الجمهوريــة الجزائريــة الديمقراطيــة الشعبيــة

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

TRAINING OFFER

Bachelor's, Master's, Doctorate

MASTER'S DEGREE WITH INTEGRATED BACHELOR'S PROGRAM

Institution	Faculty / Institute	Department
University Dr. Yahia Farès of Médéa	Faculty of Science and Technology	Process Engineering and Environment

Domain	Field	Specialty
Science and Technology	Process Engineering	Pharmaceutical Process Engineering

Head of training programs:
(*Professor or Associate Professor, Class A or B*)

Title, Last Name & First Name	
Contact Information	

MASTER'S PROGRAM IDENTITY SHEET

Title: Master's degree with integrated bachelor's degree program

Training options, if applicable: Pharmaceutical Process Engineering

Field of study: Process Engineering

Field: Science and Technology

Keywords: Industry, pharmaceuticals, processes

I.1. Location of the program:

Established by: Dr. Yahia Farès University, Médéa

Faculty (or Institute): Faculty of Science and Technology

Department: Process Engineering and Environment

I.2. Coordinators:

Head of the training program

Full name: TLIMCANI Abdelhalime
Rank: Professor
University: Dr. Yahia Farès Médéa Department: Process Engineering and Environment
☎ : 025.58.12.53 Fax : 025.58.12.53 E - mail : h_tlemcani@yahoo.fr

Head of the training program

(Lecturer Class A or B or Assistant Professor Class A)

Full name: KERCHICH Yacine
Rank: Lecturer B
University: Dr. Yahia Farès Médéa Department: Process Engineering and Environment
☎ : 025.58.12.53 Fax : 025.58.12.53 E mail : y_kerchich@hotmail.com

Head of the specialty team (training program)

(Professor or Associate Professor, Class A or B)

Full name: KHAOUANE Latifa
Rank: Associate Professor B
University: Dr. Yahia Farès Médéa Department: Process Engineering and Environment
☎ : 025.58.12.53 Fax : 025.58.12.53 E mail : latifa_kaouane@yahoo.fr

I.3. External partners:

- ✓ Other partner institutions
- ✓ SAIDAL Group (Médéa)

Director: Mr. B. Derkaoui
Tel: +213 (25) 58 56 78 Tel/Fax: +213 (25) 61 04 90ADE (Médéa)

- ✓ CRNB BIRINE: Birine Nuclear Research Center

Director: Mr. A. Kerris
Tel: 027 87 29 35 / 027 87 29 21   Fax: 027 87 42 80
Companies and other socio-economic partners:
(Indicate the name, address, and status of the company. Specify the name(s) and contact details (phone number and email address) of the contact person(s) within the company).

- ✓ International partners:

Specify the contribution of each partner institution to the project in terms of: quality, experience, expertise, material resources,

II. CONTEXT AND OBJECTIVES OF THE TRAINING

II.1. Presentation of the project

With the opening of the Algerian market to investment in the field of medicines, the pharmaceutical industry in Algeria has been facing an increasing need for qualified personnel in recent years due to the increased production of medicines. Furthermore, given the restrictive standards to which it is subject, the design and large-scale production of medicines requires control and validation at every stage of the manufacturing process. To meet these needs, the pharmaceutical industry must have master's and bachelor's degree holders with dual expertise combining process engineering and its technological nature with pharmaceutical sciences. The integrated master's degree program in pharmaceutical process engineering trains students who, thanks to their multidisciplinary background, can meet these requirements through courses taught in the Department of Pharmaceutical and Environmental Process Engineering. Graduates of this program have the skills required to perform high-level or supervisory functions in the design, validation, management, and control of pharmaceutical production processes for active ingredients (primary production) and drug formulation (secondary production).

II.2. Training objectives

The aim of this Master's program is to train graduates to work in all areas of the pharmaceutical industry. It also enables graduates to acquire specific skills in pharmacology and processes that are particularly useful in the pharmaceutical industry.
Other objectives:
- Acquisition of basic knowledge for the synthesis of active ingredients

- Study of different pharmaceutical forms
- Knowledge of the main methods of drug analysis (reading, handling, and interpreting)
- Mastery of separation processes in pharmaceutical operations
- Mastery of the design and operation of chemical and biochemical reactors.
- Mastering IT tools (software - algorithms and programming for the design of new bioactive molecules and the simulation of chemical processes)
- Managing industrial and laboratory health and safety

Profiles and skills to be acquired

Training of Masters capable of sizing all installations involved in the drug manufacturing process.
Training of Masters capable of mastering transfer phenomena in pharmaceutical engineering (heat, mass, and momentum transfer).
Masters capable of transposing from laboratory scale (molecular synthesis) to industrial scale (industrial production).
- Career opportunities

The program aims to train specialized executives who can fill the following positions:
• Galenist
• Galenist development laboratory manager
• Research manager
• Project manager
• Production director
• Research laboratory manager
• Preparation for a doctoral degree.

Regional and national employability potential

Algerian and foreign companies are seeking to increase demand for master's degrees in pharmacy and drug technology.

- Sectors of activity:

1. Pharmaceutical industries in the Médéa region and nationwide
2. Higher education
3. Analysis and testing laboratories.

Partner involvement in training

Integrate students into the industrial world so that they can familiarize themselves with the specialty and keep up to date with new technologies in the pharmaceutical industry.
Also contribute to bringing the university and industry closer together through various exchanges.

II.3. Conditions of access

– Required qualifications:

(Specify the baccalaureate degrees that grant access to this program (specialization and average):)
Admission to the Master's program with integrated Bachelor's degree in Pharmaceutical Process Engineering is guaranteed for baccalaureate holders meeting the following criteria:

Priority 1:
Bachelor's degree in Process Engineering

Priority 2:

Bachelor's degree in Mathematics
Bachelor's degree in Experimental Sciences
Bachelor's degree in Mathematical Technology

– Specific educational prerequisites:

– Selection procedures:

- Case study

(Explicitly state the selection criteria (mentions, grades in main subjects, etc.)

Ranking is based on the overall average obtained in the high school diploma.

Additional condition: To be included in the ranking, the average calculated between the mathematics and physics grades (Maths + Physics)/2 must be greater than or equal to 13/20.

Written test:

- **Interview:**
- **Other (specify):**

II.4. Planned enrollment

1st cohort: Academic year 2015/2016: 15.

2nd cohort: Academic year 2016/2017: 20.

3rd cohort: Academic year 2017/2018: 25.

II.5. Coordination of the program with courses offered at the university level

Pharmaceutical process engineering is an option within the process engineering specialty, and the links are:

Group of courses A	Semester 3 common
Field	**Specialty**
Automatic	Automatic
Electromechanical	Electromechanical
	Industrial maintenance
Electronic	Electronic
Electrical engineering	Electrical engineering
Biomedical engineering	Biomedical engineering
Industrial engineering	Industrial engineering
Telecommunications	Telecommunications

Group of courses B	Semester 3 common
Field	**Specialty**

Aeronautics	Aeronautics
Civil engineering	Civil engineering
Climate engineering	Climate engineering
Marine engineering	Naval Propulsion and Hydrodynamics
	Naval Construction and Architecture
Mechanical engineering	Energy
	Mechanical engineering
	Materials engineering
Hydraulics	Hydraulics
Transportation engineering	Transportation engineering
Metallurgy	Metallurgy
Optics and precision mechanics	Optics and photonics
	Precision mechanics
Public works	Public works

Group of courses C	Semester 3 common
Field	**Specialty**
Process engineering	Process engineering
Mining engineering	Mining
	Valorization of mineral resources
Hydrocarbons	Hydrocarbons
Industrial health and safety	Industrial health and safety
Petrochemical industries	Refining and petrochemicals

The programs that share common core courses (semester 3) have been grouped into three groups: A, B, and C. These groups broadly correspond to the fields of electrical engineering (Group A), mechanical engineering and civil engineering (Group B), and finally process engineering and mining engineering (Group C).

