

# 5th YEAR GPE\_SEMESTER 9

# Practical info

# Location(s)





### Water supply and waste water treatment



ECTS 5 crédits



Hourly volume

# Introducing

#### **Objectives**

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

- 1. Understand and be able to explain:
- Notions of resources, water uses, access to water, pollution of receiving environments
- Who are the water stakeholders
- The role of unit operations (OPU) and advanced technologies in the drinking water production and wastewater treatment sectors
- 2. Know how to find information on the quality of a water resource and be able to assess whether the water is drinkable based on legislation
- 3. Propose and size treatment lines for producing drinking water from fresh waters and for purification of domestic wastewater, that are adapted to the quality of the resource, respectful of human health and the receiving environments and economical in energy and resources or able to valorize resources. In particular, the student will be able
- 3.1 designing an appropriate treatment line for the production of drinking water from fresh water, sizing its major unit operations and computing its energy consumption
- 3.2 comparing several processes for wastewater and sludge treatment
- 3.3 sizing an activated sludge treatment plant for the removal of major pollutants and choosing a sludge

drying technology

3.4 sizing a sludge methanisation equipment

#### Necessary prerequisites

Unit operations 3A and 4A (sedimentation, filtration, membranes) (I4PETF32), Reaction engineering 3A ICBE (I3BERR12), Metrology/environment/risks (I4PEQS11), Biochemical reaction engineering (I4PERB11)

## Practical info

#### Location(s)

0





### Rational use of energy



ECTS 5 crédits



Hourly volume

22h

# Introducing

# Objectives

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

\*How to establish energy and exergy balances on energy production or energy consumption scenarios. Critical analysis of the obtained results.

\*Identify dysfunctions in a system and to propose optimal solutions. To propose new scenarios considering energy aspects.

\*How to establish a life cycle analysis on energy production processes and different energy use scenarios; to use a software (Umberto) and the appropriate databases. Use of results for process ecodesign.

- \* Pinch analysis for improving energy use in a process.
- \*Other optimization methods (numerical methods) depending on the case study for process ecodesign.

The student will be able to:

- \*Mobilise knowledges in chemical engineering in order to solve complex problems in the field of matter and energy processing.
- \*Conception, design, modelling, conducting and optimizing (for technical and economical criteria) installations in the field of chemical engineering
- \* Considering safety, energy efficiency and management of environmental impacts in the early step of process design and in functioning of unit processes and processes.

\*Conception of new unit processes and processes in different industrial fields like Ecoindustry, Energy, Environment, in order to reduce the climate change threat and contribute to energy transition.

#### Necessary prerequisites

Energetic thermodynamics Process simulation and assessment Processes and energy

# Practical info

#### Location(s)

0





#### Waste treatment and valorization



**ECTS** 5 crédits



Hourly volume

63h

# Introducing

### **Objectives**

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

- the legal and usual definitions of wastes in France.
- the strategies for waste treatment
- the principles of unit operations and processes commonly used in solid waste reduction, treatment or valorisation (chemical, biochemical or thermal processes).

The student will be able to:

- identify basic rules and policies for an environmental problem, and use it to define a technical problem or to propose an adapted solution
- quantify the dispersion of air pollutants from industrial sources
- determine the valorisation potential for an industrial waste (or gas effluent or wastewater)
- analyse and design processes the treatment or valorisation of solid wastes

#### The student will be able to:

- identify basic rules and policies for an environmental problem, and use it to define a technical problem or to propose an adapted solution
- quantify the dispersion of air pollutants from industrial sources
- determine the valorisation potential for an industrial

waste (or gas effluent or wastewater)

- analyse and design processes the treatment or valorisation of solid wastes

### Necessary prerequisites

Good knowledge of the basis of chemical engineering

# Practical info

### Location(s)





#### Advanced Separation processes for new water-uses, valorisation and new resources



5 crédits



Hourly volume 15h

# Introducing

#### **Objectives**

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

- to know the context of the new resources for water and compounds of interest (sea/brine waters, secondary effluent, food bio products )
- To know specific processes for water production (desalination, reuse, ultrapure water, water for industrial use ..)
- principle and design of sorption unit operations (ion exchange, preparative chromatography, adsorption)
- principle and design of advanced membrane separation (reverse osmosis. operations electromembrane processes)
- principle and design of unit operations based on a phase transition (precipitation, crystallization, ¿)

The student will be able to:

- to design processes for domestic wastewaters tertiary
- to design desalination processes
- to design design processes for ultrapure water production or specific water for utilities
- -to design processes for N , P and C recovery
- identify new resources
- conceive and design systems for these new resource
- apply the knowledge to other case studies

# Necessary prerequisites

Unit operation I4PETF31 Chemistry I1ANBC11 Energy and mass balance I3BEGP11 2AICBE Numerical Methods of resolution

## Practical info

### Location(s)





# Process control & optimization



ECTS 5 crédits



Hourly volume 63h

# Introducing

Toulouse

### **Objectives**

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

- 1. how to proceed for the simulation and regulation of dynamic systems via an open programming platform and a dynamic system analyzer (Simulink)
- 2. how to formulate and solve an optimization problem (single-objective or multi-objective) through suited methods (derivative-based or evolutionary)

The student will be able to:

3. compare different methods for the regulation and optimization of a dynamic industrial case study (Waste Water Treatment Plant ¿ WWTP)

### Necessary prerequisites

Process control Balance equations in reactive systems Programming (Matlab)

# Practical info

### Location(s)





# Reactor design and multiphase flow modelling



ECTS 5 crédits



Hourly volume 63h

# Introducing

Toulouse

### **Objectives**

At the end of this module, the student will have understood and be able to explain the use and the development of conservation equations describing multiphase systems. He will be initiated to the multiscale approach for process engineering in three steps:

- Knowledge integration from local entity (inclusion, pore, interface) to the multiphase process.
- Development of closure relations from isolated object to dense media with interactions.
- Sensitivity to scale up and scale down criteria in function of time and space range (heterogeneity, one way/two way or no coupling problems).

#### The student will be able to:

- Choose the right scale to describe the multiphase process and the appropriate tool to design the reactor.
- Incorporate transport phenomena and couple them in consistency with the chosen scale
- Simulate the multifunctional behaviour of multiphase system (work project) and insure the value of the results by balance estimation.

# Practical info

Location(s)





#### Human relations



ECTS 6 crédits



Hourly volume 78h

# Introducing

### Location(s)



Toulouse

### **Objectives**

L'étudiant devra être capable de :

- -Analyser des situations de groupe avec des concepts issus de la psychologie sociale
- -ldentifier les dimensions éthiques de ces situations et prendre position
- -Repérer et comprendre des informations liées aux RH
- -Analyser une situation de management dééquipe en référence à un cadre théorique
- -Formuler et argumenter des solutions managériales
- -Agir dans un milieu naturel : analyser, décider, agir ; mettre en œuvre la sécurité, utiliser du matériel spécifique. découvrir un site.
- -Respecter et s'intégrer dans un environnement différent de ses habitudes
- -S'engager avec cohérence dans le projet d'activités
- -Prendre part activement au collectif
- -Valider son projet professionnel et construire une stratégie pour trouver un emploi

#### Necessary prerequisites

None

# Practical info





# Design and environmental assessment of processes



**ECTS** 9 crédits



Hourly volume 64h

# Practical info

Location(s)

