الجمهورية الجزائرية الديمقراطية الشعبية

People's Democratic Republic of Algeria

وزارة التعليم العالي والبحث العلمي

Ministry of Higher Education and Scientific Research

جامعة 20 أوت 1955- سكيكدة

University 20 août 1955-Skikda

Academic Licence Degree

Civil Engineering

Institution	*Faculty*	*Department*
University 20 août 1955-Skikda	**Faculty of Technology**	***Civil Engineering***
Domain	*Branch*	*Speciality*
Science and Technology	***Civil Engineering***	***Civil Engineering***

Objective

The Licence degree in "specialty civil engineering" aims to provide students with high-level scientific and technical training in the fields of civil engineering.
This training consists of training students capable of managing multi-faceted superstructure and infrastructure projects (Buildings, Roads, structures, VRD, hydraulics, etc.). The licensee is able to participate as a qualified employee in the design and execution tasks.

License's program Content

Branch
Civil Engineering

Specialty
Civil Engineering

Semester 5

Teaching Unit	Program content – Title	Credits	Coefficient	Weekly hourly volume – Course	Weekly hourly volume – Tutorial	Weekly hourly volume – Practical work	Semester hourly volume (15 weeks)	Complementary work consulting (15 weeks)	Evaluation method – Progressive assessment	Evaluation method – Exam
Fundamental Teaching Unit Code : FTU 3.1.1 Credits : 12 Coefficients : 6	Strength of materials	4	2	1h30	1h30		45h00	45h00	40%	60%
	Reinforced concrete 1	4	2	1h30	1h30		45h00	45h00	40%	60%
	Metal frame	4	2	1h30	1h30		45h00	45h00	40%	60%
Fundamental Teaching Unit Code : FTU 3.1.2 Credits : 6 Coefficients : 3	Soil mechanics 2	4	2	1h30	1h30		45h00	45h00	40%	60%
	Building materials	2	1	1h30			22h30	27h30		100%
Methodology Teaching Unit Code: MTU 13 Credits : 9 Coefficients: 5	Topography	4	1			1h30	22h30	27h30	100%	
	Soil mechanics 2	2	1			1h30	22h30	27h30	100%	
	Building materials 2	2	1			1h30	22h30	27h30	100%	
	Drawing of buildings and public works	3	2			2h30	37h30	37h30	100%	
Discovery Teaching Unit Code : DTU 3.1 Credits: 2 Coefficients : 2	Topography 2	1	1	1h30			22h30	02h30		100%
	Hydraulics	1	1	1h30			22h30	02h30		100%
Transversal Teaching Unit Code: TTU 3.1 Credits : 1 Coefficients : 1	Technics and construction rules	1	1	1h30			22h30	02h30		100%
Total semester 5		**30**	**17**	**12h00**	**6h00**	**7h00**	**375h00**	**375h00**		

Semester 6

Teaching Unit	Program content – Title	Credits	Coefficient	Weekly hourly volume – Course	Weekly hourly volume – Tutorial	Weekly hourly volume – Practical work	Semester hourly volume (15 weeks)	Complementary work consulting (15 weeks)	Evaluation method – Progressive assessment	Evaluation method – Exam
Fundamental Teaching Unit *Code : FTU 3.2.1* *Credits : 8* *Coefficients : 4*	*Calculation of structures*	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
	Metal constructions	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
Fundamental Teaching Unit *Code : FTU 3.2.2* *Credits : 10* *Coefficients : 5*	*Reinforced concrete2*	*6*	*3*	*3h00*	*1h30*		*67h30*	*82h30*	*40%*	*60%*
	Foundations and geotechnical works	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
Methodology Teaching Unit *Code : MTU 3.2* *Credits : 9* *Coefficients : 5*	*Project 's of end study*	*4*	*2*			*3h00*	*45h00*	*55h00*	*100%*	
	Computer aided calculation	*3*	*2*			*2h30*	*37h30*	*37h30*	*100%*	
	Metering and price estimation	*2*	*1*	1h30			*22h30*	*27h30*		*100%*
Discovery Teaching Unit *Code : DTU 3.2* *Credits : 2* *Coefficients : 2*	*Cariageway and roads*	*1*	*1*	*1h30*			*22h30*	*2h30*		*100%*
	Site organisation	*1*	*1*	*1h30*			*22h30*	*2h30*		*100%*
Transversal Teaching Unit *Code : TTU 3.2* *Credits : 1* *Coefficients : 1*	*Professional project and enterpreise management*	*1*	*1*	*1h30*			*22h30*	*02h30*		*100%*
Total semester 6		**30**	**17**	*15h00*	*6h00*	**5h30**	**375h00**	**375h00**		

Democratic Republic of Algeria and Popular

Ministry of Higher Education and Scientific Research

Skikda University

LMD TRAINING OFFER

ACADEMIC LICENSE

NATIONAL PROGRAM

2018 - 2019

Establishment	Faculty / Institute	Department

Domain	Sector	Specialty
Science *And* *Technology*	*Process Engineering*	*Process Engineering*

People 's Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research

Pedagogical Committee National of the Domain Science and Technology

2019 - 2018

Degree title: Process Engineering		Year: 2018-2019

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Summary	Page

I – Identity card of the License

1 - Location of the training:

Faculty (or Institute):

Department:

References of the license authorization decree (attach copy of the decree)

2- External partners:

Other partner establishments:

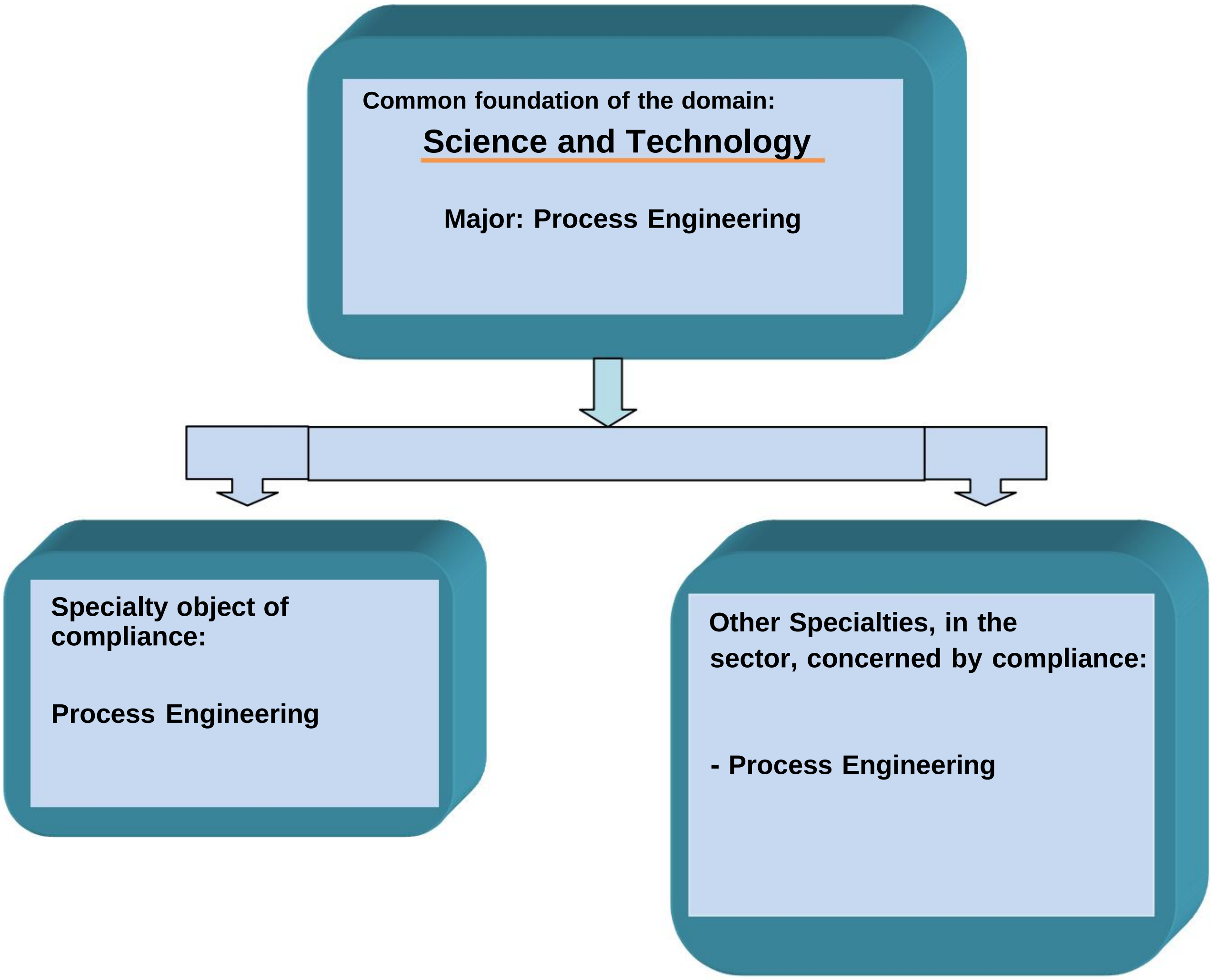
Companies and other socio-economic partners:

International partners:

3 – Context and objectives of the training

A – General organization of the training: position of the project

If several licenses are offered or already supported at the level of the establishment (same training team or other training teams), indicate in the following diagram, the position of this project in relation to the other courses.



B - Training objectives:

Process Engineering is an important sector in the field of science and technology (Domain ST). Indeed, this sector, which initially developed around fundamental Chemical Engineering, brings together a very wide range of specialties (Chemical Engineering, Environmental Engineering, Materials Engineering, Pharmaceutical Engineering, Electrochemical Engineering, Cryogenics, Energy , Agri-food, etc.).

Process Engineering is essential in all industrial processes for the transformation of matter and energy. To this end, it is essential to train people capable of mastering transformation processes on an industrial scale.
This bachelor's degree, whose curriculum contains the fundamental subjects of the sector *(physical chemistry, unit operations, transfer phenomena, reactors,* etc.) constitutes basic training for all the specialties of Process Engineering.

At the end of this multidisciplinary training, graduates will have acquired basic knowledge, not only in basic sciences *(Maths, Physics, Chemistry),* but also in technology and industrial processes *(Reactors, Process, Transfer Phenomena, Instrumentation, Industrial installations, etc.)* which are necessary for the understanding of process engineering and its various applications.

This training allows the graduate not only to pursue studies and prepare for various specialized masters, but also to integrate quickly into the socio-economic sector.

C – Profiles and skills targeted:

The general character of the license constitutes a basic training of the sector allowing access to masters in the different options (Chemical engineering, *Environmental engineering, Pharmaceutical engineering, Water treatment, Electrochemical engineering, Polymer engineering, Cryogenics* etc.), these aim to consolidate the basic notions of process engineering.