This degree offers multidisciplinary and cross-disciplinary programs:

Multidisciplinary, in the sense that the courses in this specialization are 100% identical for semesters 1 and 2 with all specializations in the Science and Technology field. Furthermore, the courses in semester 3 for all specializations in the same group of programs are also 100% identical.

Semester	Group of fields	Common teachings

Semester 1	A - B - C	(30 / 30) Credits
Semester 2	A - B - C	(30 / 30) Credits
Semester 3	A - B	(18 / 30) Credits
	A - C	(18 / 30) Credits
	B - C	(24 / 30) Credits

Across the board, this Bachelor's degree offers students the choice to join, if they express the desire and depending on the number of places available:

- All other specializations in the ST field at the end of semester 2.
- All specializations in the same group of courses at the end of semester 3.
- All specializations in another group of courses at the end of semester 3

(Subject to equivalence and the opinion of the teaching team).

- All specializations in the same group of courses at the end of semester 4

(Subject to equivalence and the opinion of the training team).

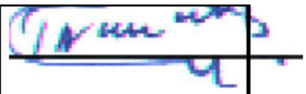
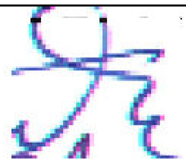
III. Resources

III.1 Human resources

TEACHING STAFF*:

First and Last Name	Department	Specialty	Rank	Laboratory Affiliated Research	Signature
HANINI SALAH	Process engineering and environment	Process engineering	Professor	Biomaterials and Transport Phenomena Laboratory (U Médéa)	
MOULAI MOSTEFA NADJI	Process engineering and environment	Process engineering	Professor	Waste Treatment and Recycling Laboratory (U Médéa)	
KREA MOHAMED	Process engineering and environment	Process engineering	Professor	Waste Treatment and Recycling Laboratory (U Médéa)	
BENKORTBI OTHMANE	Process engineering and environment	Process engineering	**MCA**	Biomaterials and Transport Phenomena Laboratory (U Médéa)	

SI-MOUSSA CHERIF	Process engineering and environment	Process engineering	**MCB**	Biomaterials and Transport Phenomena Laboratory (U Médéa)	
NEDJIOUI MOHAMED	Process engineering and environment	Process engineering	**MCA**	Waste Treatment and Recycling Laboratory (U Médéa)	
CHERIFI HAKIMA	Process engineering and environment	Process engineering	**MCA**	Biomaterials and Transport Phenomena Laboratory (U Médéa)	
HAMADACHE MABROUK	Process engineering and environment	Process engineering	**MCB**	Biomaterials and Transport Phenomena Laboratory (U Médéa)	
AINAS MAHFOUD	Process engineering and environment	Process engineering	**MAA**		
KERCHICH YACINE	Process engineering and environment	Process engineering	**MCB**	Waste Treatment and Recycling Laboratory (U Médéa)	
HADIDI NOUREDDINE	Process engineering and environment	Process engineering	**MCB**	Biomaterials and Transport Phenomena Laboratory (U Médéa)	
FERHAT SAMIRA	Process engineering and environment	Process engineering	**MAA**	Biomaterials and Transport Phenomena Laboratory (U Médéa)	
KHELADI RAZIKA	Process engineering and environment	Process engineering	**MAA**		

MOUNIR ZIRARI	Materials engineering	Materials engineering	**MAA**	Waste Treatment and Recycling Laboratory (U Médéa)	
TIR MOHAMED	Process engineering and environment	Process engineering	**MCB**	Waste Treatment and Recycling Laboratory (U Médéa)	

EXTERNAL SPEAKERS

OVERALL SUMMARY OF HUMAN RESOURCES:

Grade	Internal Staff	External Staff	Total
Professors	4		4
Lecturers (A)	3		3
Lecturers (B)	5		5
Assistant Professor (A)	5		5
Assistant Professor (B)	/		/
Other			
Total	**17**		**17**

PERMANENT SUPPORT STAFF (INDICATE THE DIFFERENT CATEGORIES)

Grade	Workforce
Professors	4
MCA	3
MCB	5
MAA	5
MAB	/

III.2. Material resources and logistics

Available	**Expected**
Test bench for drying study Test bench for adsorption	

study Test bench for liquid-liquid extraction study Test benches for discontinuous distillation and rectification study Test bench for heat transfer study by conduction Test bench for heat transfer study by convection and radiation Test bench for cooling tower study Test bench for tubular heat exchanger study Test benches for Faraday's law study Test benches for Redox titration study Test benches for electrochemical behavior study of metals in aqueous medium Test benches for determination of Nernst's law Test bench for UV-Visible spectrophotometric analysis Test bench for Infrared spectrophotometric analysis Test bench for acid-base titration by conductimetric method Test benches for kinetics study of a simple chemical reaction Test benches for verification of Arrhenius' law Test benches for kinetics study of a complex chemical reaction Test benches for kinetics study of a catalyzed chemical reaction Test benches for surface tension determination Test benches for demonstration of adsorption isotherms Test benches for determination of contact angle Test benches for determination of reaction heat Test benches for study of vapor pressure of a liquid and enthalpy of vaporization Test benches for liquid-liquid equilibrium study. Determination of critical dissolution temperature. HPLC UV INFRARED SEM TURBIDIMETER RHEOMETER TENSIOMETER VISCOSIMETER	

IV. PARTNERSHIP AND COOPERATION

IV.1. University Partnership

Institution	Nature et modalités du partenariat

IV.2. Socio-professional partnership

Institution	Domaine d'activité	Nature et modalités

VI.1. Semester Course Organization Sheet

(Please submit the sheets for all 4 semesters)

1-Semester 1 :

Teaching unit	Teaching hours : per semester	Teaching hours : per week				Coefficient	Credits	Assessment mode	
	14-15 weeks	Lecture	Tutorial	PW	Others			Continuous assessment	Exam
Fondamental teaching unit									
FTU 1									
Physical separation methods	45h00	01H30	01H30			2	4	40%	60%
Membrane separation methods	45h00	01H30	01H30			2	4	40%	60%
FTU 2									
Reactor design	45h00	01H30	01H30			2	4	40%	60%
Process control	45h00	01H30	01H30			2	4	40%	60%
FTU 3									
ORGANIC SYNTHESIS OF DRUGS	45h00	01H30	01H30			2	4	40%	60%
Methodological teaching unit									
MTU 1									

PW Physical Separation	22h30			01H30		1	2	100%	
PW Membrane Separation	22h30			01H30		1	2	100%	
MTU 2									
PW Reactor Design	22h30			01H30		1	2	100%	
PW Process Control	22h30			01H30		1	2	100%	
MTU 2									
PW ORGANIC SYNTHESIS OF MEDICINES	15h00			01H00		1	1	100%	
Transversal teaching unit									
EQUIPMENT	45h00	03H00				1	1		100%
Total Semester 1	375	25				**16**	**30**		

2- Semester 2 :

Teaching unit	Teaching hours : per semester	Teaching hours : per week				Coefficient	Credits	Assessment mode	
	14-15 weeks	Lecture	Tutorial	PW	Others			Continuous assessment	Exam
Fondamental teaching unit									
FTU 1									
DRUG DESIGN METHODS	67h30	03H00	01H30			3	6	40%	60%
GENERAL PHARMACOLOGY	67h30	03H00	01H30			3	6	40%	60%
FTU 2									
Physicochemical methods of analysis	67h30	03H00	01H30			2	4	40%	60%
FTU 3									
BIOCHEMICAL AND MICROBIOLOGICAL ENGINEERING	67h30	03H00	01H30			2	4	40%	60%
Methodological teaching unit									

MTU 1									
PW Physicochemical methods of analysis	22h30			01H30		2	4	100%	
MTU 2									
PW BIOCHEMICAL AND MICROBIOLOGICAL ENGINEERING	22h30			01H30		2	4	100%	
Transversal teaching unit									
TTU 1									
Endlish	22h30	01H30				1	2		100%
Total Semester 2	337h30	22h30				15	**30**		

3- Semester 3 :

