

Spring semester

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|---------------------------------------|-----------|------|
| Microbial and Mammalian cells culture | 7 credits | 98h |
| Genetic and Enzymatic engineering | 4 credits | 72h |
| Multi-disciplinary Projects | 7 credits | 119h |
| Unit Operations | 6 credits | 89h |
| Communicating within organizations | 6 credits | 75h |

Microbial and Mammalian cells culture

 **ECTS**
7 credits **Component**
INSTITUT
NATIONAL
DES SCIENCES
APPLIQUEES
TOULOUSE **Number of
hours**
98h

In brief

> **Teaching language(s):** Français, Anglais

Presentation

Description

Basic concept of cellular biology, establishment of a cell line, normal and transformed cells, culture media and culture systems, contaminations, transfection, different uses of mammalian cells

Kinetic models of growth and metabolites production, effects of the variables and environmental parameters, interaction between the biological dynamics and the mass transfers, equations of the bio-reactors: batch, chémostat, plug flow reactors, fed-batch, reactor with cellular recycling, application to the metabolites productions, numerical processing of the experimental data.

Organisation:

At the beginning of the course the students will receive a document containing the major informations given in the course and a document with the informations "step by step" to manipulate themselves two cell lines.

The "uses of mammalian cells" will be treated by the students themselves, groups of 3 students will work on different examples and will present the results of their work.

Main difficulties for students:

-practice of mammalian cell cultures

-mathematical approach of the various concepts of biochemical engineering

Objectives

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

- How to establish a cell line in culture
- Mammalian cell culture specificities in terms of conditions and media
- Major uses of mammalian cells
- Various kinetic behaviours of microbial growth and production
- Several strategies from implementation of the microbial cultures in the bio-reactor

The student will be able to:

- use a vocabulary specific to cell culture
- name major characteristics of a mammalian cell
- manipulate a cell line
- analyse, comment and criticize a scientific paper in the domain
- to calculate the various kinetic and stoichiometric parameters of microbial cultures

to calculate the potentialities of productions for the various bio-reactors

Pre-requisites

Basic knowledge of cellular biology

Basic concepts of molecular biology

Courses on kinetics, microbiology, metabolism, reactor engineering

Useful info

Contacts

Education manager

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Place

➤ Toulouse

Genetic and Enzymatic engineering

 **ECTS**
4 credits

 **Component**
INSTITUT
NATIONAL
DES SCIENCES
APPLIQUEES
TOULOUSE

 **Number of
hours**
72h

In brief

› **Teaching language(s):** Français, Anglais

Lectures, practical courses, literature review, oral presentation.

Objectives

Presentation

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

Description

Enzymatic engineering

Overview of protein structures, Computational tools and softwares for DNA and protein sequence analyses sequence analyses / linitiation to molecular graphism and molecular modelling / analyses and comparisons of 3D structures/ Case study: a-amylase family.

Genetic engineering

Genetic engineering will be taught through the preparation of literature review reports related to genetic engineering and synthetic biology (genome editing, metabolic engineering, control of gene expression, etc..). This will be completed by the oral presentation and critical analysis of a scientific article in front of the student class.

Organisation:

Enzyme engineering

Understand the bioinformatics methods and computational tools used for i) genome assembly and annotation, ii) genome and protein sequence and structure analysis iii) comprehension of enzyme mechanism and engineering.

Genetic engineering

Understand the main approaches used for genetic engineering and synthetic biology. Understand the methodology used for scientific article search in data bases, for writing a scientific literature review and presenting a critical analysis of scientific articles.

The student will be able to:

Enzymatic engineering

Describe the methods used for bioinformatics analysis of genome and protein structures (sequence alignment and molecular modelling and graphism tools). Apply computational

methods to structure-activity relationship studies and enzyme engineering.

Genetic engineering

Use of bibliographic database for scientific article search.

Construct and write a scientific literature review

Know and describe various approaches and methods entering in the field of genetic engineering.

Pre-requisites

Structural biochemistry and molecular biology

Useful info

Place

➤ Toulouse

Multi-disciplinary Projects

 **ECTS**
7 credits

 **Component**
INSTITUT
NATIONAL
DES SCIENCES
APPLIQUEES
TOULOUSE

 **Number of
hours**
119h

In brief

› **Teaching language(s):** Français, Anglais

Presentation

Description

The program includes 4 parts:

- Methodology for project management
- Principles of the " quality, safety and environment respect" approach
- Multidisciplinary project that mobilizes knowledge in biochemical engineering, transfer phenomena, bioreactors engineering, balance sheet and unit operations
- The practice of individual and collective sports activities

Organisation:

The application of the learnings is made in group activities

The QSE approach is applied on practical class.

Objectives

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

- The methods for project rational management
- The main concepts and the tools for quality
- The specific requirements for safety and environment in project management.

The student will be able to:

- Implement only and/or in a team the projects of actions,
- Manage in specialist the implementation and the follow-up of a project
- Plan actions and anticipate those of the others,
- Regulate the activity during project implementation,
- Make choices adapted to the interactions between the actors in order to be efficient,
- Communicate to obtain the wish action,
- Allocate roles between the partners by taking into account the individual skills,

- Act according to the constraints and to the adversity.

Pre-requisites

I1CCGE40 / I2CCGE10 / I3CCGE10 / I3BEMT10 / Biochemical engineering/ Transfer phenomena

Useful info

Place

➤ Toulouse

Unit Operations

 **ECTS**
6 credits

 **Component**
INSTITUT
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DES SCIENCES
APPLIQUEES
TOULOUSE

 **Number of
hours**
89h

In brief

➤ **Teaching language(s):** Français, Anglais

heat transfer phenomena: conduction, convection and radiation.

Mass transfer : principles of distillation and absorption

Presentation

The student will be able to:

Size heat and mass exchangers

Description

Fundamental laws of heat transfer phenomena : conduction, convection and radiation. Thermal resistance. Conduction in solids : steady state and transient state. Natural and forced convection. Heat and mass exchanger: theory, calculations, technology.

Useful info

Place

➤ Toulouse

Organisation:

Lectures, tutorials with exercises (application to bioprocess) and lab works

Objectives

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

Communicating within organizations

 **ECTS**
6 credits

 **Component**
INSTITUT
NATIONAL
DES SCIENCES
APPLIQUEES
TOULOUSE

 **Number of
hours**
75h

Presentation

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

Objectives

The classes given in French will focus on :

- How to react to society's demand for technical and scientific information
- How to foster critical thinking in order to give appropriate answers when questioned about such issues
- How to communicate effectively in the workplace

The classes given in English will focus on the specific linguistic characteristics of English used in such contexts in order for the students to understand and master them.

The students will also be made aware of the specificity of professional communication within the English-speaking world

Module L2

The objectives, defined in reference to the CEFR for the 5 language activities, depend on the language studied - Chinese, German, Spanish - and the level of the student.

They can be consulted on :

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

Pre-requisites

For classes in English : mastery of general English.

Useful info

Place

➤ Toulouse