PR3100
Chemical Engineering and Sustainable Development

Professor: François Puel (S7), Moncef Stambouli (S6, S8)

Language of instruction: English – **Number of hours**: 36 – **ECTS**: 3

Prerequisites: Heat transfer, basis of fluid mechanics, thermochemistry, chemical kinetics

Period:				
	S6	Elective 01	February to April	IN16DE1, SEP6DE1
	S7	Elective 02	September to January	IN27DE2, FEP7DE2
	S8	Elective 08	February to April	IN28IE1, SEP8IE1

Course Objectives

This course is a general introduction to the techniques and methods employed in Chemical Engineering. It will allow students to acquire skills that are easily transposable to a number of other fields of engineering. One of the main objectives of Chemical Engineering is to design, implement and optimize environmentally friendly processes for use in the manufacture of an extensive range of products in many areas including the pharmaceutical, petrochemical, fine chemical, food, cosmetics, water and waste treatment, high-tech, biotechnology and traditional industries.

Many techniques and processes are widely used in the recycling and recovery of materials and the treatment of liquid and gas effluents, thus making them powerful allies of sustainable development policies on a global scale.

On completion of the course, students should be able to

- master the basic concepts of chemical engineering allowing them to design simple units in various fields (biotechnologies, energy production, water and waste treatment, …)
- extend these skills in new applications
- design environment-friendly processes

Course Contents

- Lecture: introduction, flow models, mass and energy balance
- Case study: production of bioethanol
- Lecture: perfectly stirred reactors (1)
- Case study: production of an active pharmaceutical principle
- Lecture: perfectly stirred reactors (2)
- Case study: design of industrial wastewater treatment reactors
- Lecture: plug flow reactor
- Case study: production of styrene
- Lecture: liquid-vapor equilibria, single-stage distillation
- Case study: seawater desalination
- Lecture: multi-stage distillation with constant molar fluxes
- Case study: production of bioethanol
- Lecture: multi-stage distillation
- Case study: ammonia recycling in the fabrication process of solar panels
- Lecture: basis of mass transfer
- Case study: modeling of in vitro and in vivo treatments of oral intoxications
- Lecture: mass transfer
- Case study: design of a purification unit for polluted air
- Lecture: electrochemistry, electrochemical processes
- Case study: design of a fuel cell for a car

- Lecture: membrane processes
- Case study: design of a membrane bioreactor for industrial waste treatment

Course Organization

Lectures: 15 hr, Tutorials: 18 hr, Exam: 3 hr

Teaching Material and Textbooks

- Course book + slides
- Techniques de l'ingénieur Procédés J 4010 ; J 1070 ; J 1072 ; J 1073 ; J 1074
- Perry Chemical Engineer's Handbook 7th edition, 1997, Mac Graw Hill

Evaluation

- Bibliographic study and oral presentation (40% of the final grade);
- Final exam: case study during a 3-hr session in teams of 3 or 4 students and written report (60% of the final grade).