Teaching unit	Teaching hours : per semester	Teaching hours : per week				Coefficient	Credits	Assessment mode	
	14-15 weeks	Lecture	Tutorial	PW	Others			Continuous assessment	Exam
Fondamental teaching unit									
FTU 1									
Process modeling and optimization	67h30	03H00	01H30			2	4	40%	60%
FTU 2									
Pharmaceutical formulation	45h00	3h00				3	6		
Preparation of marketing authorization applications	45h00	03H00				2	4	40%	60%
FTU 3									
Computer-aided design (CAD)	45h00	01H30	01H30			2	4	40%	60%
Industrial safety	45h00	01H30	01H30			2	4	40%	60%

Methodological teaching unit									
PW Computer-aided design (CAD)	22h30			1H30		1	2	100%	
Transversal teaching unit									
TTU 1									
Management, quality assurance and environmental protection	45h00	01H30	01H30			1	2	40%	60%
Technical operations on pharmaceutical equipment	22h30	01H30				1	2		
Discovery teaching unit									
DTU 1									
Regulations in the pharmaceutical industry	22h30	01H30				1	2		
Total Semester 3	360	24				16	**30**		

Semester 4

The introductory research internship or professional internship is mandatory during the fourth semester and accounts for 25% of the total course hours. It is equivalent to six modules, or one semester. The internship can be carried out in a research facility affiliated with the university or in a public, semi-public, or private institution, or in an institution related to the field of study.

It is the subject of a thesis and a defense before a jury and is graded. The defense jury is composed of at least three members of the program, including the internship supervisor.

Internship in a company, culminating in a thesis and a defense.

	SHV	Coeff	Credits
Personal Work	240h	7	20
Internship	100h	3	10
Seminars	/		
Other	/		
Total Semester 4	**340h**	**10**	**30**

VI.2 Overall summary of the Master's program:

TE / HV	FTU	MTU	DTU	Cd TU	Total
Lectures	472,5	0	22,5	112,5	607,5
Tutorials	270			1,5	271,5
Practical sessions	0	172,5	0	0	172,5
Personal work	240	100	0	0	340
Others	0	0	0	0	0
Total	982,5	272,5	22,5	114	1391,5
Credits	89	24	1	6	**120**
% in credits for each TU	0,74	0,20	0,01	0,05	

VI.3 – Teaching unit organization sheets

(Create one sheet per teaching unit)
Teaching unit name: UEF 1
Field of study: process engineering
Speciality : pharmaceutical process engineering

Semester: 1

Breakdown of the total number of hours in the TU and its subjects	Lectures : 01H30 Tutorials : 01H30 Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU : FTU1 credits8 Subject 1: Physical separation methods Credits: 4 Coefficient: 3 Subject 2: Membrane separation methods Credits: 4 Coefficient: 3
Assessment method (continuous or exam)	continuous + exam
Description of subjects	Physical separation methods: Acquire practical knowledge of operating principles and methods for selecting, sizing, and choosing equipment applicable to unit operations for fluid/fluid separation. Membrane separation methods: Study of fluid flow in porous media and introduction to unit operations for solid-fluid separation, particularly crystallization.

TU designation : FTU 2
Field process engineering
Speciality: pharmaceutical process engineering

Semester :1

Breakdown of the total number of hours in the TU and its subjects	Lectures : 01H30 Tutorials : 01H30 Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU: FTU2 crédits 8 Subject 1: Reactor Design Credits: 4 Coefficient: 3 Subject 2: Process Control

	Credits: 4 Coefficient: 3
Assessment method (continuous or exam)	continuous or exam
Description of subjects	Reactor design: The course aims to present and apply chemical engineering methods used in the design, sizing, and modeling of reaction sections. Process control: The course covers the control of linear stationary systems. In particular, it will address the concepts of dynamic models and feedback loops. The Laplace transform will be used as a tool to facilitate the analysis and synthesis of controllers, particularly through the concept of transfer functions.

TU designation : FTU 3
Field process engineering
Speciality: pharmaceutical process engineering

Semester :1

Breakdown of the total number of hours in the TU and its subjects	Lectures : 01H30 Tutorials : 01H30 Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU : FTU3 crédits4 Subject 1: organic synthesis of drugs Credits: 4 Coefficient: 3
Assessment method (continuous or exam)	continuous + exam
Description of subjects	Organic synthesis of drugs: The aim of the course is to enable students to extract as much information as possible about the physicochemical properties, predictable chemical behavior, and retrosynthesis of organic molecules, based on an intelligent reading of structural formulas.

TU designation : MTU 1
Field process engineering
Speciality: pharmaceutical process engineering

Semester :1

Breakdown of the total number of hours in the TU and its subjects	Lectures : Tutorials : Practical sessions 01H30 Personal work :
Credits and coefficients assigned to the T and	TU : MTU1 crédits 2 Subject 1 : Physical separation methods:

its subjects	Credits : 2 Coefficient : 1 Subject 2 : Membrane separation methods: Credits : 2 Coefficient : 1
Assessment method (continuous or exam)	continuous + exam
Description of subjects	Have practical knowledge of several fluid-fluid separation methods used in the pharmaceutical industry. Membrane separation methods: Have practical knowledge of several solid-fluid separation methods used in the pharmaceutical industry.

TU designation : MTU 2
Field process engineering
Speciality : pharmaceutical process engineering

Semester :1

Breakdown of the total number of hours in the TU and its subjects	Lectures : Tutorials : Practical sessions 01H30 Personal work :
Credits and coefficients assigned to the T and its subjects	TU : UFM2 crédits2 Subject 1 : reactor design Credits : 2 Coefficient : 1 Subject 2 : Process control Credits : 2 Coefficient :1
Assessment method (continuous or exam)	continuous + exam
Description of subjects	reactor design: Study the optimal conditions for implementing a single-stoichiometry or multiple-stoichiometry reaction in one or more reactors. Know how to diagnose malfunctions or improve the performance of a real reactor. Process control: - Establish the mathematical model appropriate for the control design. - Analyze the control problem. - Select and synthesize an appropriate control strategy. - Evaluate the performance of the selected control strategy.

TU designation : MTU 3
Field process engineering
Speciality : pharmaceutical process engineering

Semester :1

Breakdown of the total number of hours in the TU and its subjects	Lectures : Tutorials : Practical sessions 01H30 Personal work :
Credits and coefficients assigned to the T and its subjects	TU : MTU 3 crédits2 Subject 1 : Organic synthesis of drugs Credits : 2 Coefficient : 1
Assessment method (continuous or exam)	continuous exam
Description of subjects	Organic synthesis of drugs: Perform reactions on a laboratory scale to synthesize an organic-based drug.

TU designation : TTU 3
Field process engineering
Speciality : pharmaceutical process engineering

Semester :1

Breakdown of the total number of hours in the TU and its subjects	Lectures : 01H30 Tutorials : Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU : TTU1 crédits1 Subject 1 : Equipement Credits : 1 Coefficient : 1
Assessment method (continuous or exam)	continu + examen
Description of subjects	Equipment: Use of available analytical techniques for drug control and identification

TU designation : FTU 1
Field process engineering
Speciality : pharmaceutical process engineering

Semester :2

Breakdown of the total number of hours in the TU and its subjects	Lectures : 03H00 Tutorials : 01H30 Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU : FTU 1 crédits12 Subject 1 : Drug Design Methods: Credits : 6 Coefficient : 3 Subject 2 : Drug Design Methods: Matière 2 : general pharmacology Credits : 6 Coefficient :3
Assessment method (continuous or exam)	continu + examen
Description of subjects	Drug Design Methods: The objective of this course is to explain the different stages from drug design to dispensing, in order to help students understand the interactions between the scientific disciplines involved in this process. The course aims to quickly immerse students in the world of medicine. Pharmacology: Students will acquire knowledge of the fundamental concepts of pharmacodynamics and pharmacotherapy: 1. They will be able to define the main targets of drugs and understand the methods used to determine their activity. 2. They will have acquired a fundamental understanding of the relationship between drugs and their targets. 3. They will understand all the general concepts relating to the use of drugs in human medicine. This course provides a basis for the subsequent systematic teaching of different pharmacological classes (special pharmacology).

