

SCIENCES FOR ENGINEERS FIELD_11 ECTS

Introducing

Description

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

Location(s)

 Toulouse

Analytical Methods 1

Introducing

Description

This module is divided into three parts in order to understand and manage theoretical and experimental concepts relating to analytical methods.

Electrochemistry (Conductimetry, probes, ion-selective electrodes).

Liquid and gas Chromatographies: theory, instrumentation and quantification methods.

Sensors (biomass, microscopy, temperature, flow, pressure, viscosity, etc.).

Objectives

At the end of this module, the student will have understood and be able to explain the principles of analytical techniques implemented currently in laboratories and the associated mechanisms using his/her knowledge in quantum physics and chemistry (chemical reactions, physical and chemical properties &)

The student will be able to:

AA1 Choose the most relevant technique regarding the problem by explaining the relating theoretical concepts.

AA2 Carry out these analytical techniques.

AA3 Define and interface sensors with their electronic

signal processing unit and identify needs for filtering, amplification and other signal processing requirements

AA4 Analyse and discuss the results in a critical way.

Necessary prerequisites

Thermodynamic 1Y (I1ANETTH) and 2Y (I2BETH11) / Chemistry of solutions 1Y (I1ANETCH) / Organic Chemistry 2Y (I2BECH11) / biostructural chemistry 2Y / Electrokinetics 1Y

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

Location(s)

 Toulouse

Chemical reaction engineering

Introducing

Description

Mass balance in reactional homogeneous systems. Continuous and batch systems. Transient and steady states. Progress reaction parameters and global balances. Reaction rate, law for reaction rates and temperature influence. Identification of reaction rate laws. Pseudo-first order approximation. Ideal reactors (batch, continuous stirred and plug flow). Mass balances application in ideal reactors. Isothermal reactors design.

Objectives

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

- kinetics of a chemical, or biochemical reaction
- Rate-limiting step, catalysis, inhibition
- Reaction rates, kinetic order and constant, activation energy
- Reaction progress parameters
- Mass balances applied to reactors
- Continuous and batch stirred reactors
- Plug flow reactors

The student will be able to:

- define a system, its boundaries, for a defined purpose; calculate all the molar fluxes (inlet, outlet, transformation, variation);
- choose the best ideal reactor for a homogeneous isothermal chemical reaction in liquid phase and

calculate it (reactor design)

- write mass balances by using reaction progress parameters
- establish a kinetic law from reaction mechanisms in the case of simple chemical and enzymatic reactions. Understand how physiological aspects can impact the kinetics of microbiological reactions.
- propose experimental and numerical methods for determining the kinetic law for a homogeneous reaction from experimental data.
- determine a kinetic constant for a given temperature (Arrhenius law)
- treat a general homogeneous isothermal problem of chemical reaction engineering

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

Location(s)

 Toulouse

Process control

Introducing

Description

- Overall total or partial mass balance, enthalpy balance in transient and steady state
- Concept of system, input and output variables, disturbance
- Some mathematical aspects: linearization of a function with several variables, Laplace Transformation
- Transfer function
- Block diagram
- ↳ 1st order, 2nd order and pure delay linear systems
- Open loop and closed loop
- Derivative Proportional Integral Regulation
- Concept of stability of a system
- Setting the parameters of a regulator
- Applications: chemical and biological reactors

Objectives

Acquire the main concepts of process control and apply them to simple cases of process engineering and biochemical engineering.

Necessary prerequisites

I2BEBT10 Global mass and energy balances on geometric domains
I2BEMT11 Laplace transform, Taylor expansion, Decomposition into simple elements

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

Location(s)

 Toulouse

Industrial facilities

Introducing

Description

- Introduction of general concepts associated with a process, including classification and schematization and the notion of unit operation.
 - Presentation of the methodology for carrying out (macroscopic) mass balances on a process in stationary mode including the notion of variance
 - Application of these concepts on case studies of increasing complexity
 - Mass balances on different unit operations (separator, mixer, divider, etc.) and on processes combining these unit operations, reactors, etc. –
- Mass balances on installations with or without recycling

Objectives

The mass balance is an essential tool for quantifying the performance of industrial installations and optimizing them according to criteria of yield, production, productivity, etc. It is also an essential tool for the environmental assessment of processes and bioprocesses. This course therefore aims to train students in the functional analysis approach of processes by introducing the basic concepts associated with the study of processes, including their schematization and the writing of the corresponding macroscopic mass balances. It presents a methodology for solving these balances through the concept of the degree of freedom of a system (variance). These approaches are illustrated through case studies ranging from a unit operation to a complex process

operating in steady state.

At the end of the course, the student will be able to:

- Understand the basic concepts associated with processes (continuous process, discontinuous process, reactions, separations, recycling) –
- Understand and analyze a process from the diagram and literal descriptive elements in order to identify the mass flows (flow rates and compositions)
- Calculate the variance of a system and a process
- Write and solve the mass balances associated with an industrial installation operating in steady state
 - Present these results by checking their consistency (physical meaning, units..)

Necessary prerequisites

none

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

Location(s)

 Toulouse

Careers

Introducing

Description

The number of hours devoted to “discovering careers” is approximately 50 hours. It encompasses all the activities listed below and scheduled in the timetable.

Project to discover engineering professions and functions

This project is carried out in groups of 5 or 6, and aims to expose students to the realities of the industrial world as early as possible. To this end, they are asked to carry out a study designed to identify the jobs available to them - R&D engineer, quality engineer, production engineer, technical sales engineer, etc. - and the sectors in which they will be able to work - environment, pharmaceuticals, chemicals, agri-food, etc. Ideally, all these projects should cover the full range of opportunities offered by the 2 Biochemical Engineering and Process Engineering specializations.

Please note that these projects are not bibliographic projects designed to explain how a particular product is made! The aim is to place each industrial branch - which can, if necessary, be described in scientific and technological terms - in its organizational, economic, environmental and/or societal context, and above all to identify the specific features, in terms of the job, of the engineers working in it. Students are guided in their work by a teacher, but it is essential that during these projects students get out of INSA, meet professionals, visit factories, firms, design offices...

Objectives

The “discovering careers” section complements the “PPI” scheme, which helps students to reflect on and discuss their educational and career plans, and to take a more coherent career path. The objectives of “discovering careers” are listed below (in no particular order):

1°) to help students project themselves into what will be their daily professional life when they leave INSA, and to enable them to make their choice of specialization in year 3 in a well-thought-out manner. The aim is to give them as complete a picture as possible of the career opportunities available at the end of the 2 specializations to which the pre-orientation leads;

2°) to encourage students to open up to the world outside INSA, with particular emphasis on contacts with industry;

3°) to enable students to understand the usefulness of the courses they are taking by placing them in a professional context;

4°) to give students who have a particular project the opportunity to implement it (civic or community project, etc.)

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

Location(s)

 Toulouse