At the end of the 3rd year (L3), the graduate has acquired sufficient theoretical and practical knowledge *(Knowledge and Know-how)* which enables him to assimilate any process for the transformation of matter. He is thus capable of establishing processing balance sheets, sizing and controlling equipment and taking measurements in a production and processing chain.

The skills acquired make it possible to integrate different industrial sectors *(chemical, pharmaceutical, electrochemical, food industries, materials, cosmetics, water treatment, environmental protection,* etc.), and to meet the country's need for executives techniques.

D – Regional and national employability potential:

Process Engineering deals with the industrialization of chemistry and processes for transforming and purifying matter. The fields of application follow one another throughout the development of the manufacturing process: development in the laboratory, pilot scale, sizing of the equipment, construction of the unit then its operation.

This course in process engineering aims to train versatile executives with knowledge and

know-how that allows them to be involved at all levels of the process. They are intended to occupy positions of Study Manager, Project Manager, Process Technician, etc.

This course targets large companies operating in the fields of processes, chemistry, energy and the environment on a national scale, such as Sonatrach, Sonelgaz, ADE, cement factories, Saidal, etc. At the regional level, there is also a strong potential for outlets at the level of the SME-SMI fabric having activities of design offices, consulting firms, material transformation and treatment.

With the course offered as part of this license, graduates are able to integrate different *socio-economic sectors :*

Technical education in secondary; Research laboratories; Public bodies;
Design offices; The industrial sector.

For this last sector, these graduates constitute the backbone of the management in the production units *(Chemical Industries, Petrochemicals, Refining, Cement, Water Treatment, Drug Manufacturing Technology, Agrifood, etc.)*

E – Gateways to other specialties:

Common semesters 1 and 2	
Sector	Specialties
Aeronautics	Aeronautics
civil engineering	civil engineering
HVAC engineering	HVAC engineering
Maritime genius	Naval propulsion and hydrodynamics
	Naval construction and architecture
Mechanical Engineering	Energetics
	Mechanical construction
	Materials Engineering
Hydraulic	Hydraulic
transport engineering	transport engineering
Metallurgy	Metallurgy
Precision optics and mechanics	Optics and photonics
	Precision engineering
Public works	Public works
Automatique	Automatique
Electromechanical	Electromechanical
	Industrial maintenance
Electronic	Electronic
Electrical engineering	Electrical engineering
Biomedical genius	Biomedical genius
Industrial Engineering	Industrial Engineering
Telecommunication	Telecommunication
Process Engineering	Process Engineering
mining engineering	Mining
	Development of mineral resources
Hydrocarbons	Hydrocarbons
Industrial hygiene and safety	Industrial hygiene and safety
Petrochemical industries	Refining and petrochemicals

Table of courses and specialties in the field of Science and Technology

Die group A	Semester 3 common
Sector	**Specialties**
Automatique	Automatique
Electromechanical	Electromechanical Industrial maintenance
Electronic	Electronic
Electrical engineering	Electrical engineering
Biomedical genius	Biomedical genius
Industrial Engineering	Industrial Engineering
Telecommunication	Telecommunication

Die group B	Semester 3 common
Sector	**Specialties**
Aeronautics	Aeronautics
civil engineering	civil engineering
HVAC engineering	HVAC engineering
Maritime genius	Naval propulsion and hydrodynamics Naval construction and architecture
Mechanical Engineering	Energetics Mechanical construction Materials Engineering
Hydraulic	Hydraulic
transport engineering	transport engineering
Metallurgy	Metallurgy
Precision optics and mechanics	Optics and photonics Precision engineering
Public works	Public works

Die group C	Semester 3 common
Sector	**Specialties**
Process Engineering	Process Engineering
mining engineering	Mining Development of mineral resources
Hydrocarbons	Hydrocarbons
Industrial hygiene and safety	Industrial hygiene and safety
Petrochemical industries	Refining and petrochemicals

The sectors which present common basic lessons between them (semester 3) have been grouped into 3 groups: A, B and C. These groups correspond schematically to the families of Electrical Engineering (Group A), Mechanical Engineering and Civil Engineering (Group B) and finally Process Engineering and Mining Engineering (Group C).

This license offers multidisciplinary and transversal teaching programs:

Multidisciplinary, in the sense that the lessons in this specialty are 100% identical for semesters 1 and 2 with all the specialties of the Science and Technology field. On the other hand, the lessons of semester 3 for all the specialties of the same group of courses are also 100% identical.

Semester	Die group	Common lessons
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

In a transversal way, this License offers the choice to the student to join, if he expresses the desire and according to the teaching places available:

- All other specialties in the ST field at the end of semester 2.

- All specialties of the same group of courses at the end of semester 3.

- All the specialties of another group of courses at the end of semester 3 (Subject to conditions of equivalence and the opinion of the training team).

- All specialties of the same group of courses at the end of semester 4 (Subject to equivalence and advice from the training team).

F – Expected training performance indicators:

All training must meet the quality requirements of today and tomorrow. As such, to better appreciate the performance expected from the proposed training on the one hand and by exploiting the flexibility and adaptability of the LMD system on the other hand, it is proposed, for information purposes, for this license a certain number of mechanisms to evaluate and monitor the progress of teaching, training programs, student/teacher and student/administration relations, the future of graduates of this license as well as the assessments of the university's partners as to the quality of the graduates recruited and /or lessons taught. It is up to the training team to enrich this list with other criteria according to its means and its own objectives.

The methods of evaluation can be concretized by surveys, field monitoring of students in training and surveys of recruited graduates as well as with their employers. For this, a report must be drawn up, archived and widely distributed.

1. Evaluation of the course of the training:

In addition to the regular meetings of the teaching committee, a meeting at the end of each semester is organised. It brings together teachers and students from the promotion to discuss any problems encountered, possible improvements to be made to teaching methods in particular and to the quality of training in general.

To this end, a more or less exhaustive list is proposed below of the indicators and methods envisaged for the evaluation and monitoring of this training project by the educational committee:

Prior to training:

Evolution of the rate of students who have chosen this License (Ratio supply / demand).
Rate and quality of students who choose this license.

During the training:

Regularity of educational committee meetings.
Conformity of the themes of the End of Cycle Projects with the nature of the training.
Quality of the relationship between students and administration.
Support provided to struggling students.

Rate of student satisfaction with teaching and teaching methods.

After training:

Success rate of students per semester in this License.
Dropout rate (failures and dropouts) of students.
Identification of the causes of student failure.

Reorientation alternatives are offered to students in a situation of failure.

Rate of students graduating on time.

Rate of students who continue their studies after the bachelor's degree.

2. Evaluation of the teaching process:

The lessons in this course are subject to regular evaluation (once a year) by the training team which will, on request, be made available to the various institutions: National Pedagogical Committee for the Field of Science and Technology , Regional Conferences, Vice-rectorate in charge of pedagogy, Faculty, etc.

As a result, a system for evaluating programs and teaching methods can be put in place based on the following indicators:

Equipment of classrooms and educational laboratories with materials and supports necessary for educational improvement (projection systems (data shows), wifi connection, etc.).

Existence of a communication and teaching platform in which courses, TD and TP are accessible to students and their questions answered.
Equipment of educational laboratories with materials and equipment in line with the content of the lessons.

Number of effective teaching weeks provided during a semester and what about student absenteeism?

Rate of achievement of teaching programs.

Digitization and preservation of End of Studies and/or End of Cycles dissertations.

Number of practicals carried out as well as the multiplication of the type of practicals per subject (diversity of practicals).

Quality of the establishment's documentary fund in relation to the specialty and its accessibility.

Support from the socio-economic sector for training (company visit, internship, course-seminar provided by professionals, etc.).

3. Integration of graduates:

A coordination committee is created, made up of training managers and members of the administration, which is mainly responsible for monitoring the integration of graduates from the sector into professional life, compiling a file for monitoring graduates of the sector, to identify and/ or update the existing economic and industrial potential at regional and national level, to anticipate and encourage new professions in relation to the sector in association with the chamber of commerce, the various support agencies employment, public and private operators, etc., to participate in any action concerning the professional integration of graduates (organization of events with socio-economic operators).

To carry out these missions, this committee has all the latitude to carry out or order any study or survey on the employment and post-employment of graduates. Below is a list of indicators and methods that could be considered to assess and monitor this operation:

Recruitment rate of graduates in the socio-economic sector in a position directly related to training.

Nature of jobs held by graduates.

Diversity of outlets.

Installation of an association of former graduates of the sector.

Creation of small businesses by graduates of the specialty.

Degree of satisfaction of employers.

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4 - Available human resources:

A: Supervision capacity (expressed in number of students that can be supported):

Number of students:

B: Internal pedagogical team mobilized for the specialty: (To be informed and approved by the faculty or institute)

Full name	graduation diploma	Specialty diploma (Master, PhD)	Grade	Subjects to teach	sign-in

Visa of the department

Faculty or institute visa

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C: External pedagogical team mobilized for the specialty: (To be informed and approved by the faculty or institute)

Full name	Establishment of attachment	graduation diploma	Specialty diploma (Master, PhD)	Grade	Subjects to teach	sign-in

Visa of the department

Faculty or institute visa

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D: Overall summary of human resources mobilized for the specialty (L3):

Grade	Internal workforce	External Workforce	Total
Teachers			
Lecturers (A)			
Lecturers (B)			
Assistant Professor (A)			
Assistant Professor (B)			
Other (*)			
Total			

(*) Technical and support staff

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5 - Material resources specific to the specialty

A- Pedagogical Laboratories and Equipment : Sheet of existing pedagogical equipment for the practical work of the planned training (1 sheet per laboratory)

Title of the laboratory:

Capacity in students :

No.	Equipment designation	Number	Comments

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B- Internship sites and in-company training: (see agreements/agreements section)

Training place	Number of students	Training period

C- Documentation available at the level of the institution specific to the proposed training (Mandatory field):

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D- Spaces for personal work and ICT available at department and faculty level:

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II – Half-yearly organization sheets for the teaching of the specialty

