INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

4th YEAR CHEMICAL ENGINEERING

Practical info

Location(s)

Toulouse

Improve your management abilities

ECTS
4 crédits

Hourly volume
45h

Management I3CCGE51

Introducing

Objectives

At the end of this module, the student will

¿ Know the legal environment and responsibilities of a business
activity
¿ Be able to objectively assess the financial health of a company and evaluate the rentability of an investment
¿ Realize a market diagnosis (benchmarking) and a business diagnosis in order to make decisions and set goals and strategies
¿ Collect the market data and put in action a business plan adapted to the means and goals of the company
Module L 2
The objectives, defined in reference to the CEFRL for the 5 language activities, are specific for the language studied Chinese, German, Spanish ¿ and the level of the student.

They can be consulted on :

https://moodle.insa-toulouse.fr/course/view.php?id=44

In certain cases, students may be authorised to follow an English module instead of another language

Necessary prerequisites

Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Toulouse School of Management

Practical info

Location(s)

Toulouse

Unit operations 1

ECTS
5 crédits

Hourly volume
56h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- the basic concepts concerning intermolecular and interfacial interactions
- Different ways to perform filtration processes
- basic concepts of deep-bed filtration and membrane separation (UF/MF/NF)
- dimensionless numbers to characterise physical phenomena involved in mixing and separation operations
- design tools for unit operation of filtration and mixing

The student will be able to:
- identify interactions between compounds or interface/ compounds involved in filtration and mixing operations
- identify main membrane fouling phenomena for a given
application
- operate some filtration units at lab or pilot scale
--select the required unit operation and technology for a filtration or a mixing operation
- write the mass balances
- design a deep-bed filter
- design a membrane operation (MF, UF, NF)
- design a stirred tank and a static mixer

Necessary prerequisites

Hydraulics and dispersed systems (I3BETF21)
Fluid properties (I3BEPF12)
Heat and mass transfer (I3BETF32)
Thermodynamics
Basic concepts of Chemistry and Physics

Practical info

Location(s)

Toulouse

Unit operations 2

ECTS
5 crédits

Hourly volume
83h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- Phase equilibrium diagrams
- General concept for mass transfer unit operations (Ideal stages, operating linesż). Kinetic limitations and theirs effects on separation
- Different ways to perform separation processes (single contact, cross-current and counter-current contactors)
- design tools for separators.

The student will be able to:
- use the equilibrium diagrams
- choose the required technology for a separation
- choose the contact mode
- write the mass balance
- design a multistage separation device (extraction, distillation, adsorption, absorptionż)
- then propose a contactor technology.

Necessary prerequisites

Hydraulics and dispersed systems (I3BETF21)
Fluid properties (I3BEPF12)
Heat and mass transfer (I3BETF32)
Thermodynamics

Basic concepts of Chemistry and Physics

Practical info

Location(s)

Toulouse

Processes simulation and analysis

ECTS
5 crédits

Hourly volume
73h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- the basics of chemical engineering process simulation tools at various scales
- the life cycle and carbon balance principles
- the basics of multidimensional analysis
- the elementary notions about process optimisation

The student will be able to:
- select the appropriate simulation tool with respect to the scale of investigation
- synthesize their knowledge to analyze the results of a commercial simulation tool
- simulate industrial processes in steady state
- perform the Life Cycle Analysis of an existing process
- use the FLUENT software to simulate single phase flows
- use the PROSIM Plus software to simulate general steady state processes
- use the UMBERTO software to perform a global analysis of a process within its environment.
- gather knowledge from various fields to choose the modelling approach, perform the set-up of the simulation and analyse the results
- perform an optimisation study with PROSIM
- set up simulations of unsteady state processes with PROSIM Batch and FLUENT

Necessary prerequisites

Modelling and numerical methods for transport phenomena (momentum, mass and energy) and thermodynamics
Basic concepts for Unit Operation
Technology and design of Unit Operation
Hydraulic and dispersed systems
Transport and reaction in fluid medium

Practical info

Location(s)

Toulouse

Chemical and environmental engineer, define and build a project

ECTS
5 crédits

Hourly volume
79h

Practical info

Location(s)

Toulouse

Heterogeneous reaction engineering

ECTS
5 crédits

Hourly volume
37h

Introducing

Objectives

Know and explain the concepts of
- chemical catalysts
- heterogeneous reaction mechanisms and associated kinetic laws
- limiting step(s) in heterogeneous reactions
- apparent (overall) reaction rate
- dimensionless numbers (Hatta, Biot, Thiele, Weiss)
- effectiveness factor and enhancement factor

Establish an intrinsic kinetic law
Determine the limiting process(es) in a heterogeneous chemical reaction
Express dimensionless numbers used in heterogeneous reactions (Hatta, Biot, Thiele, Weisz) and explain their meaning
Express the apparent global rate of a chemical reaction depending on the working conditions
Select and design the most suitable reactor to perform a given reaction
Integrate and prioritize the mechanisms in order to model heterogeneous chemical reactors (batch or continuous)

