural convection (Newton's law),
- The expressions for heat flux by conduction and convection and temperature profiles within different systems in steady-state conditions (simple and composite walls, cylindrical and spherical layers, simple and composite).

### Section GP3E:

At the end of this common teaching section, the student should have understood and be able to explain (main concepts):

- Heat transfer in solids with and without heat production in steady-state
- Heat transfer in solids with and without heat production in transitional regime
- Heat transfer by radiation

Section GB:

At the end of this teaching section, the student should have understood and be able to explain (main concepts):

- Different technologies of heat exchangers (tubular, plate, coil, double-wall) implemented industrially
- Principles and operating theories of heat exchangers
- Sizing of heat exchangers

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## Necessary prerequisites

- Thermodynamics
- Differential Equations and Partial Differential Equations

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## Practical info

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### Location(s)

📍 Toulouse

## Hydraulic engineering



ECTS



Hourly volume  
39h

### Introducing

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#### Description

Macroscopic mass, momentum and energy balances  
Fluid rheology  
application of energy balances (Bernoulli) ducted and free flows  
Linear and singular pressure losses  
Turbomachinery: Pumps and turbines  
Hydraulic networks  
Extension to total energy balance (EC thermodynamics)

#### Objectives

dimension a complete plant (processes, plants, hydropower turbine) from the hydraulic point of view

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évaluation par les pairs...

### Practical info

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#### Location(s)

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## Processes

# Introducing

## Description

Introduction to the concept of process, the way of building it, constraints of the industrial production. Representation and estimate of the cost of a process. Description of some large production channels. Critical analysis of a transformation channel of matter or energy, through a project in group.

## Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

- the principle of raw materials transformation processes (oil, coal, gas, ore, biomass), of organic and mineral heavy chemistry (refining, petrochemistry,  $\text{NH}_3$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{Na}_2\text{CO}_3$ ,  $\text{NaOH}$ ,  $\text{Cl}_2$ , manure...) and of energy production (thermal, nuclear, biomass)
- the principle of the diagrammatic representation of a process (flowsheet) and associated graphics
- the principles of cost estimation of a process
- the industrial context of the sector

The student will be able to:

- describe a production system
- read, interpret, propose an installation flowsheet
- to write global balances on a process in order to calculate matter and energy flows

- identify of information fluxes
- make an critical analysis of a process
- estimate the cost of a process
- know to work in autonomy starting from a schedule of conditions to find and analyze scientific documentation.

## Necessary prerequisites

Mineral and organic chemistry, biochemistry  
Thermodynamics  
Chemical kinetics, reactors  
Unit operations of chemical engineering  
Regulation  
Metrology

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## Practical info

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# Ecological Transition, GHG Reduction, Responsibility and Environment (EARTH)

## Introducing

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### Description

The teaching includes a "2 tonnes" workshop, which provides a fun way of understanding the orders of magnitude linked to the objectives of carbon neutrality in 2050. It also includes assignments on the following topics: housing; electricity production; inequalities and responsibilities; mobility; the climate inaction debate; agriculture and food; and aeronautics. Students also work on a complex problem linked to ecological issues, starting their reflections from an everyday object or service.

### Objectives

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At the end of this module, the student will be able to:

- ✂ Be comfortable with the fundamental concepts related to greenhouse gas emissions, and be able to make simple calculations on this subject.
- ✂ Know the order of magnitude of important quantities.
- ✂ Be able to fetch emission values from the ADEME database and use them appropriately.
- ✂ Think about ecological issues in all their complexity and study a specific problem
- ✂ Have an understanding of life cycle analysis and how to apply it
- ✂ Be able to research scientific literature

- ✂ Be able to understand and analyse figures/data
- ✂ Draw political conclusions from scientific facts and one's own values
- ✂ Debate, discuss and confront points of view.

### Necessary prerequisites

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Basic knowledge on energy.

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