TU designation : FTU 2
Field process engineering
Speciality : pharmaceutical process engineering

Semester :2

Breakdown of the total number of hours in the TU and its subjects	Lectures : 01H30 Tutorials : 01H30 Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU : FTU 1 crédits 6 Subject 1 : physical method of analysis Credits : 6 Coefficient : 3
Assessment method (continuous or exam)	continu + examen
Description of subjects	physical analysis method Students will become familiar with laboratory techniques that are only used by industry on a subcontract basis. This provides them with a broad-based education, enabling them to choose the most appropriate solutions to the problems they will encounter, while mastering real expertise in a more limited field.

TU designation : FTU 3
Field process engineering
Speciality: pharmaceutical process engineering

Semester :2

Breakdown of the total number of hours in the TU and its subjects	Lectures : 03H00 Tutorials : 01H30 Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU : FTU 3 crédits 6 Subject 1 : Biochemical and Microbiological Engineering Credits : 6 Coefficient : 3
Assessment method (continuous or exam)	continu + examen
Description of subjects	1. Describe and explain the theoretical principles and key factors underlying the operation of bioreactors. 2. Establish and calculate material and energy balances for biotechnological systems and interpret the results. 3. Develop reasoning and calculations based on (bio)chemical and biological kinetics for the design of batch, continuously stirred tank, and semi-continuous reactors, and apply them in specific cases. 4. Describe, explain, and calculate the phenomena of mass, energy, and momentum transfer that can occur within bioreactors, particularly in relation to aeration and agitation. 5. Research the actual values of constants or other correlation parameters essential for the

	design of biological reactors. 6. When designing a new biological reactor, propose the most appropriate reactor design for the industrial context in question, providing a reasoned argument (including its advantages and limitations).

TU designation : MTU 1
Field process engineering
Speciality: pharmaceutical process engineering

Semester :2

Breakdown of the total number of hours in the TU and its subjects	Lectures : Tutorials : Practical sessions 01H30 Personal work :
Credits and coefficients assigned to the T and its subjects	TU : MTU 1 crédits 2 Subject 1 : physical method of analysis Credits : 2 Coefficient : 1
Assessment method (continuous or exam)	continu
Description of subjects	Subject 1: physical analysis method For each subject, state its title and specify its objective in a few lines

TU designation : MTU 2
Field process engineering
Speciality: pharmaceutical process engineering

Semester :2

Breakdown of the total number of hours in the TU and its subjects	Lectures : Tutorials : Practical sessions 01H30 Personal work :
Credits and coefficients assigned to the T and its subjects	TU : MTU 2 crédits 2 Subject 1 : Biochemical and microbiological engineering Credits : 2 Coefficient : 1
Assessment method (continuous or exam)	continu
Description of subjects	Subject 1: Biochemical and microbiological engineering For each subject, state its title and describe its objective in a few lines.

TU designation : TTU 1
Field process engineering

Speciality: pharmaceutical process engineering
Semester :2

Breakdown of the total number of hours in the TU and its subjects	Lectures : 01H30 Tutorials : Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU : TTU 2 crédits 2 Subject 1 : English Credits : 2 Coefficient : 1
Assessment method (continuous or exam)	continu
Description of subjects	Know how to describe and explain a process, experiment, or phenomenon related to process engineering

TU designation : FTU 1
Field process engineering
Speciality: pharmaceutical process engineering

Semester :3

Breakdown of the total number of hours in the TU and its subjects	Lectures : 03H00 Tutorials : 01H30 Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU : FTU 2 crédits 5 Subject 1 : process modeling and optimization Credits : 5 Coefficient : 3
Assessment method (continuous or exam)	continu + exam
Description of subjects	Know how to describe and explain a process, experiment, or phenomenon related to process engineering

TU designation : FTU 2
Field process engineering
Speciality: pharmaceutical process engineering

Semester :3

Breakdown of the total number of hours in the TU and its subjects	Lectures : 6H00 Tutorials : Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU : FTU 2 crédits 10 Subject 1 : Galenic pharmacy Credits: 5

	Coefficient: 3 Subject 2: Preparation of marketing authorization applications Credits: 5 Coefficient: 3
Assessment method (continuous or exam)	continu + exam
Description of subjects	Subject 1: Galenic pharmacy Provide a wide range of knowledge in the field of galenic formulation. Subject 2: Preparation of marketing authorization applications

TU designation : FTU 3
Field process engineering
Speciality: pharmaceutical process engineering

Semester :3

Breakdown of the total number of hours in the TU and its subjects	Lectures : 03H00 Tutorials : 03H00 Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU : FTU 3 crédits 10 Subject 1: Computer-Aided Design Credits: 5 Coefficient: 3 Subject 2: Industrial Safety Credits: 5 Coefficient: 3
Assessment method (continuous or exam)	continu + exam
Description of subjects	Subject 1: Computer-aided design: The objective is twofold: on the one hand, it allows students to familiarize themselves with the concepts of computer-aided design in pharmaceutical processes and, on the other hand, it allows students to learn about workplace safety requirements in the industry and the measures to be taken to prevent accidents involving the handling of toxic substances, combustible and pressurized gases, flammable materials, radioactive materials, etc., which could harm people and the environment. Subject 2: Industrial Safety The objective is for students to learn about workplace safety requirements in industry and the measures to be taken to prevent accidents involving the handling of toxic substances, combustible and pressurized gases, flammable

	materials, radioactive materials, etc., which could harm people and the environment

TU designation : MTU 1
Field process engineering
Speciality: pharmaceutical process engineering

Semester :3

Breakdown of the total number of hours in the TU and its subjects	Lectures : Tutorials : Practical sessions 01H30 Personal work :
Credits and coefficients assigned to the T and its subjects	TU : MTU 1 crédits 1 Subject 1: Computer-Aided Design Credits: 1 Coefficient: 1
Assessment method (continuous or exam)	continu
Description of subjects	The objective is twofold: on the one hand, it allows students to familiarize themselves with the concepts of computer-aided design in pharmaceutical processes.

TU designation :TTU 1
Field process engineering
Speciality: pharmaceutical process engineering

Semester :3

Breakdown of the total number of hours in the TU and its subjects	Lectures : 03H00 Tutorials : 01H30 Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU : FTU 1 crédits 3 Subject 1: Management, quality assurance, and environmental protection Credits: 2 Coefficient: 2 Subject 2 : Technical operations on pharmaceutical equipment Credits: 1 Coefficient: 2
Assessment method (continuous or exam)	continu
Description of subjects	Subject 1: Management, quality assurance, and environmental protection: This course provides graduates with knowledge of business management and administration to prepare them to manage the companies for which

	they will be responsible. Subject 2: Technical operations on pharmaceutical equipment: Learn standard techniques and procedures for sterilization, treatment, and cleaning.

TU designation :DTU 1
Field process engineering
Speciality: pharmaceutical process engineering

Semester :3

Breakdown of the total number of hours in the TU and its subjects	Lectures : 01H30 Tutorials : Practical sessions Personal work :
Credits and coefficients assigned to the T and its subjects	TU : DTU 1 crédits 1 Subject 1: Regulations in the pharmaceutical industry Credits: 1 Coefficient: 2
Assessment method (continuous or exam)	Continu
Description of subjects	Topic 1: Regulations in the pharmaceutical industry: Understanding the regulations applicable to the pharmaceutical industry

VI.4 - Detailed program by subject

(1 detailed sheet per subject)

Course title: Course 1: Physical separation methods (VHS: 45 hours, Lectures: 1.5 hours; Tutorials: 1.5 hours)

Semester: 1
FTU 1

Course objective:
Acquire practical knowledge of the operating principles and methods of selection, sizing, and choice of equipment applicable to unit operations of fluid/fluid separation.
Recommended prior knowledge:
Transport phenomena, mathematics, and chemistry.
Course content:
- Diffusion theory - Fick's and Stefan's laws - Molecular and convective transfer coefficients. Analogy between heat and mass transfer - Distillation (continuous and batch) of binary and multicomponent mixtures - Graphical (McCabe and Thiele) and numerical methods - Simplified ("shortcut") and rigorous methods - Study of tray columns: equipment, efficiency, capacity - Absorption of one or more components with or without chemical reaction - Stripping - Hydrodynamics of packed columns - Study of different types of packing and absorbers - Liquid-liquid extraction: single stage, multi-stage systems with and without reflux - Types and choice of extractors - Supercritical extraction - Solid-liquid extraction elements: principles and equipment - Use of the ASPEN+ process simulator for each of the techniques studied
Assessment method: Continuous : 40%; Final exam: 60%

References:

Michel feidt, ENERGETIQUE – Concepts et applications. 2006, Edt. DUNOD, ISBN 2100490664.