Necessary prerequisites

Chemical reaction Engineering I (I2BERR12)
Chemical reaction Engineering II (I3BERR12)
Heat and mass transfer (I3BETF32)

Thermodynamics (I2BETH11)
Fluid properties (I3BEPF12)

Practical info

Location(s)

Toulouse

Political sciences semester 1

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
1 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
2 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
4 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
5 crédits

Hourly volume

Practical info

Location(s)

Toulouse

Heat exchangers with or without phase transition and simultaneous heat and mass transfer

ECTS
5 crédits

Hourly volume
70h

Practical info

Location(s)

Toulouse

Energy and Processes

ECTS
5 crédits

Hourly volume
43h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- the world context of power-generating systems, which produces a net power output from a fossil, nuclear or renewable energy source.
- the legal and technical context of the various forms of renewable energy (wind, solar photovoltaic, biomass ...),
- the different thermodynamic cycles associated to the power generation systems, the refrigeration and heat pump systems and the gas liquefaction.
- the use of energy and exergy balances for these thermodynamic systems in order to optimize their operation

The student will be able to:
- design a given steam power plant, including the choice of working fluid temperatures, pressures and the determination of fluid working flows plus the pre-sizing of compressors and turbines
- design a refrigeration system, including the choice of working fluid temperatures, pressures and the determination of fluid working flows plus the preliminary design of compressors and expansion devices,
- design a gas liquefaction plant
- participate in the implementation of a wind energy area development and a site photovoltaic,
- participate in the implementation of a biogas network.

Necessary prerequisites

Thermodynamic I3BETH11

Practical info

Location(s)

Toulouse

Project for research introduction

ECTS
3 crédits

Hourly volume
29h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- the approach and tools for a good literature and patent survey
- how to develop a scientific work
- the health and safety rules in a research laboratory
- the basic methods for project management
- principles of patent right

The student will be able to:
- to delimit and deepen a scientific research project
- to draw an up-to-date inventory of knowledge on this topic and to identify the international leading research teams
- to propose and to experimentally perform a scientific approach to address a problem based upon the previous literature survey with respect to health and safety rules
- to share and communicate the results with a common scientific formalism (paper, poster)
- to perform a project management approach

Necessary prerequisites

Literature survey basic knowledge
All scientific knowledge in relation with a research project

Practical info

Location(s)

Toulouse

Biological reactor engineering

ECTS
2 crédits

Hourly volume
33h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- the different types of biological catalysts and their working modes
- the stoichiometry, kinetic laws and their combination for the description of microbial cell behaviour for growth and production,
- the description and modelling of batch, fed-batch and continuous, single or multi stage biological reactors with or without recycling.

The student will be able to:
- identify the general metabolic scheme of microbial growth
- establish the stoichiometric equations and kinetic laws for biological reactions with respect to the environment conditions
establish an intrinsic kinetic law
- integrate and prioritize the mechanisms in order to model homogenous and heterogeneous biological reactors

Necessary prerequisites

Microbiology and mass balances

Practical info

Location(s)

Toulouse

Metrology Environment and Risks

ECTS
5 crédits

Hourly volume
76h

Introducing

Objectives

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

-the principles of environmental laws in France , and what tools to access legal informations
- the choice of suitable and argued measurements either for the analysis of environmental impacts or to process design
- what are the main environmental issues and principles of waste management
- the main risks in the process industry and mechanisms linked to accidents

The student will be able to:

- find and use legal informations (from legacy context) related to environmental law (ICPE , TGAP , environmental impacts, ...)
- choose and apply relevant method (s) in order to characterize the compounds and / or pollutants in complex environments or matrix doing a critical analysis of the methodology and the experimental results
- analyze a case of risk for Environment , to identify the categories of impacts, to describe pollution from the origin (=source) to the environmental targets
- analyze a situation of industrial risk, to identify and to calculate physico-chemical parameters of the involved phenomena and to propose technical solutions

Necessary prerequisites

General Chemistry
Biological reactors
Chemical engineering unit operations
Mass and energy balances

Practical info

Location(s)

Toulouse

Communication in organisations with LV2

ECTS
6 crédits

Hourly volume

Introducing

Objectives

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

-How to answer the demand of the civil society for technical and scientific information
-How to carry out critical analysis in order to give appropriate answers when questioned about such issues
-How to consider the circulation and content of information within the organizations in which they will be hired

The classes given in English will focus on the specific linguistic characteristics of the English used in scientific contexts in order for the students to understand and master them.
The students will also be made aware of the specificities of scientific English as relates to publications in his specific field of research.

Module L 2
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Necessary prerequisites

Necessary knowledge:
For classes in English : understanding of scientific English

Practical info

Location(s)

Toulouse

Improving one's autonomy and building one's own professional project level 2 S

ECTS
4 crédits

Hourly volume
40h

Practical info

Location(s)

Toulouse

Political sciences semestre 2

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
1 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
2 crédits

Hourly volume

Practical info

Location(s)

Toulouse

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ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
4 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
5 crédits

Hourly volume

Practical info

Location(s)

Toulouse