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Semester 1

Teaching unit	Materials	Credits	Coefficient	Weekly hourly volume			Hourly volume Semester (15 weeks)	Work Additional in Consultation (15 weeks)	Assessment method	
	Entitled			course	TD	TP			Control Continued	Revi
Fundamental EU Code: UEF 1.1 Credits: 18 Coefficients: 9	Mathematics 1	6	3	3h00	1h30		67:30	82:30	40%	60%
	Physics 1	6	3	3h00	1h30		67:30	82:30	40%	60%
	Structure of matter	6	3	3h00	1h30		67:30	82:30	40%	60%
Methodological Unit Code: UEM 1.1 Credits: 9 Coefficients: 5	Physics 1	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	Lab Chemistry 1	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	IT 1	4	2	1h30		1h30	45:00	55:00	40%	60%
	Writing methodology	1	1	1:00			3:00 p.m.	10:00 a.m.		100
Discovery Unit Code: UED 1.1 Credits: 1 Coefficients: 1	Professions in science and technology 1	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 1.1 Credits: 2 Coefficients: 2	Foreign language 1 (French and/or English)	2	2	3:00			45:00	05:00		100%
1Total semester 1		30	17	4:00 p.m.	4:30 a.m.	4:30 a.m.	375h00	375h00		

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Semester 2

Teaching unit	Materials	Credits		Weekly hourly volume			Hourly volume Semester (15 weeks)	Work Additoinal in Consultation (15 weeks)	Assessment method	
	Entitled			TD TP course					Control Continued	Review
Fundamental UE Code: UEF 1.2 Credits: 18 Coefficients: 9	Mathematics 2	6	3	3h00 1h30			67:30	82:30	40%	60%
	Physics 2	6	3	3h00 1h30			67:30	82:30	40%	60%
	Thermodynamics	6	3	3h00 1h30			67:30	82:30	40%	60%
Methodological Unit Code: UEM 1.2 Credits: 9 Coefficients: 5	Physics Lab 2	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	Lab Chemistry 2	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	IT 2	4	2	1h30		1h30	45:00	55:00	40%	60%
	Presentation methodology	1	1	1h00			3:00 p.m.	10:00 a.m.		100%
Discovery Unit Code: UED 1.2 Credits: 1 Coefficients: 1	Professions in science and technology 2	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 1.2 Credits: 2 Coefficients: 2	Foreign language 2 (French and/or English)	2	2	3:00			45:00	05:00		100%
Total semester 2		30	17	4:00 p.m.	4:30 a.m.	4:30 a.m.	375h00	375h00		

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Semester 3

Unit teaching	Entitled	Credits		Hourly volume weekly			Volume Hourly Semester (15 weeks)	Work Complementary in Consultation (15 weeks)	Assessment method	
				TD TP course					Control Continued	Review
Fundamental EU Code: UEF 2.1.1 Credits: 10 Coefficients: 5	Mathematics 3	6	3	3h00 1h30			67:30	82:30	40%	60%
	Waves and vibrations	4	2	1h30 1h30			45:00	55:00	40%	60%
Fundamental EU Code: UEF 2.1.2 Credits: 8 Coefficients: 4	Fluid mechanics	4	2	1h30 1h30			45:00	55:00	40%	60%
	Mineral chemistry	4	2	1h30 1h30			45:00	55:00	40%	60%
Methodological Unit Code: UEM 2.1 Credits: 9 Coefficients: 5	Probabilities and statistics	4	2	1h30 1h30			45:00	55:00	40%	60%
	IT 3	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	Technical drawing	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	Practical work Waves and vibrations	1	1			1h00	3:00 p.m.	10:00 a.m.	100%	
Discovery Teaching Unit Code: UED 2.1 Credits: 2 Coefficients: 2	HSE Facilities industrial	1	1	1h30			10:30 p.m.	02:30		100%
	Regulations and standards	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 2.1 Credits: 1 Coefficients: 1	Technical English	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 3		30	17	1:30 p.m.	7:30 a.m.	4:00 a.m.	375h00	375h00		

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Semester 4

Unit teaching	Materials Entitled	Credits		Hourly volume weekly TD TP course			Hourly volume Semester (15 weeks)	Work Complementary in Consultation (15 weeks)	Assessment method Control Continued	Review
Fundamental UE Code: UEF 2.2.1 Credits: 8 Coefficients: 5	Chemistry of solutions	4	2	1h30	1h30		45:00	55:00	40%	60%
	Organic chemistry	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental EU Code: UEF 2.2.2 Credits: 8 Coefficients: 4	Chemical thermodynamics	4	2	1h30	1h30		45:00	55:00	40%	60%
	Numerical methods	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental UE Code: UEF 2.2.3 Credits: 2 Coefficients: 1	Chemical kinetics	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
Methodological Unit Code: UEM 2.2 Credits: 9 Coefficients: 5	Practical work Chemistry of solutions	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	organic chemistry	1	1			1h00	3:00 p.m.	10:00 a.m.	100%	
	Practical work Fluid mechanics	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	Practical work Numerical methods	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	Practical work Chemical kinetics	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
Discovery Teaching Unit Code: UED 2.2 Credits: 2 Coefficients: 2	Introduction to refining and petrochemicals	1	1	1h30			10:30 p.m.	02:30		100%
	Notions of transfer phenomena	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 2.2 Credits: 1 Coefficients: 1	Techniques of expression and communication	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 4		30	17	12:00 p.m.	6:00 a.m.	7:00 a.m.	375h00	375h00		

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Semester 5

Teaching unit	Materials Entitled	Credits	Coefficient	Weekly hourly volume TD TP course			Volume Hourly Semester (15 weeks)	Work Complementary in Consultation (15 weeks)	Assessment method Control Continued	Review
Fundamental EU Code: UEF 3.1.1 Credits: 10 Coefficients: 5	Heat transfer	4	2	1h30 1h30			45:00	55:00	40%	60%
	Material Transfer	4	2	1h30 1h30			45:00	55:00	40%	60%
	Transfer of Quantity of Movement	2	1	1h30			10:30 p.m.	11:30 p.m.	40%	60%
Fundamental UE Code: UEF 3.1.2 Credits: 8 Coefficients: 4	Electrochemistry	4	2	1h30 1h30			45:00	55:00	40%	60%
	Instrumentation - sensors	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
	Kinetics and homogeneous	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
analysis UE Methodology	catalysis Techniques of	4	2	1h30		1h30	45:00	55:00	40%	60%
Code: UEM 3.1 TP	Physical Chemistry 1 and Credits: 9	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
Chemical Engineering 1 Coefficients: 5 Macroscopic balances		3	2	1h30 1h00			37:30	37:30	40%	60%
Discovery Unit Code: UED 3.1 Credits: 2 Coefficients: 2	pharmaceutical processes	1	1	1h30			10:30 p.m.	02:30		100%
	Agro-food processes	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 3.1 Credits: 1 Coefficients: 1	Pollution: Air, water, soil	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 5		30	5:30 p.m. 5:30 a.m. 3:00 a.m.				375h00	375h00		

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Semester 6

Teaching unit	Materials	Credits		Weekly hourly volume			Volume Hourly Semester (15 weeks)	Work Complementary in Consultation (15 weeks)	Assessment method	
	Entitled			TD TP course					Control Continued	Review
Fundamental UE Code: UEF 3.2.1 Credits: 10 Coefficients: 5	Unit operations	6	3	3h00 1h30			67:30	82:30	40%	60%
	Thermodynamics of equilibriums	4	2	1h30 1h30			45:00	55:00	40%	60%
Fundamental EU Code: UEF 3.2.2 Credits: 8 Coefficients: 4	Homogeneous reactors	4	2	1h30 1h30			45:00	55:00	40%	60%
	Surface phenomena and heterogeneous catalysis	4	2	1h30 1h30			45:00	55:00	40%	60%
Methodological Unit Code: UEM 3.2 Credits: 9 Coefficients: 5	End of cycle project	4	2			3:00	45:00	55:00	100%	
	Process simulators	3	2	1h30 1h00			37:30	37:30	40%	60%
	Physical chemistry 2 and chemical engineering 2	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
Discovery Unit Code: UED 3.2 Credits: 2 Coefficients: 2	Cryogenic processes	1	1	1h30			10:30 p.m.	02:30		100%
	Corrosion	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 3.2 Credits: 1 Coefficients: 1	Professional project and business management	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 6		30	17	1:30 p.m.	7:00 a.m.	4:30 a.m.	375h00	375h00		

The assessment methods presented in these tables are only indicative, the establishment's training team may suggest other weightings.

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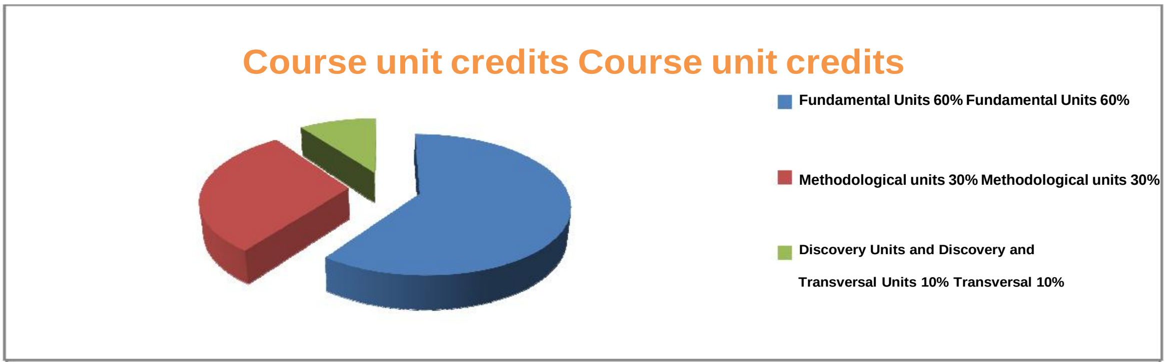
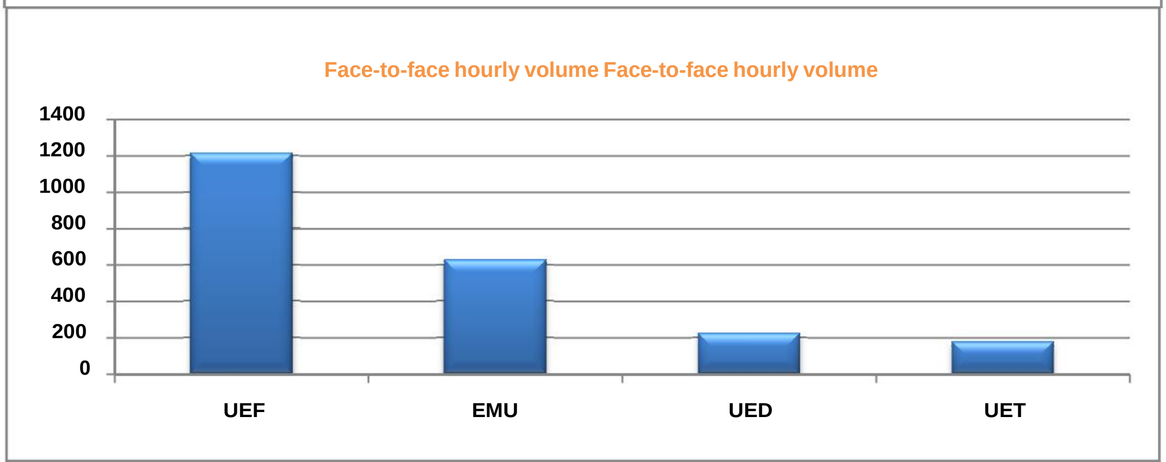
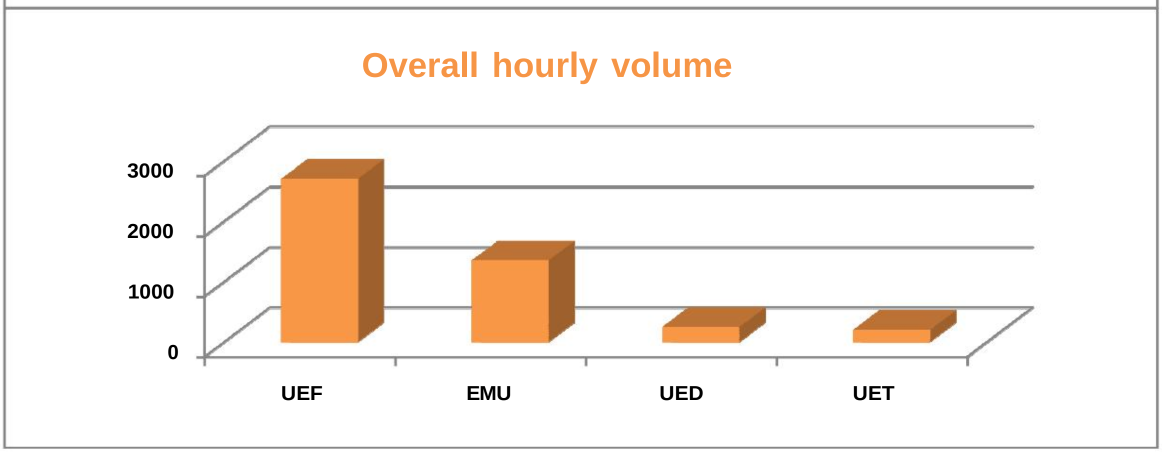
Overall training summary: Overall training summary:

EU / VH	UEF	EMU	UED	UET	Total
Course	742h30	4:00 p.m.	10:00 p.m.	6:00 p.m.	1:30 p.m.
TD	472h30	45:00	---	---	517:30
TP	---	420h00	---	---	420h00
Personal work	2:00 p.m.	720h00	25:00	8:00 p.m.	2250h00
other (explain, list,)	---	---	---	---	---
Total	2700h00	1350h00	250h00	200h00	4500h00
Credits	108	54	10	8	180
% in credits for each teaching unit	60%	30 %	10%		100%







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III - Detailed program by subject

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Semester: 1

Teaching unit: UEF 1.1 Subject 1:
Mathematics1 VHS: 67h30
(Course: 3h00, TD: 1h30)
Credits: 6
Coefficient: 3

Material content:

Chapter 1. Methods of mathematical reasoning 1-1 (1 week)
Direct reasoning 1-2
Reasoning by contraposition 1-3
Reasoning by contradiction
1-4 Reasoning by counterexample
1-5 Reasoning by induction
Chapter 2. Sets, relations and applications 2.1 Set theory (2 weeks)
2-2 Order relation,
Equivalence relations 2-3 Injective,
surjective, bijective application: definition of an application, direct image, reciprocal image, characteristic of an application.
Chapter 3 Real functions with one real variable 3-1 (3 weeks)
Limit, continuity of a function 3-2
Derivative and differentiability of a
function Chapter 4 Application to elementary (3 weeks)
functions 4-1 Power
function 4-2 Logarithmic
function 4-3 Exponential
function 4-4 Hyperbolic
function 4-5 Trigonometric
function 4-6 Inverse
function Chapter 5. Limit expansion (2 weeks)
5-1 Taylor's formula
5-2 Limit expansion 5-3
Applications
Chapter 6. Linear algebra (4 weeks)
6-1 Laws and internal
composition 6-2 Vector space, basis, dimension (definitions and elementary properties)
6-3 Linear mapping, kernel, image, rank.

Evaluation mode:
Continuous control: 40%; Review: 60%.

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Semester: 1

Teaching unit: UEF 1.1 Subject

2: Physics1 VHS:

67h30 (Course: 3h00, TD: 1h30)

Credits: 6

Coefficient: 3

Material content:

Mathematical reminders (2 weeks)

1- Dimensional equations 2-
Vector calculation

Chapter 1. Kinematics (5 Weeks)

1- Position vector in coordinate systems (Cartesian, cylindrical, spherical, curvilinear)- law of motion - Trajectory 2- Velocity and acceleration in coordinate systems.

3- Applications: Motion of the material point in the different coordinate systems.

4- Relative movement.

Chapter 2. Dynamics: 1- (4 weeks)

General: Mass - Force - Moment of force – Absolute and Gallilian reference frame 2-

Newton's laws 3- Principle of conservation of momentum 4- Differential equation of motion 5- Kinetic moment 6- Applications of the fundamental law for forces (constant, time dependent, velocity dependent, central force, etc).

Chapter 3 Work and energy (4 weeks)

1- Work of a force

2- Kinetic energy

3- Potential energy – Examples of potential energy (gravity, gravitational, elastic)

4- Conservative and non-conservative forces - Total energy theorem

Assessment mode:

Continuous control: 40%; Review: 60%.

Semester: 1

Course unit: UEF 1.1 Subject 3:
VHS material structure: 67h30

(Course: 3h00, TD: 1h30)
Credits: 6

Coefficient: 3

Material content:

Chapter 1. FUNDAMENTALS (2 Weeks)
States and macroscopic characteristics of the states of matter, changes in the states of matter, notions of atom, molecule, mole and Avogadro's number, atomic mass unit, atomic and molecular molar mass, molar volume, Weight law: Conservation mass (Lavoisier), chemical reaction, Qualitative aspect of matter, Quantitative aspect of matter:

Chapter 2. MAIN CONSTITUENTS OF MATTER (3 Weeks)
Introduction: Faraday's experiment: relationship between matter and electricity, Highlighting the constituents of matter and therefore of the atom, and some physical properties (mass and charge), Rutherford's planetary model, Presentation and characteristics of the atom (Symbol, atomic number Z, mass number A, number of protons, neutrons and electrons), Isotopy and relative abundance of the various isotopes, Separation of isotopes and determination of the atomic mass and the average mass of an atom: Mass spectrometry: Bainbridge spectrograph, Binding and cohesion energy of nuclei, Stability of nuclei:

Chapter 3 RADIOACTIVITY – NUCLEAR REACTIONS (1 Week)
Natural radioactivity (ÿ, ÿ and ÿ radiation), Artificial radioactivity and nuclear reactions, Kinetics of radioactive decay, Applications of radioactivity

Chapter 4 ELECTRONIC STRUCTURE OF THE ATOM (4 weeks)
Wave-particle duality, Interaction between light and matter, Bohr's atomic model: hydrogen atom, The hydrogen atom in wave mechanics, Polyelectronic atoms in wave mechanics

Chapter 5. THE PERIODIC CLASSIFICATION OF THE ELEMENTS (2 Weeks)
Periodic table of D. Mendeleiev,Modern periodic table, Evolution and periodicity of the physico-chemical properties of the elements, Calculation of the radii (atomic and ionic), successive ionization energies, electron affinity and electronegativity (Mulliken scale) by Slater's Rules

Chapter 6. CHEMICAL BONDINGS (3 Weeks)
The covalent bond in Lewis theory, The polarized covalent bond, dipole moment and partial ionic character of the bond, Geometry of molecules: Gillespie theory or VSEPR, Chemical bond in the quantum model

Assessment method:

Continuous control: 40%; Review: 60%.

Semester: 1

Teaching unit: UEM1.1 Subject
1: Physics1 VHS: 22h30
(TP: 1h30)
Credits: 2
Coefficient: 1

Material content:

5 manipulations at least (3H00 / 15 days): - (15 Week)
Methodology of presentation of report of TP and calculation of errors.

- Verification of Newton's 2nd law

- Free fall

- Simple pendulum

- Elastic collisions

- Inelastic collisions

- Moment of inertia

- Centrifugal force

Assessment method:

Continuous control: 100%

Semester: 1

Teaching unit: UEM1.1 Subject
2: Lab Chemistry 1 VHS:

22h30 (TP: 1h30)
Credits: 2

Coefficient: 1

Material content:

1. Safety in the laboratory - **(15 weeks)**

Concepts of danger and risk - General rules of safety, - Safety in the chemistry laboratory, - Pictograms, storage of chemical products, - Disposal of waste

- FIRST AID.

2. Preparation of solutions 3. Acid-base titration: - Strong acid, strong base.
- Weak acid strong base.
4. Iodometry: -

Theoretical elements on oxidation-reduction: -
Titration of an aqueous solution of iodine by an aqueous solution of sodium thiosulphate.
5. Manganimetry: -
Dosage of the permanganate ion in an acid medium using a solution of oxalic acid.
- Dosage in return of a solution of potassium dichromate using an aqueous solution of ferrous salt of known titer.

6. Construction of molecular buildings

Assessment method:

Continuous control: 100%

Semester: 1

Teaching unit: UEM1.1 Subject 3:

Computer science1 VHS:

45h00 (Course: 1h30, Lab: 1h30)
Credits: 4

Coefficient: 2

Objective and recommendations:
The objective of the subject is to allow students to learn to program with an evolving language (Fortran, Pascal or C). The choice of language is left to the discretion of each institution. The notion of algorithm must be supported implicitly during language learning.

The practicals aim to illustrate the notions taught during the course. The latter must begin with the courses according to the following schedule: • Initiatory practical sessions for familiarization with the computer machine from a hardware and operating systems point of view (exploration of the different functionalities of the OS) • Initiation practical sessions for the use of a programming environment (Editing, assembling, compiling, etc.) • Application practical work on the programming techniques seen in cl

Material content:

Chapter 1. Introduction to computing 1- (5 weeks)
Definition of computing 2-
Evolution of computing and computers 3-
Information coding systems 4- Operating principle of a computer 5- Hardware part of a computer
6- System part
The basic systems (operating systems (Windows, Linux, Mac OS, etc.)
Programming languages, application software Chapter
2. Notions of algorithm and program 1- Concept of an (7 Weeks)
algorithm 2- Representation in flowchart 3- Structure of a program 4- Approach and analysis of a problem 5 - Data structure

Constants and Variables, Data Types
6- Operators
The assignment operator, Arithmetic operations, Relational operators, Logical operators, Priorities in operations
7- Entry/exit operations
8- Control structures
Conditional control structures, Repeating control structures
Chapter 3 Indexed variables (3 weeks)
1- One-dimensional tables
Representation in memory, Operations on arrays
2- Two-dimensional arrays
In-memory representation, Operations on two-dimensional arrays

Evaluation mode:

Continuous control: 40%; Review: 60%.