J. R. WELTY ; R.E WILSON ; C.E WICKS, « Fundamentals of momentum, heat and mass transfer », John Wiley and Son, New – York (1976)

C.O. BENNET ; J. E. Myers « Momentum, Heat and Mass Transfer» John Wiley and Son, New – York (1974)

F.P. INCROPERA; D.P. Dewitt, « Fundamentals of Heat and Mass Transfer», John Wiley and Son, New – York (1985)

Course title: Course 2: Membrane separation methods (VHS: 45 hours, Lectures: 1.5 hours; Tutorials: 1.5 hours)

Course objective:
Study of fluid flow in porous media and introduction to unit operations for solid-fluid separation, particularly crystallization**.**

Recommended prior knowledge:
Transport phenomena, mathematics, chemistry, and thermodynamics.

Course content:
- Industrial applications Theoretical elements necessary for solid-fluid separation techniques - Physical characteristics of liquids and solids: characterization of porous media (granularity, porosity); concepts of surface tension - Fluid flow through porous media: Kozeny-Carman

modeling; Kozeny, Burke-Plummer, and Ergun laws; co-current two-phase flow - Particle fall in fluids: Stokes, Allen, and Newton laws Solid-fluid separation techniques - Decantation, centrifugation, cycloning, hydrocycloning - Filtration: screening, cake filtration, clarification, thick bed filtration - Washing and dewatering of filter cakes - Membrane filtration: micro-, nano-, ultrafiltration, reverse osmosis; tangential filtration; diafiltration

Assessment method:
Continuous assessment: 40%; Final exam: 60%.

References:
Christie J. Geankoplis "Transport Processes and Unit Operations". Third Edition, Prentice Hall, 1993
Warren Lee McCabe, Julian Smith, Peter Harriott "Unit Operations of Chemical Engineering". McGraw-Hill Education, 2005
Nirali Prakashan " Unit Operations-ii Heat & Mass Transfer". Twenty-Third edition, 2009

Course title: Course 1: Reactor Design (VHS: 45 hours, Lectures: 1.5 hours; Tutorials: 1.5 hours)

Semester: 1
FTU 2

Teaching objective:
The course covers the main chemical engineering models used in reactor representation and analysis of their operation. Extensive integration is achieved through application problems and case studies.

Recommended prior knowledge:
Chemistry and thermodynamics

Course content:
- Homogeneous reactors - General balance equations and sizing of ideal adiabatic reactors - Analysis of the behavior of non-ideal reactors. Study of residence time distribution. Models of axial dispersion reactors and series mixer reactors. - Heterogeneous catalytic reactors. Microkinetics at the catalyst grain level (Wheeler theory). Sizing of fixed-bed and fluidized-bed reactors (Davidson and Harrison model). - Gas-liquid reactors. Hatta theory. Sizing of mixer reactors and absorption columns.

Assessment method:
Continuous assessment: 40%; Final exam: 60%.

References:
Jacques Villermaux “Chemical Reaction Engineering, Reactor Design and Operation.” Tec et Doc, 1995
Pierre Trambouze, Jean-Paul Euzen “Chemical Reactors.” Editions Technip, 2002
Michel Feidt, ENERGETICS – Concepts and Applications. 2006, Edt. DUNOD, ISBN 2100

Subject 2: Process Control (VHS: 45 hours, Lectures: 1.5 hours; Tutorials: 1.5 hours)

Teaching objective:
- pose a control problem;
- define the important variables associated with the control problem;
- set up the mathematical model appropriate for the control design;
- analyze the control problem;
- select and synthesize an appropriate control strategy;
- evaluate the performance of the selected control strategy

Recommended prior knowledge:
Applied mathematics: signals and systems

Subject content:
The course covers the control of stationary linear systems. In particular, it will address the concepts of dynamic models and feedback loops. The Laplace transform will be used as a tool to facilitate the analysis and synthesis of controllers, particularly through the concept of transfer functions. The PID controller will be used as a reference. We will also study certain advanced control methods (at least more advanced than the simple PID controller) and certain more complex control problems (delay systems, multivariable systems, inferential control, batch process control, etc.). The course will focus in particular on the concepts of mass and energy balance, chemical kinetics, and unit operations, and will be illustrated with examples taken from industry.

Assessment method: Continuous : 40%; Exam: 60%.

References:
Jacques Villermaux "Chemical Reaction Engineering, Reactor Design and Operation." Tec et Doc, 1995.
Pierre Trambouze, Jean-Paul Euzen "Chemical Reactors." Editions Technip, 2002.

Course title: Course 1: Organic Synthesis of Medicines (VHS: 45 hours, Lectures: 1.5 hours; Tutorials: 1.5 hours)

Semester: 1
FTU 3

Teaching objective:
To learn organic synthesis techniques applied to drugs.

Recommended prior knowledge:
Knowledge of reaction mechanisms, organic chemistry.

Subject content:
Reactions for protecting the main functions of organic synthesis
-alcohol
-amine
-carboxylic acid
-aldehyde and ketone
-unsaturated compounds

-aromatic compounds
Applications to amino acids: peptide synthesis
Antibiotics
Pharmacology and therapeutic research
Relationship between chemical structure and pharmacological activity

Assessment method:

Continuous assessment: 40%; Final exam: 60%.

References:

- Vandamme, Rival, Pabst, Heitz, Initiation à la connaissance du médicament (introduction to medicine), lavoisier
- Kirkiacharian Serge, Guide to medicinal chemistry and medicines, Lavoisier
- Jonathan Clayden, Stuart Warren, Nick Greeves, peter wothers, Organic chemistry, Lavoisier

Course title: Course 1: Physical Separation (Lectures: 22.5 hours, Practical work: 1.5 hours)

Semester: 1
MTU 1

Course objective:
To acquire practical knowledge of several fluid-fluid separation methods used in the pharmaceutical industry.

Recommended prior knowledge:
Course content:

Continuous distillation,
Batch distillation,
Extraction
Absorption

Assessment method: Continuous 100%

References:

Michel feidt, ENERGETIQUE – Concepts et applications. 2006, Edt. DUNOD, ISBN 2100490664.
J. R. WELTY ; R.E WILSON ; C.E WICKS, « Fundamentals of momentum, heat and mass transfer », John Wiley and Son, New – York (1976)
C.O. BENNET ; J. E. Myers « Momentum, Heat and Mass Transfer» John Wiley and Son, New – York (1974)
F.P. INCROPERA; D.P. Dewitt, « Fundamentals of Heat and Mass Transfer», John Wiley and Son, New – York (1985)

Course title: Course 2: Membrane separation (Lectures: 22.5 hours, Practical work: 1.5 hours)

Teacher responsible for the course unit:
Teacher responsible for the course:

Course objective:
To acquire practical knowledge of several solid-fluid separation methods used in the pharmaceutical industry

Recommended prior knowledge:
Course content:
Micro and nano filtration
Reverse osmosis
Electrodialysis
Pervaporation

Assessment method: Continuous 100%

References:

Christie J. Geankoplis "Transport Processes and Unit Operations". Third Edition, Prentice Hall, 1993

Warren Lee McCabe, Julian Smith, Peter Harriott "Unit Operations of Chemical Engineering". McGraw-Hill Education, 2005

Nirali Prakashan " Unit Operations-ii Heat & Mass Transfer". Twenty-Third edition, 2009

Course title: Course 1: Reactor Design (Lectures: 22.5 hours, Labs: 1.5 hours)

Semester: 1
MTU 2

Course objective:
To study the optimal conditions for implementing a single-stoichiometry or multiple-stoichiometry reaction in one or more reactors. Learn how to diagnose malfunctions or improve the performance of a real reactor.

