INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

5th YEAR GPE_SEMESTER 9

Practical info

Location(s)

Toulouse

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)

Toulouse

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 eco-design.
* 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)

Toulouse

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)

Toulouse

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

ECTS
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 operations (reverse osmosis, 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 reuse
- 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 use
- 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)

Toulouse

Process control & optimization

ECTS
5 crédits

Hourly volume
63h

Toulouse

Introducing

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

Toulouse

Introducing

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
-Identifier les dimensions éthiques de ces situations et prendre position
-Repérer et comprendre des informations liées aux RH
-Analyser une situation de management d¿équipe 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)

Toulouse