Semester: 1

Teaching Unit: UEM1.1 Subject
4: VHS Writing Methodology: 15h00
(Course: 1h00)
Credits: 1
Coefficient: 1

Material content:

Chapter 1. Concepts and general information on writing techniques - Definitions, **(2 weeks)**
standards Applications: writing a summary, a letter, a request

Chapter 2. Searching for information, synthesis and exploitation **(3 weeks)**
- Searching for information in the library (paper format: books, reviews)
-Search for information on the Internet (digital: databases, search engines, etc.).

- Apps

Chapter 3 Writing Technique and Procedures **(3 weeks)**
- Basic principle of writing - punctuation, syntax, sentences
- sentence length
- Division into paragraphs
- The use of a neutral style and writing in the third person
- Readability
- Objectivity
- Intellectual rigor and plagiarism

Chapter 4 Writing a Report **(4 weeks)**
Cover pages, Summary, Introduction, Method, Results, Discussion, Conclusion,
Bibliography, Appendices, Summary and Key Words

Chapter 5. Applications **(3 weeks)**
Report of practical work

Assessment method:
Control Review: 100%.

Semester: 1

Teaching unit: UED1.1 Subject
1: Science and technology professions1 VHS: 22h30
(Course: 1h30)
Credits: 1
Coefficient: 1

Material content:

Chapter 1.
1.1. Professions in electronics, electrical engineering, communication systems and new sensor technologies (3 weeks)
- Electronics industry, electrical engineering
- Instrumentation and microsystems - Technological advances in Electronics, Telecommunications and Sensor Technology (Home automation, Mobile telephony, Non-destructive testing, Ultrasonic imaging, Aeronautics, Road and rail transport, Video surveillance, Security of goods and people, transport safety)

I.2. Automation and industrial computing professions - History (2 weeks) of automation and industrial computing - Applications of computing - programmable logic controllers - Fields of application (electricity production plants, continuous industrial systems, robots industrial and autonomous applications, on-board automotive applications)

Chapter 2. II.1 Introduction to process engineering (2 weeks)
- History of process engineering
- Industrial process, chemical engineering and major fields of industrial chemistry - Role of the process specialist

II.2. Introduction to Mining (2 weeks)
Engineering - Mining Industry and Mining Sectors; - Role of the mining specialist

II.3. Hydrocarbons and petrochemical industry - (2 weeks)
The different Hydrocarbons: from production to marketing - Definition of petrochemicals; Different axes of petrochemicals and petrochemical products - Role of the specialist in the oil and gas industry

II.4 Health and safety (2 weeks)
- Definition and different axes of the HSE sector - Sectors of activity - Role of the specialist and training of the specialist in HSE

Assessment method:
Control Review: 100%.

Semester: 1

Teaching unit: UET1.1 Subject

1: French language1 VHS:

22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Material content:

Chapter 1: The Library and the Books (1 week)

- Books – Searching for information
- Verbal communication
- Write, communicate with words

Chapter 2: Grammar and Style (3 weeks)

- Times and fashions
- Coordination and subordination
- Direct, indirect and free indirect speech
- The punctuation
- The enunciation

Chapter 3: Definition and basis of the typology (2 weeks)

- Text Definitions
- Definition of the typology
- Base of the typology

Chapter 4: Textual typologies (3 weeks)

- Textual or homogeneous typology
- Intermediate typology
- Functional typologies (general diagram of communication)
- Enunciative typologies
- Situational typologies
- Heterogeneous typology

Chapter 5: The Storytelling (3 weeks)

- Narrative modes
- Narrative voices
- Narrative Perspectives
- Narrative instance
- Time and space

Chapter 6: The argumentative text – structure (3 weeks)

- Modes of argument
- The ideas of the argument
- Objectivity and subjectivity
- The summary and the formulation
- Methodical reading

Assessment mode:

Review: 100%.

Semester: 1

Course unit: UET1.1 Subject 1:

English language1 VHS: 22h30

(Course: 1h30)

Credit: 1

Coefficient: 1

Objective:

The English syllabus consists of the following major parts. Sample texts are used to let students acquainted with both Scientific and Technical English as well as for both scientific and technical vocabulary and grammar acquisition.

The texts are selected according to the vocabulary built up, familiarization with both scientific and technical matters in English and further comprehension. Each text is therefore followed by a set of vocabulary concepts, a set of special phrases (idioms) and comprehension questions. There is also a terminology which means the translation of some words from English to French one. Besides, the texts are followed at the end by a translation of long statements which are selected from the texts.

Program Content:

A. Phonetics: **(3 weeks)**

-Consonant sounds: ***eg :*** **/ k/; /m/; /b/;/j/**

- Vowels sounds: eg: /e/; /i/; /u:/

- Diphthongs: eg: /aI/; /eI/

- Triphthongs: eg: /eIa/; /aIa/

B. General Grammar: **(6 weeks)**

1- Parts of speech - Verb: definition, transitive, negative form, interrogative form, regular, irregular …

- Noun: definition, kind, singular, plural, compound nouns …

- Adverbs: definition

- Adjectives: definition

2- Types of sentences

- Simple sentences

- Compound sentences (using connectors eg.: but, …)

- Complex sentences (using relative pronouns eg. who, where, …)

C. Texts (6 Weeks)

Each semester may include scientific or technical texts in which we focus on the application of the previous lessons.

Assessment method:

Review: 100%.

Semester: 2

Teaching unit: UEF 1.2 Subject

1: Mathematics2 VHS: 67h30

(Course: 3h00, TD: 1h30)

Credits: 6

Coefficient: 3

Material content:

Chapter 1: Matrices and determinants (3 weeks)

1-1 Matrices (Definition, operation)

1-2 Matrix associated with a linear map

1-3 Linear application associated with a matrix

1-4 Base change, transition matrix

Chapter 2: Systems of Linear Equations (2 weeks)

2-1 General

2-2 Study of all the solutions

2-3 Methods of resolutions of a linear system

-Resolution by Cramer's method

-Resolution by the inverse matrix method

-Resolution by the method of Gauss

Chapter 3: Integrals (4 weeks)

3-1 Indefinite integral, property

3-2 Integration of rational functions

3-3 Integration of exponential and trigonometric functions

3-4 The integral of polynomials

3-5 Defined integration

Chapter 4: Differential equations 4-1 (4 weeks)
ordinary differential equations 4-2 first
order differential equations 4-3 second
order differential equations 4-4 second
order ordinary differential equations with constant coefficient

Chapter 5: Multivariate Functions (2 Weeks)

5-1 Limit, continuity and partial derivatives of a function

5-2 Differentiability

5-3 Double, triple integrals

Assessment method:

Continuous control: 40%; Review: 60%.

Semester: 2

Teaching unit: UEF 1.2 Subject

2: Physics2 VHS:

67h30 (Course: 3h00, TD: 1h30)

Credits: 6

Coefficient: 3

Material content:

Math reminders: (1 week)

1- Elements of length, surface, volume in Cartesian, cylindrical, spherical coordinate systems.

2- Multiple derivatives and integrals.

Chapter I. Electrostatics: (6 Weeks)

1- Electrostatic charges and fields.

2-Electrostatic potential.

3- Electric dipole.

4- Flow of the electric field.

5- Gauss's theorem.

6- Conductors in balance.

7- Electrostatic pressure.

8- Capacitance of a conductor and a capacitor.

Chapter II. Electrokinetics: (4 Weeks)

1- Electrical conductor.

2- Ohm's law.

3- Joule's law.

4- Electric Circuits.

5- Application of Ohm's Law to networks.

6- Kirchhoff's laws.

Chapter III. Electromagnetism: (4 Weeks)

1- Definition of a magnetic field.

2- Lorentz force.

3- Laplace's law.

4- Faraday's law.

5- Law of Biot and Savart.

6- Magnetic dipole.

Assessment method:

Continuous control: 40%; Review: 60%.

Semester: 2

Teaching unit: UEF 1.2 Subject

3: Thermodynamics VHS: 67h30

(Course: 3h00, TD: 1h30)

Credits: 6

Coefficient: 3

Material content:

CHAPTER I: General information on thermodynamics (2 weeks)

1-Fundamental properties of state functions

2- Definitions of thermodynamic systems and the external environment

3- Description of a thermodynamic system

4- Evolution and states of thermodynamic equilibrium of a system

5- Possible transfers between the system and the external environment

6-Transformations of the state of a system (operation, evolution)

7-Reminder of the ideal gas laws

CHAPTER II (2.5 weeks)

1- Concept of temperature

2- Notion of heat or quantity of heat Q

3- Calorimetry

4- Work

CHAPTER III: The First Law of Thermodynamics (2.5 weeks)

1) Equivalence between heat and work

2) Statement of the first principle

3) General expression of the first principle

4) Definition of internal energy U

5) Differential expression of internal energy

6) Differential expression of the first principle

7) Calculation of the variation of the internal energy ÿU

8) Concept of enthalpy H

CHAPTER IV: Applications of the first principle of thermodynamics to *thermochemistry*

Heats of reaction, standard state, standard enthalpy of formation, enthalpy of dissociation, enthalpy of change of physical state, enthalpy of a chemical reaction (1.5 weeks)

CHAPTER V: 2nd principle of thermodynamics (03 weeks)

1- Introduction

2- *Notion of entropy*

***3-* Thermal machines**

CHAPTER VI: 3rd Principle and absolute entropy **(01 week)**

1) Statement of the 3rd Principle, absolute entropy at zero Kelvin (°K)

2) The standard molar absolute entropy of a pure body

3) Standard molar absolute entropy at T Kelvin (TK)

4) ST standard molar absolute entropy of a pure (solid, liquid, gas)

5) The entropy variation of a chemical reaction ÿSR

6) The entropy variation of a chemical reaction has a temperature T; ÿSR (T)

CHAPTER VII: Free energy and enthalpy – Criteria for the evolution of a system (02.5 weeks)

1- Introduction,

2- Free energy and enthalpy

3- Chemical balances

Assessment method:

Continuous control: 40%; Review: 60%.

Semester: 2

Teaching unit: UEM1.2 Subject
1: Physics2 VHS: 22h30
(TP: 1h30)
Credits: 2
Coefficient: 1

Material content:

5 manipulations at least (3H00 / 15 days): (15 weeks)

- Presentation of measuring instruments (voltmeter, ammeter, rheostat, oscilloscopes, generator, etc.