Recommended prior knowledge:
Course content:
Practical work (1 to 3): Material and energy balances

Assessment method: Exam: 100%

References:

• J. villermaux : génie de la réaction et calcul de réacteurs
• O. Levenspeil, reactor design
• G. F. Froment and K. B. Bischoff, Chemical Reactor Analysis and Design.
• Les techniques de l’ingénieur
• Raffinage et Génie Chimique, Tomes I et II, édition de l’IFP
• Trambouze, Les Réacteurs chimiques, édition de l’IFP

Course title: Course 2: Process Control (Lectures: 22.5 hours, Practical work: 1.5 hours)

Course objectives:

- Establish the mathematical model appropriate for control design.
- Analyze the control problem.
- Select and synthesize an appropriate control strategy.
- Evaluate the performance of the selected control strategy.

Recommended prior knowledge:
Mathematics.

Subject content:
Performance evaluation
Control analysis

Assessment method: Exam: 100%

References:
(Books and handouts, websites, etc.).

Course title: Course 1: Organic synthesis of drugs (Lecture: 15.5 hours, Lab: 1 hour)
Semester: 1
MTU 3

Course objective:
Carry out reactions on a laboratory scale to synthesize an organic-based drug.
Recommended prior knowledge:
Organic chemistry, reaction mechanisms, and kinetics

Course content:
-4 complete practical sessions on organic drug synthesis (including analysis) at Saidal and our laboratory

Assessment method: Continuous assessment: 100%

References:
Documentation available at Saidal and the University of Médéa

Course title: Subject 1: Equipment (VHS: 45 hours, Lectures: 3 hours)

Semester: 1
TTU1

Course objective:
Knowledge of the different types of equipment used in the pharmaceutical industry.

Recommended prior knowledge:
Thermodynamics, Transport Phenomena, Unit Operations

Course content:
Steam equipment in galenics and pharmaceutical units. Types of modern boilers and their structures.
- Machines for crushing medicinal materials. Types of mills for pulverizing crushed materials.
- Equipment for mixing liquids in the pharmaceutical industry (types of agitators, pneumatic mixing: bubbling).
- Equipment for evaporating and drying medicinal substances (vacuum evaporators, condensers, types of air dryers, infrared dryers, belt dryers, etc.).
- Tablet machines, powdering equipment.
- Equipment for determining tablet hardness and disintegration.
- Gas transfer equipment (compressors, vacuum pumps, fans).
- Equipment for moving liquids and solids (siphons, jet pumps, centrifugal pumps, elevators, climatic conveyors).
- Equipment for separating solids and liquids (clarifiers, separators, etc.).

Assessment method: Examen : 100%

References:
Dr. Heinrich Klefenz , -Industrial Pharmaceutical Biotechnology, **Code** - PHIPB50003
Dr. Gilbert S. Banker and Dr. Christopher T. Rhodes, Modern Pharmaceutics , Code - PHMPP50007

Course title: **Course 1:** Drug Design Methods (VHS: 67.5 hours, Lectures: 3 hours; Tutorials: 1.5 hours)

Semester: 2
FTU 1

Course objective:
The objective of this course is to explain the different stages from drug design to dispensing, in order to help students understand the interactions between the scientific disciplines involved in this process. The course aims to quickly immerse students in the world of medicine.

Recommended prior knowledge:
Chemistry, biology, toxicology, and analysis

Course content:
The main topics covered in Volume 1 describe the successive stages and constraints involved in developing a future drug, emphasizing the role of chemistry and biology in the design process and discussing the key principles of the various disciplines (analysis, pharmacology, toxicology, galenics, etc.) that students will encounter during their studies and that they will reproduce on a timeline of the drug's development. In Volume 2, students will be asked to take a position on a new drug used as an example as part of a supervised assignment: how was it discovered? How is it presented? What are the key elements of the scientific leaflet? The methods for this second point will combine the use of computer research tools

Assessment method: Continuous assessment: 40%; Final exam: 60%.

References:

Documentation available at Saidal and the University of Medea.

Course title: Course 2: General Pharmacology (VHS: 67.5 hours, Lectures: 3 hours; Tutorials: 1.5 hours)

Course objective:
By the end of this course, students will have acquired knowledge of the fundamental concepts of pharmacodynamics and pharmacotherapy: 1. They will be able to define the main targets of drugs and understand the methods used to determine their activity. 2. They will have acquired a fundamental understanding of the relationship between drugs and their targets. 3. They will understand all the general concepts relating to the use of drugs in human medicine. This course provides a basis for the subsequent systematic teaching of different pharmacological classes (special pharmacology).

Recommended prior knowledge:
Biochemistry, biology, and physiology.

Course content:
Study of crystallization/precipitation techniques: - Crystalline state, crystal lattice, polymorphism - Phase equilibria - Crystallization kinetics: nucleation and crystal growth - Practice and equipment - Industrial applications Theoretical elements necessary for solid-fluid separation techniques - Physical characteristics of liquids and solids: characterization of porous media (granularity, porosity); concepts of surface tension - Fluid flow through porous media: modeling Kozeny-Carman; Kozeny, Burke-Plummer, Ergun laws; co-current two-phase flow - Particle fall in fluids: Stokes, Allen, Newton laws Solid-fluid separation techniques - Decantation, centrifugation, cycloning, hydrocycloning - Filtration: screening, cake filtration, clarification, thick bed filtration - Washing and dewatering of filter cakes - Membrane filtration: micro-, nano-, ultrafiltration, reverse osmosis; tangential filtration; diafiltration

Assessment method: Continuous assessment: 40%; Final exam: 60%.

References:

- Isabelle Claverie-Morin, Isabelle Claverie, Helene Hedde, Pharmacologie generale, toxicologie: mecanismes fondamentaux, Wolters Kluwe
- Denis Stora, Pharmacologie B.P. edition porphyre.

Course title: Course 1: Physicochemical Methods of Analysis (Total hours: 67.5, Lectures: 3 hours; Tutorials: 1.5 hours)

Semester: 2
FTU 2

Teaching objective:

Recommended prior knowledge:

General, inorganic, and organic chemistry.

Subject content:

- In-depth study of certain techniques and applications (molecular absorption spectrophotometry, infrared spectrophotometry, atomic absorption spectrophotometry, etc.).
- Study of new techniques and applications (photoelectron and ion spectroscopy "XPS or ESCA – UPS – AES")

Further develop electrochemical instrumental methods

- Chromatographic separation methods
- Thermal methods
- Electronic circuits in analytical instruments
- Computers in analytical instrumentation

Assessment method: Continuous assessment: 40%; Final exam: 60%.

References:

D.G. Watson, Pharmaceutical Analysis A Textbook for Pharmacy Students and Pharmaceutical Chemists - Watson - Churchill 1999

L. Ohannisian, A.J. Streeter, HandBook of Pharmaceutical Analysis, Marcel Dekker 2002

Course title: Course 1: : Biochemical and microbiological engineering (VHS: 67H30, Lectures: 3h00; tutorials: 1H30)

Semester: 2
FTU 3

Teaching objective:

- Describe and explain the theoretical principles and key factors underlying the operation of bioreactors - Establish and calculate material and energy balances for biotechnological systems and interpret the results. - Develop reasoning and calculations based on (bio)chemical and biological kinetics for the design of batch, continuously stirred tank, and semi-continuous reactors and apply them in specific cases. - Describe, explain, and calculate the phenomena of mass, energy, and momentum transfer that can occur within bioreactors, particularly in relation to aeration and agitation. - Research the actual values of constants or other correlation parameters essential for the design of biological reactors. - When designing a new biological reactor, propose the most appropriate reactor design for the industrial context in question, providing a reasoned argument (including its advantages and limitations).