- Equipotential surfaces in electrostatics.

- Association and Measurement of resistances

- Association and Measurement of capacities

- Voltage and current dividers

- Charging and discharging a capacitor

- Oscilloscope

- Practical work on magnetism

Assessment method:
Continuous control: 100%

Semester: 2

Course unit: UEM1.2 Subject 2:
Chemistry2 VHS: 22h30

(TP: 1h30)
Credits: 2

Coefficient: 1

Material content:

Chapter 1.

1. Ideal gas equation : **(15 weeks)**

- The gas system,

- Verification of the three empirical laws (Laws of Boyle-Mariotte, Gay Lussac, Charles-Amontons).

2. Determination of the mass capacity of solids

3. Determination of the mechanical equivalent of heat (J)

4. Application of the first principle of thermodynamics :

- Determination of the energy released by a chemical reaction (HCl / NaOH)

5. The heat pump (inverse Carnot cycle)

Assessment method:
Continuous control: 100%

Semester: 2

Teaching unit: UEM1.2 Subject

3: Computer science 2 VHS:

45h00 (Course: 1h30, Lab: 1h30)
Credits: 4

Coefficient: 2

Material content:

Chapter 1: Functions and Procedures (6 Weeks)
1- Functions

Types of functions, declaration of functions, calling of functions
2- Procedures
Notions of global variables and local variables, simple procedure, procedure with arguments

Chapter 2: Records and Files (4 weeks)
1- Structure of heterogeneous data
2- Structure of a record (concept of fields)
3- Manipulation of record structures
4- Notion of file
5- File access modes
6- Reading and writing to a file

Chapter 3: Advanced concepts (5 weeks)
1- Recursion
2- Modular programming
3- The graphics
4- Pointers

Assessment method:
Continuous control: 40%; Review: 60%.

Bibliographic references:

1- Algorithms for Dummies large format Book by John Paul Mueller (Informatiker, USA) and Luca Massaron

2017 2- Algorithmics: course with 957 exercises and 158 problems Book by Charles E. Leiserson, Clifford Stein and Thomas H. Cormen 2017

3- Algorithms: Basics Book by Thomas H. Cormen 2013

Semester: 2

Teaching Unit: UEM1.2 Subject
4: VHS Presentation Methodology: 15h00
(Course: 1h00)
Credits: 1
Coefficient: 1

Material content:

Chapter 1: The Oral Presentation (3 Weeks)
Communication

Preparation of an oral presentation
Different types of plans

Chapter 2: presentation of an oral presentation (3 Weeks)
Structure of an oral presentation
Presentation of an oral presentation

Chapter 3: Plagiarism and Intellectual Property (3 Weeks)
1- Plagiarism
Definitions of plagiarism, sanction of plagiarism, how to borrow the work of other authors, quotations, illustrations, how to be sure to avoid plagiarism?
2- Writing a bibliography Definition,
objectives, how to present a bibliography, writing the bibliography

Chapter 08: Presenting Written Work (6 Weeks)
- Present a written work

- Applications: presentation of an oral presentation

Assessment method:
Review: 100%.

Semester: 2

Teaching unit: UED1.2 Subject

1: Science and technology professions2 VHS: 22h30

(Course: 1h30)

Credits: 1

Coefficient: 1

Material content:

Chapter I. Mechanical Engineering and Metallurgy (6 Weeks)
- Origins (textiles, first mechanized industry, steam engine, etc.)
- Technical progress and its
adaptation - Fields of mechanics (transformation of metals, production and maintenance of industrial equipment, aeronautics, energy transformations, etc.)
- Trades in the mechanical industry (engineer in mechanical construction and mechanical manufacturing, thermal engineer, etc.)
- Trades in metallurgy and plastics Chapter II.
Maritime engineering sector - (2 weeks)
Naval and navigation architect
- Naval equipment engineer

Chapter III. Civil and Hydraulic Engineering (4 weeks)
sector - History of the construction and use of concrete - Building
materials - Public Works and
Development - Road and rail infrastructure, bridges, retaining structures, dams,
- The various trades in civil engineering and
BTP - Introduction and history of
hydraulics - Fields of study of hydraulics (Drinking water supply
AEP and Sanitation, hydraulic flows)
- Jobs in hydraulics

Chapter 4: Renewable Energy Sector & Environmental Science Engineering Sector (2 weeks)

Assessment method:
Review: 100%.

Semester: 2

Teaching unit: UET1.2 Subject

1: French language2 VHS:

22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Material content:

Chapter 1: The Explanatory (5 weeks)
Text - Definitions *(1 Lesson)*
- Presentation of an explanatory
text - Structure of an explanatory
text 1.1 Functions of the explanatory text *(1Course)*
- The informative function

- The didactic function
1.2 Characteristics of the explanatory text *(3 Courses)*
- Difference with a descriptive text
- Organizational characteristics
- Lexical and grammatical characteristics (personal pronoun, verbal form, logical connectors)
- Coherence and cohesion

- The operations required for the production of an explanation - The situation of enunciation of a text
Chapter 2: Reading Tools (5 weeks)
- Write a reading sheet
- To take notes

- Build a paragraph
Chapter 3: The Essay (3 weeks)
- Analyze a subject
- Identify a problem
- Build a plan
- Write an introduction
- Write a conclusion
- Do a resume
Chapter 4: Preparing for an oral (1 week)
Chapter 5: Analyzing a work, text, image and form (2 Weeks)
- Semiotics and semiology
- Rhetoric and stylistics
Chapter 6: Document Synthesis – Lectures (2 Weeks)

Assessment method:
Review: 100%.

Semester: 2

Teaching unit: UET1.2 Subject

1: English language2 VHS:

22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Objective:

The English syllabus consists of the following major parts. Sample texts are used to let students acquainted with both Scientific and Technical English as well as for both scientific and technical vocabulary and grammar acquisition.

The texts are selected according to the vocabulary built up, familiarization with both scientific and technical matters in English and further comprehension. Each text is therefore followed by a set of vocabulary concepts, a set of special phrases (idioms) and comprehension questions.

There is also a terminology which means the translation of some words from English to French one. Besides, the texts are followed at the end by a translation of long statements which are selected from the texts.

Program Content

A. Phonetics: (3 weeks)

- Pronunciation of the final (ed)

- Silent letters: definition, spelling + pronunciation of each letter B. General Grammar: (6 weeks)

1- Tenses

Simple present, simple past, simple future, present continuous, present perfect, past perfect

2- Modals

- eg: can, may, should, must …

3- Ask questions using "wh questions": (means all questions wich start with wh questions) - eg.: who, where, when, how …

C. Texts: (6 weeks)

Each semester may include scientific or technical texts in which we focus on the application of the previous lessons.

Assessment method:

Review: 100%.

Semester: 3

Teaching unit: UEF 2.1.1 Subject 1:

Mathematics 3 VHS: 67h30

(Course: 3h00, TD: 1h30)

Credits: 6

Coefficient: 3

Teaching objectives:

At the end of this course, the student should be able to know the different types of series and their convergence conditions as well as the different types of convergence.

Prior knowledge recommended

Mathematics 1 and Mathematics 2

Material content :

Chapter 1: Simple and multiple integrals 1.1 — **3 weeks**
Reminders on the Riemann integral and on the calculation of primitives.
1.2 Double and triple integrals.
1.3 Application to the calculation of areas, volumes…

Chapter 2: Improper integrals 2.1 — **2 weeks**
Integrals of functions defined on an unbounded interval.
2.2 Integrals of functions defined on a bounded interval, infinite at one end.

Chapter 3: Differential equations 3.1 — **3 weeks**
Review of ordinary differential equations.
3.2 Partial differential equations.
3.3 Special Features.

Chapter 4: Series — **2 weeks**
4.1 Numerical series.
4.2 Sequences and series of functions.
4.3 Integer series, Fourrier series.

Chapter 5: Fourier transformation 5.1 — **3 weeks**
Definition and properties.
5.2 Application to solving differential equations.

Chapter 6: Laplace transformation 6.1 — **2 weeks**
Definition and properties.
6.2 Application to solving differential equations.

Assessment mode :

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

Bibliographic references:

(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

Semester: 3

Teaching unit: UEF 2.1.1 Subject
2: Waves and Vibrations VHS:

45h00 (Course: 1h30, TD: 1h30)
Credits: 4

Coefficient: 2

Teaching objectives

Introduce the student to the phenomena of mechanical vibrations restricted to low amplitude oscillations for 1 or 2 degrees of freedom as well as the study of the propagation of mechanical waves

Prior knowledge recommended

Mathematics 2, Physics 1 and Physics 2

Material content :

Chapter 1: Introduction to Lagrange's equations 1.1 — 2 weeks
Lagrange's equations for a particle 1.1.1
Lagrange's equations 1.1.2
Case of conservative systems
1.1.3 Case of friction forces depending on velocity
1.1.4 Case of an external force depending du
temps 1.2 System with several degrees of freedom.

Chapter 2: Free oscillations of systems with one degree of freedom — 2 weeks
2.1 Undamped oscillations

2.2 Free oscillations of damped systems

Chapter 3: Forced oscillations of systems with one degree of freedom 1 week 3.1
Differential equation 3.2
Mass-spring-damper system 3.3
Solution of the differential equation
3.3.1 Harmonic excitation
3.3.2 Periodic excitation
3.4 Mechanical impedance

Chapter 4: Free oscillations of systems with two degrees of freedom 1 week 4.1
Introduction

4.2 Systems with two degrees of freedom

Chapter 5: Forced oscillations of systems with two degrees of freedom 2 weeks 5.1
Lagrange equations 5.2
System masses-springs-dampers 5.3
Impedance
5.4 Applications
5.5 Generalization to systems with n degrees of freedom

Chapter 6: One-dimensional propagation phenomena 6.1 — 2 weeks
Generalities and basic definitions

6.2 Propagation equation
6.3 Solution of the propagation equation
6.4 Sinusoidal traveling wave
6.5 Superposition of two sinusoidal traveling waves

Chapter 7: Vibrating Strings — 2 weeks

7.1 Wave equation 7.2
Harmonic traveling waves 7.3 Free oscillations of a string of finite length 7.4 Reflection and transmission

Chapter 8: Acoustic waves in fluids 8.1 Wave equation 8.2 Speed of sound 8.3
Traveling sinusoidal wave 8.4 Reflection-Transmission

1 week

Chapter 9: Electromagnetic waves 9.1 Wave equation 9.2 Reflection-Transmission
9.3 Different types of electromagnetic waves

2 weeks

Assessment mode :

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

Bibliographic references:

(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

1. T. Becherrawy; Vibrations, waves and optics; Hermes science Lavoisier, 2007
2. T. Becherrawy; Vibrations, waves and optics; Hermes science Lavoisier, 2010
3. J. Brac; Propagation of acoustic and elastic waves; Hermes science publ. Lavoisier, 2003.
4. J. Bruneaux; Vibrations, waves; Ellipses, 2008.