Recommended prior knowledge:
Transport phenomena, unit operations, biochemistry, and microbiology.
Course content:
From design to pilot-scale implementation of microbiological and enzymatic processes. Theoretical and methodological foundations of applied chemical kinetics and chemical reactor design, with a focus on the specific characteristics (kinetics and transport phenomena) of biochemical and microbiological processes, with the aim of systematizing the principles underlying the analysis and sizing of bioreactors.
- Kinetically and thermodynamically characterized (micro)biological processes: Cell growth, its measurement or estimation, use of substrate(s), production of product(s). Yields. Productivities. Kinetic models. Parameter estimation.
- Methodology of material and energy balances for the analysis of biotechnological systems and their performance.
- Batch, continuous, and semi-continuous reactors.
- Transfer phenomena applied to the analysis of aeration, agitation, rheology, scale-up, and sterilization of bioreactors.

Assessment method: Continuous assessment: 40%; Final exam: 60%.

References: -
Bioprocess Engineering Principles' par Pauline M. Doran 2^e^ édition (2013)
Bioprocess Engineering' par Michael L. Shuler & Fikret Kargi 2^e^ édition (2002)

Course title: Course 1: Physicochemical Methods of Analysis (Lectures: 22.5 hours, Practical work: 1.5 hours)

Semester 2
MTU 1

Teaching objective:

Master the techniques of analysis and control of drugs in the pharmaceutical industry

Recommended prior knowledge:

- Organic chemistry - Physicochemical methods of analysis - Thermodynamics

Course content:

- DSC thermal analysis - Thermogravimetric analysis - Thermomechanical analysis - HPLC, GC-MS

Assessment method: Continuous assessment: 100%

References:

SKOOG, Principes d'analyse instrumentale.
BURGOT, G., Méthodes instrumentales d'analyse chimique et applications.
SILVESTEIN, Identification spectromètre.
VALEUR, La fluorescence moléculaire.

Course Title: Course 1: Biochemical and Microbiological Engineering (Lectures: 22.5 hours, Practical Work: 1.5 hours)

Semester: 2
MTU 2

Course objective:
Master the processes of transformation, production, separation, and purification on a laboratory scale.

Recommended prior knowledge:
Biochemistry, biology, process engineering

Course content:
Practical work in:
- Strain transformation, production monitoring
- Primary separation, isolation, purification, polishing

Assessment method: Continuous assessment: 100%

References:
- Bioprocess Engineering Principles' par Pauline M. Doran 2e édition (2013)
- Bioprocess Engineering' par Michael L. Shuler & Fikret Kargi 2e édition (2002)

Course title: Course 1: English (VHS: 22:30, Class: 1:30)

Semester: 2
TTU.1

Course objective:

Be able to describe and explain a process, experiment, or phenomenon related to process engineering.

Recommended prior knowledge:

Course content:

Technical English (review of verb tenses, description of qualities of substances, description of position and movement, description of sequence).

Assessment method: Exam: 100%

References:

R. Murphy, English Grammar in Use - Reference and Practice for Intermediate Students, Cambridge University Press, 1989.
M. McCarthy, F O'Dell, English Vocabulary In Use - Upper-Intermediate & Advanced, Cambridge University Press, 1994.

Course title: Course 1: Process Modeling and Optimization (VHS: 67.5 hours, Lectures: 3 hours; Tutorials: 1.5 hours)

Semester: 3
FTU 1

Course objectives:
- Formulate a problem situation in the form of an optimization model
- analyze an optimization model, in particular determine whether it is linear or convex
- characterize the optimal solutions of an optimization model and, when possible, calculate them analytically (using optimality conditions), analyze their sensitivity using duality in the linear case
- propose, with justification, the use of a solution algorithm based on the type of problem, its size, and the expected convergence properties
- implement a solution algorithm (simplex algorithm, unconstrained first- or second-order method)
- apply an implementation or resolution software to concrete problems, comment on and interpret the results obtained
- report in writing on the formulation, analysis, and/or resolution of optimization models

Recommended prior knowledge:
Requires sufficient maturity in mathematics.

Course content:
- Linear optimization:

Introduction, canonical forms, geometry of polyhedra, simplex algorithm, duality and sensitivity analysis, introduction to discrete optimization (branch & bound).
- Nonlinear optimization:

Models: definitions and terminology, optimality conditions for problems with and without constraints; recognizing and exploiting the convexity of a problem.
Methods: online search methods for problems without constraints (gradient, Newton, and quasi-Newton methods); convergence properties (local and global); implementation details; introduction to other methods (conjugate gradients, problems with constraints, unavailability of derivatives).
- Design of experiments
- Connective methods

Assessment method: Continuous assessment: 100%

References:

- Introduction to Linear Optimization, Dimitri Bertsimas and John Tsitsiklis, Athena Scientific, 1997.
- Linear Programming. Foundation and Extensions, Robert Vanderbei, Kluwer Academic Publishers, 1996.
- Integer Programming, Laurence Wolsey, Wiley, 1998.
- Numerical Optimization, Jorge Nocedal et Stephen J. Wright, Springer, 2006.
- Convex Optimization, Stephen Boyd et Lieven Vandenberghe, Cambridge University Press, 2004

Course title: Course 1: Galenic Pharmacy (VHS: 45 hours, Lectures: 3 hours; Tutorials: 0 hours)

Semester: 3
FTU 2

Course objective: To provide a broad range of knowledge in the field of galenic formulation.

Recommended prior knowledge:

Course content:
Formulation of liquid forms
- Properties of active ingredients in solution
- Surfactants
- Polymers and macromolecules
- Flavoring – Preservation
- Non-sterile/sterile pharmaceutical forms
- Illustrations of various examples of establishing protocols for liquid form formulations for different routes of administration

Formulation of semi-solid forms
- Hydrophilic and lipophilic excipients
- Illustrations of various examples of establishing protocols for semi-solid form formulations for rectal and dermal routes

Formulation of solid forms
- Properties of the solid state
- Structure and forms of crystals
- Crystallization and factors responsible
- Illustration using various examples of the establishment of protocols for the formulation of solid forms (tablets, capsules, lyophilizates, powders, etc.) for different routes of administration.

Formulation of peptides and proteins
- Structure and properties of peptides and proteins in solution
- Stability of proteins and peptides
- Illustration using various examples of the establishment of protocols for peptide and protein formulations

Physicochemical interactions between active ingredients and excipients, and incompatibilities

Stability of drugs
New pharmaceutical forms:
- extended-release systems;
- transdermal systems;
- transmucosal routes of administration (nasal and pulmonary);
- drug carriers (liposomes, microspheres);
- inclusion complexes

Conservation operations:
- Stabilization of deterioration mechanisms;
- Problems posed by incompatibilities;
- Setting an expiration date;
- Packaging.

Assessment method:
Examination: 100%

References:
Books available at the central library

Course title: Course 2: Preparation of marketing authorization applications (VHS: 45 hours, Lectures: 3 hours; Tutorials: 0 hours)

Course objective:
Pharmaceutical and galenic chemistry

Course content:
Analytical and pharmaceutical development of marketing authorization applications
- Galenic development: formulation and industrial manufacturing processes
- Stability studies of active ingredients and finished products: container/content interactions
- Analytical dossier of reference substances
- Method validation - Criteria for accepting an analytical method and establishing standards.
- Evaluation of residual impurities
- Pharmacokinetics of a drug
- Case studies
- Synthetic drugs
- Analytical content of the marketing authorization application for synthetic drugs
- Composition and galenic development
- Method of preparation
- Control of active and non-active components
- Control of intermediate products
- Control of the finished product: choice of extraction and dosage methods
- Stability: ICH standards
- Medicines of natural origin in allopathy and homeopathy
- Scientific and technical data essential for the preparation of the marketing authorization application (so-called simplified procedure)

Criteria for evaluating the pharmaceutical quality of raw materials of natural origin
- Control of intermediate products and different dosage forms
- Industrial extraction techniques
- Stability studies: active ingredients and finished product
- Marketing authorization: regulations
- Institutions responsible for medicines
- Marketing authorization application: general information, CTD format, modifications to marketing authorization applications, abbreviated applications, parajuridical standards
- Marketing authorization: chemical and pharmaceutical documentation
- Scientific and technical data essential for preparing the marketing authorization application.
- Criteria for evaluating the pharmaceutical quality of raw materials.