Semester: 3

Teaching unit: UEF 2.1.2 Subject 1:

Fluid mechanics VHS: 45h00

(Course: 1h30, Tutorial: 1h30)

Credits: 4

Coefficient: 2

Teaching objective:

Introducing the student to the field of fluid mechanics, the statics of fluids will be detailed in the first part. Then in the second part the study of the movement of inviscid fluids will be considered Prior knowledge recommended: mathematics, integral calculus,

Chapter 1: General information on fluid mechanics. (02 weeks)

I.1 What is Fluid Mechanics ?; I.2 Description of the movement.; I.3 Streamlines and trajectories.; I.4 Flow patterns: velocity profiles; I.5 Reminders of vector analysis and elements of index calculation.

Chapter 2: .Physical properties of fluids. (02 weeks)

II.1 Density; II.2 Isothermal compressibility; II.3 Surface tension; II.4 Viscosity; II.5 Mathematical problem of fluid mechanics; II.6 Particle derivative; II.7 Boundary conditions; II.8 Dimensions, dimensional equations and units.

Chapter 3: Hydrostatics. (03 weeks)

III.1 Fundamental law of hydrostatics; III.2 Hydrostatic pressure in an incompressible fluid.
III.3Compressible fluid: perfect gas, III.4 Resultant of hydrostatic pressure forces.; III.5 Force exerted on a wall by a fluid; III.6 Archimedes thrust.

Chapter 4: Conservation of mass. (02 weeks)

IV.1 Leibniz's theorem; IV.2 Continuity Equation; IV.3 Flow conservation.

Chapter 5: Perfect fluid. (05 weeks)

V.1 Reminders of Mechanics ; V.2 Momentum theorem. V.3 Euler's equations; V.4 Bernoulli's theorem., V.5. Examples of application of Bernoulli's theorem: Pitot probe; Venturi nozzle; Unsteady emptying of a tank; V.6 Air escape from a pressure vessel: limit of compressibility.

Assessment mode: Continuous assessment: 40%; Final exam: 60%

Bibliographic references:

R. Comolet, 'Experimental fluid mechanics', Volume 1, 2 and 3, Ed. Masson et Cie.

R. Ouziaux, 'Applied fluid mechanics', Ed. Dunod, 1978 BR

Munson, DF Young, TH Okiishi, 'Fundamentals of fluid mechanics', Wiley & sons.

RV Gilles, 'Fluid Mechanics and Hydraulics: Courses and Problems', Schaum Series, Mc Graw Hill, 1975.

CT Crow, DF Elger, JA Roberson, ' Engineering fluid mechanics', Wiley & sons

RW Fox, AT Mc Donald, 'Introduction to fluid mechanics', fluid

mechanics' VL Streeter, BE Wylie, 'Fluid mechanics',

Mc Graw Hill FM White, ''Fluid mechanics',

Mc Graw Hill S. Amiroudine, JL Battaglia, 'Fluid mechanics Course and corrected exercises', Ed. Dunod

-NOT. Midoux, Mechanics and rheology of fluids in chemical engineering, *Ed. Lavoisier, 1993.*

- M. Fourar, General equations, elastic solids, fluids, turbomachines, similarity, *Ed. Ellipses, 2nd Edition 2015.*

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Semester: 3

Course unit: UEF 2.1.2 Subject 1:
Inorganic Chemistry

VHS: 45h00 (Class: 1h30, TD: 1h30)

Credits: 4

Coefficient: 2

Teaching objectives :

To give the basic notions of mineral chemistry

Learning of some methods such as crystallochemistry and synthesis.

Prior knowledge recommended

Basic notions of general chemistry

Content of the subject

Chapter 1: Reminders of some important definitions: 1 week

Mole, Molar Mass, Molar Volume, Molar Fraction, Mass Fraction, Volume Fraction; Density, density; Relationship between mass fraction and mole fraction; Mass balance: Concept of reagent and reagent in excess,

Concept of excess percentage, Concept of conversion percentage

Chapter 2: Crystal chemistry 3 weeks

Polyhedral description of structures, connectivity.

Chapter 3: Periodicity and in-depth study of the properties of the elements: 3 weeks

Halogens, chalcogens, nitrogen and phosphorus, boron.

Chapter 4: The major metallurgies 4 weeks

(Fe, Ti, Cu, Mg)

Chapter 5: Major mineral syntheses 4 weeks

(H_2SO_4, H_3PO_4, NH_3, HNO_3)

Assessment mode: Continuous assessment: 40%; Final exam: 60 %

Bibliographic references :

Ouahès, R, Devallez, B. General Chemistry. higher Exercises and Teaching Problems 1st cycle. Publishing Publisud.

Winnacker Karl 1903. Mineral Technology. Edition Eyrolles 1962, cop 1958. Treatise on applied chemistry: Inorganic chemistry, industrial chemistry, chemical industries, chemical engineering.

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Semester: 3

Teaching unit: UEM2.1 Subject

1: Probabilities & Statistics VHS: 45h00

(Course: 1h30, TD: 1h30)

Credits: 4

Coefficient: 2

Objectives of the subject

This module allows students to see the essential notions of probability and statistics, namely: statistical series with one and two variables, probability over a finite universe and random variables.

Prior knowledge recommended

The basics of programming acquired in Math 1 and Math 2

Material content:

Part A: Statistics

Chapter 1: Basic definitions **1 week**

A.1.1 Notions of population, sample, variables, modalities

A.1.2 Different types of statistical variables: qualitative, quantitative, discrete, continuous.

Chapter 2: One-variable statistical series A.2.1 **3 weeks**

Number, Frequency, Percentage.

A.2.2 Cumulative number, Cumulative frequency.

A.2.3 Graphical representations: bar chart, pie chart, bar chart.

Polygon of frequencies (and frequencies). Histogram.
Cumulative curves.

A.2.4 Position characteristics

A.2.5 Dispersion characteristics: range, variance and standard deviation, coefficient of variation.

A.2.6 Shape characteristics.

Chapter 3: Statistical series with two variables **3 weeks**

A.3.1 Data tables (contingency table). A cloud of dots.

A.3.2 Marginal and conditional distributions. Covariance.

A.3.3 Linear correlation coefficient. Regression line and Mayer line.

A.3.4 Regression curves, regression corridor and correlation ratio.

A.3.5 Functional adjustment.

Part B: Probabilities

Chapter 1: Combinatorial analysis **1 week**

B.1.1 Arrangements
B.1.2 Combinations

B.1.3 Permutations.

Chapter 2: Introduction to probability B.2.1 **2 weeks**

Algebra of events B.2.2
Definitions

B.2.3 Probability spaces

B.2.4 General probability theorems

Chapter 3: Conditioning and independence **1 week**

B.3.1 Conditioning,

B.3.2 Independence,

B.3.3 Bayes formula.

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Chapter 4: Random variables — 1 week

B.4.1 Definitions and properties, B.4.2 Distribution function, B.4.3 Mathematical expectation, B.4.4 Covariance and moments.

Chapter 5: Usual discrete probability distributions — 1 week

Bernoulli, binomial, Poisson, ...

Chapter 6: Usual continuous probability laws — 2 weeks

Uniform, normal, exponential,...

Assessment mode :

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

Bibliographic references:

(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

[1] D. Dacunha-Castelle and M. Duflo. Probability and Statistics: Fixed Time Problems. Mason, 1982.

[2] J.-F. Delmas. Introduction to the calculus of probabilities and to statistics. ENSTA handout, 2008.

[3] W. Feller. An introduction to probability theory and its applications, volume 1. Wiley and Sons, Inc., 3rd edition, 1968.

[4] G. Grimmett and D. Stirzaker. Probability and random processes. Oxford University Press, 2nd edition, 1992.

[5] J. Jacod and P. Protter. Probability essentials. Springer, 2000.

[6] A. Montfort. Course in mathematical statistics. Economica, 1988.

[7] A. Montfort. Introduction to statistics. Polytechnic School, 1991

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Semester: 3

Teaching unit: UEM2.1 Subject

2: Computer Science 3 VHS:

22h30 (TP: 1h30)

Credits: 2

Coefficient: 1

Objectives of the subject

Teach the student programming using easily accessible software (mainly: Matlab, Scilab, Mapple, etc.). This subject will be a tool for the realization of practical work in numerical methods in S4.

Prior knowledge recommended

The basics of programming acquired in computer science 1 and 2

Material content :

TP 1: Presentation of a scientific programming environment (Matlab, Scilab, etc.) 1 week

Lab 2: Script Files and Types of Data and Variables 2 weeks

Exercise 3: Reading, displaying and saving data 2 weeks

Exercise 4: Vectors and matrices 2 weeks

TP 5: Control instructions (for and while loops, if and switch instructions) 2 weeks

Exercise 6: Function files 2 weeks

TP 7: Graphics (Management of graphic windows, plot 2 weeks

Exercise 8: Using toolboxes 2 weeks

Evaluation mode :

Continuous control: 100%.

Bibliographic references:

(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

1. Getting started in algorithms with MATLAB and SCILAB / Jean-Pierre Grenier, - . Paris: Ellipses, 2007 .- 160 p.

2. Scilab from theory to practice / Laurent Berger, . - Paris: D. Booker, 2014.

3. Programming and simulation in Scilab / Bégyn Arnaud, Gras Hervé, Grenier Jean-Pierre, - Paris: Ellipses, 2014. - 160 p.

4. Computer science: programming and scientific computing in Python and Scilab scientific preparatory classes 1st and 2nd years / Thierry Audibert,; Amar Oussalah; Maurice Nivat, . - Paris: Ellipses, 2010 . - 520p

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Semester: 3

Teaching unit: UEM2.1 Subject 3:

Technical drawing VHS: 22h30 (TP:

1h30)

Credits: 2

Coefficient: 1

Course objectives This course will

allow students to acquire the principles of representation of parts in industrial design. Even more, this material will allow the student to represent and read the plans.

Recommended prior knowledge (brief description of the knowledge required to be able to follow this course – Maximum 2 lines).

In order to be able to follow this course, basic knowledge of the general principles of drawing is required.

Content of the subject

Chapter 1: General. 2 weeks

1.1 Usefulness of technical drawings and different types of drawings.

1.2 Drawing materials.

1.3 Normalization (Types of lines, Writing, Scale, Drawing format and folding, Title block, etc.).

Chapter 2: Elements of descriptive geometry 2.1 6 weeks

Notions of descriptive geometry.