Contents of the expert report
- Analysis and comparison of legislation
- Toxicological and pharmacological tests

- Clinical documentation
- Generic and bioequivalent drugs.

Assessment method: exam: 100%

References:

J. Ermer, J.H.McB Miller, Method Validation In Pharmaceutical Analysis, Wiley 2005.
NUSIM S. H. (ed) - Active Pharmaceutical Ingredients : Development, Manufacturing and Regulation, TAYLOR & FRANCIS 2005.

Course title: Course 1: Computer-Aided Design (CAD) (VHS: 45 hours, Lectures: 1.5 hours; Tutorials: 1.5 hours)

Semester: 3
FTU 2

Course objective:
The objective is twofold: on the one hand, it allows students to familiarize themselves with the concepts of computer-aided design in pharmaceutical processes and, on the other hand, it allows students to learn about workplace safety requirements in the industry and the measures to be implemented to prevent accidents inherent in the handling of toxic substances, combustible and pressurized gases, flammable materials, radioactive materials, etc., which could harm people and the environment.

Recommended prior knowledge:
Learners must have prior knowledge of the basic concepts of handling chemicals, electrical equipment, combustible gases, and laboratory organization.

Course content:
Use of Flowsheeting programs for static and dynamic process simulation.
- Introduction, safety regulations in Algeria, working conditions.
- Safety organization in laboratories.
- Workplace accidents and their causes.
- Toxic and harmful substances.
- Use of glassware.
- Use of combustible gases and gases under pressure and vacuum.
- Safety when working with electricity.
- Fire protection and firefighting.
- First aid in the event of an accident.
- Radioactive materials.
- Environmental protection.

Assessment method:
Exam + continuous assessment: 100%

References:

Elnashaie S., Garhyan P. Conservation Equations and Modeling of Chemical and Biochemical Processes (Dekker,2003)
F.P. Lees, Loss Prevention in the Process Industries; Hazard Identification Assesment and Control Vol 1, 2Ed, Butterworth Heinmann 1996.

Course title: Course 2: Industrial Safety (VHS: 45 hours, Lectures: 1.5 hours; Tutorials: 1.5 hours)

Course objective:
The objective is for students to learn about workplace safety requirements in industry and the measures to be taken to prevent accidents involving the handling of toxic substances, combustible and pressurized gases, flammable materials, radioactive substances, etc., which could harm people and the environment.
Recommended prior knowledge:
Students must have prior knowledge of the basic concepts of handling chemicals, electrical equipment, combustible gases, and laboratory organization.

Course content:
- Introduction; Safety regulations in Algeria; working conditions. - Safety organization in laboratories. - Workplace accidents and their causes. - Toxic and harmful substances. - Use of glassware. - Use of combustible gases and gases under pressure and vacuum. - Safety when working with electricity - Fire protection and firefighting. - First aid in the event of an accident. - Radioactive materials - Environmental protection.

Assessment method:
Continuous assessment: 100%

References:
Course materials: (Books and handouts, websites, etc.).

Course title: Course 1: Computer-Aided Design (CAD) (Lectures: 22.5 hours, Practical work: 1.5 hours)

Semester: 3
MTU 1

Course objective:
The objective is twofold: on the one hand, it allows students to familiarize themselves with the concepts of computer-aided design in pharmaceutical processes and, on the other hand, it allows students to learn about workplace safety requirements in the industry and the measures to be taken to prevent accidents involving the handling of toxic substances, combustible and pressurized gases, flammable materials, radioactive materials, etc., which could harm people and the environment.

Recommended prior knowledge:
Learners must have prior knowledge of the basic concepts of
handling chemicals, electrical equipment, combustible gases, and laboratory organization.

Course content:
Three (03) practical sessions at Saidal on computer control of the various existing installations

Assessment method: Continuous assessment: 100%

References:
Documentation available at Saidal

Course title: Course 1: Management, Quality Assurance, and Environmental Protection (VHS: 45 hours, Lectures: 1.5 hours; Tutorials: 1.5 hours)

Semester: 3
TTU 1

Teaching objective:
This course provides graduates with knowledge of business management and administration in order to prepare them to manage the businesses for which they will be responsible.

Recommended prior knowledge:
Environmental regulation and management, health and safety.

Course content:
Introduction to the principles of business organization and methods of planning and establishing various programs (introduction to economics, business organization and management, program planning)

- Management (planning, leadership)
- Quality assurance
- Origin and collection methods, pollution criteria, average composition of ERUs, population equivalent, regulatory aspects (discharge standards) - Wastewater treatment (water treatment sub-sector, sludge treatment sub-sector)

Industrial effluents - activities involving mineral discharges - activities involving organic discharges - activities involving mixed discharges - BOD of industrial wastewater - different types of processes suitable for treating dispersed pollution - different types of processes suitable for treating dissolved pollution.

1. Definitions - Standards and benchmarks
2. Regulatory context and specifications for pharmaceutical specialties and drugs for clinical trials
3. New European provisions concerning GMPs, soon to be applicable in France within the framework of GMPs.

- Quality management
- Personnel
- Premises and equipment
- Documentation
- Production
- Quality control
- Contract manufacturing and analysis
  Complaints and drug recalls
- Audits and self-inspections
- International developments and context of GMP
- Specific guidelines
- Good Laboratory Practice for Quality Control

4. Quality assurance of finished products

- Key functions and positions
- Concept of Responsible Pharmacist and person competent for analysis and release.
- Reference standards (internal monographs and European Pharmacopoeia)
- Procedures for sampling finished products
- Procedures for controlling finished products
- Finished product analysis procedures
- Analytical technique validation procedures
- Finished product acceptance or rejection procedures
- Any procedures for recovering batch heads or tails
- Procedure for handling rejected products
- Circulation of internally accepted or rejected finished products
- Circulation of externally accepted finished products (distributor or others)

5. Quality assurance of semi-finished products as finished products
6. Labeling of finished products
7. Batch records for finished products
8. Statistical tools for continuous quality improvement

Assessment method: exam: 100%

References:

B. Nelson, P. Economy, The management bible, Wiley 2005.
Sis Kemp, Quality Management Demystified, McGraw-Hill 2006.
Hillier, Lieberman, Introduction to operations research, McGraw-Hill, 2001
L.D. Williams, ENVIRONMENTAL SCIENCE DEMYSTIFIED, McGraw-Hill 2005
M.M. El-Halwagi, Pollution Prevention Through Process Integration, Elsevier Science 1997.
T.S.S. Dikshith, Prakash V. Diwan, Industrial Guide To Chemical And Drug Safety, A JOHN WILEY & SONS, 2003

Course title: Course 2: Technical operations on pharmaceutical equipment
(VHS: 22.5 hours, Classes: 1.5 hours)

Course objective:
To learn standard techniques and procedures for sterilization, treatment, and cleaning.
Recommended prior knowledge:
Computer-aided design, standards, etc.

Course content:
- Sterilization in the pharmaceutical and related industries
- Freeze-drying
- Air treatment and controlled atmosphere areas
- Cleaning of industrial equipment

Assessment method: Continuous assessment: 100%

References:

Course materials: Course transparencies

Course title: Course 1: Regulations in the pharmaceutical industry (VHS: 22.5 hours, Lectures: 1.5 hours)

Semester: 3
DTU 1

Course objective:
This course covers drug legislation. It provides the scientific, technical, and general regulatory knowledge necessary for professional practice in pharmacy in its many aspects: practitioner, pharmaceutical industry executive, research, etc.

Recommended prior knowledge:
Knowledge in the pharmaceutical field.

Course content:
- Marketing authorization - Good manufacturing practices - International standards - Staff training and management - Quality assurance - Validation

Assessment method:
Continuous assessment: 100%

References: (Books and handouts, websites, etc.).