2.2 Orthogonal projections of a point - Sketch of a point - Orthogonal projections of a straight line (any and particular) - Sketch of a straight line - Traces of a straight line - Projections of a plane (Unspecified and particular positions) - Traces of a plan.

2.3 Views: Choice and arrangement of views - Dimensioning - Slope and conicity - Determination of the 3rd view from two given views.

2.4 Method of execution of a drawing (layout, straight 45°, etc.)

Application exercises and evaluation (TP)

Chapter 3: Perspectives 2 weeks

Different types of perspectives (definition and purpose).

Application exercises and evaluation (TP).

Chapter 4: Sections and sections 2 weeks

4.1 Sections, standard representation rules (hatching).

4.2 Projections and section of simple solids (Projections and sections of a cylinder, a prism, a pyramid, a cone, a sphere, etc...).

4.3 Half Cuts, Partial Cuts, Broken Cuts, Sections, etc.

4.4 Technical vocabulary (terminology of machined shapes, profiles, piping, etc.

Application exercises and evaluation (TP).

Chapter 5: Rating 5.1 2 weeks

General principles.

5.2 Rating, Tolerance and Fit.

Application exercises and evaluation (TP).

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Chapter 6: Notions on definition and assembly drawings and bills of materials.
1 week

Application exercises and evaluation (TP).

Evaluation mode :
Continuous control: 100%.

Bibliographic references:
(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

1. Chevalier A industrial designer's guide. Hachette Technique Edition; 2. The technical drawing 1st part descriptive geometry Felliachi d. and Bensaada s. Edition OPU Algiers; 3. The technical drawing 2nd part the industrial drawing Felliachi d. and bensaada s. Edition OPU Algiers; 4. First notions of technical drawing Andre Ricordeau Edition Andre Casteilla;
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Recommendation: A large part of the TP should be in the form of personal work at home.

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Semester: 3

Teaching unit: UEM2.1 Subject 4:
Practical work Waves and Vibrations

VHS: 15h00 (practical work: 1h00)
Credits: 1

Coefficient: 1

Teaching objectives The

objectives assigned by this program relate to the initiation of the students to put into practice the knowledge received on the phenomena of mechanical vibrations restricted to the oscillations of low amplitude for one or two dof; as well as the propagation of mechanical waves.

Recommended prior knowledge Vibrations and
waves, Mathematics 2, Physics 1, Physics 2.

Material content:

TP.1 Mass – spring

TP.2 Simple pendulum

TP.3 Torsion pendulum

TP.4 Study of electrical oscillations

TP.5 Oscillating electric circuit in free and forced mode

TP.6 Coupled pendulums

TP.7 Vibrating rope

TP.8 Grooved pulley according to Hoffmann

TP.9 The loudspeaker

TP.10 Pohl's pendulum

Note: It is recommended to choose at least 5 TP among the 10 offered.

Evaluation mode: Continuous control: 100%.

Bibliographic references:
(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

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Semester: 3

Teaching unit: UED2.1 Subject 1: HSE Industrial installations VHS: 22h30

(course: 1h30)
Credits: 1

Coefficient: 1

Teaching objectives

- **Identify and assess the risk ;**
- **Implement appropriate prevention methods ;**
- **Check the reality and effectiveness of the systems put in place.**

Prior knowledge recommended

Content of the subject

Chapter 1: Introduction to Risk Assessment and Control, Accident Analysis 7 weeks

1.1 Understand the basic notions (hazard, risk) and identify the prevention actors; 1.2 Control the indicators relating to accidents at work (frequency rate, severity rate, etc.) and occupational diseases; 1.3 Observe and analyze the risks associated with a work situation; 1.4 Develop a tree of causes ;

Chapter 2: Introduction to Occupational Health and Environmental Protection 8 weeks

2.1 Identify the main hygiene and public health aspects; 2.2 Know the notions of home hygiene; 2.3 Know the main areas of environmental protection; 2.4 Understand the issue of sustainable development; 2.5 identify the role and mission of the various organizations in occupational health and safety and public health.

Assessment method: Final exam: 100%.

Bibliographic references:
(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

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Semester: 3

Teaching unit: UED2.1 Subject 2: VHS regulations and standards: 22h30 (course: 1h30)

Credits: 1

Coefficient: 1

Teaching Objectives The purpose of this course is to introduce students to regulations and standardization and to instil in them the importance of both in the industrial field. Students will thus be prepared to respect the regulations and to use the standards.

Prior knowledge recommended

Content of the subject

Chapter 1: Introduction 1.1 Regulations and regulatory texts. — 3 weeks

1.2 Economic development and standardization.

Chapter 2: Standardization 2.1 Purpose and development. Association and standardization bodies. — 4 weeks

2.2 International Standardization. Standardization in Algeria: INAPI.

Chapter 3: Standardization of production 3.1 Normative parameters. Interchangeability of products. Tolerances and adjustments. — 4 weeks

3.2 Compliance control methods, certification.

Chapter 4: Classification — 4 weeks

Classification of products. Classification of standards and their codification.

Assessment method: Final exam: 100%.

Bibliographic references: (Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

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Semester: 3

Teaching unit: UET2.1 Subject 1:

Technical English VHS: 22h30

(Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives

This course must allow the student to have a language level where he can use a scientific document and talk about his specialty and sector in English at least with ease and clarity.

Prior knowledge recommended

English 1 and English 2

Content of the subject

- Oral comprehension and expression, acquisition of vocabulary, grammar...etc. -
nouns and adjectives, comparatives, following and giving instructions, identifying things.
- Use of numbers, symbols, equations.
- Measurements: Length, surface, volume, power ...etc.
- Describe scientific experiments.
- Characteristics of scientific texts.

Assessment method :

Final exam: 100%.

Bibliographic references: (Depending
on the availability of documentation at the level of the establishment, Internet sites...etc.)

Semester: 4

Course unit: UEF 2.2.1 Subject 1:
Chemistry of solutions

VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4

Coefficient: 2

Teaching objective: This is
to give the student the basic notions relating to the chemistry of solutions.
It is a teaching which essentially aims to familiarize the student with the reasoning of chemistry in solution in order to be able to subsequently predict chemical reactions for analytical purposes. It is mainly about: -
Understanding the concept of electrolyte and conductivity of a solution, - Knowing how to calculate the pH of an aqueous solution, - Understanding the concept of oxidant and reducer and predicting oxidation-reduction reactions .

Recommended prior knowledge: Basic notions of general chemistry.

Content of the subject :

Chapter 1: Solutions 3 weeks

Definitions: Concentrations: molarity, normality, molality, title, molar and mass fraction, activity etc…
. Conductimetry: mobility of ions, electrolytes (strong, weak), conductivity (specific and molar), conductimetric cell, Kohlrausch's law, conductimetric assay

Chapter 2: Acids-Bases - 3 weeks

Acid-base balances in aqueous solution: acidity scale, acidity constant (Ka, pKa), dilution law (Oswald), pH calculation (simple solutions, mixtures, salines, buffer solutions , ampholyte solutions), reaction predictions, acid-base assays (polyacids and polybases).
- Colored indicators

Chapter 3: Redox 3 weeks

Definition, Oxidant, reducer, Redox reactions, Oxidation state and number, Balancing of redox reactions, Electrochemical cells, Thermodynamic aspect, Electrodes

Chapter 4: Solubility 3 weeks

Definition, Graphic representation, Effect of common ions, Influence of pH on solubility (case of hydroxides), Influence of potential on solubility, Influence of complexation on solubility

Chapter 5: Complexes 3 weeks

Definition, Nomenclature of complexes, Formation of complexes, Stability of complexes, Effect of pH on complexes, Effect of potential on complexes, Some fields of application of complexes

Assessment method :

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

References:

1- John Hill , Ralph Petrucci, Terry McCreary Scott Perry, Chemistry of Solutions, 2nd Ed, , Edition ERPI; 2014.

2- John C. Kotz, Chemistry of Solutions, Edition de Boeck 2006.

Semester: 4

Teaching unit: UEF 2.2.1 Subject 1:

Organic Chemistry VHS:

45h00 (Course: 1h30, TD: 1h30)

Credits: 4

Coefficient: 2

Teaching objectives: -

Introduce the basic notions of organic chemistry and present the main functional derivatives in order to understand the processes of industrial chemistry.

- Description of the mechanisms for obtaining different functions and the main reactions encountered in organic chemistry.

Recommended prior knowledge: Basic knowledge of carbon, notions of chemical bonding.

Material content:

Chapter 1: General **3 weeks**

Study of the carbon atom and its bonds

Functions and Nomenclature of Organic Compounds: IUPAC Ordinary, Trivial, Usual and Systematic Nomenclature

Chapter 2: Classification of organic functions **2 weeks**

Saturated aliphatic hydrocarbons (linear, branched), Alkenes (preparation, reactivity), Aromatic compounds (preparation, reactivity), Alcohols, thiols, aldehydes (preparation, reactivity), Ketones, carboxylic acids (preparation, reactivity) .

Chapter 3: Notions of stereo-isomerism **4 weeks**

Definition, plane isomerism (definition), function isomerism, position isomerism, tautomerism, geometric isomerism, stereochemistry: definition, representation of molecules in space, configuration isomerism.

Chapter 4: Electronic effects - **3 weeks**

Definition, Chemical bond: pure covalent, polarized covalent and ionic. Inductive effect: definition, Classification of inductive effects, Influence of the inductive effect on the acidity of a chemical compound, Influence of the inductive effect on the basicity of a chemical compound. Mesomeric effect: definition, conjugated systems and delocalization of electrons. Classification of mesomeric effects, Influence of the mesomeric effect on the acidity of a chemical compound, Influence of the mesomeric effect on the basicity of an organic com

Chapter 5: Major reactions in organic chemistry 3 weeks

Reagents and reaction intermediates; Classification of reactions: Addition; Substitution ;

Elimination; Rearrangement; Elementary rules: Markovnikov, Zeitsev ;

Assessment method:

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

Reference:

1- Paul Arnaud, Organic Chemistry,DUNOD; 2004.

2- Jean pierre Mercier, Pierre Gaudard Organic chemistry: an initiation; Presses polytechniques Romandes 2001.

3- Melania Kiel Organic Chemistry course and corrected exercises;; estem; 2004.

4- Jonathan Clayden, Nick , Stuart Warren , André Pousse, Organic Chemistry; Greeves deBoeck 2nd edition; 2013.

5-John McMurry, Eric Simanek, Organic chemistry the main principles; DUNOD 2nd edition; 2007.

Semester:4

Teaching unit: UEF 2.2.2 Subject
1: Chemical thermodynamics VHS: 45h00
(Course: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives : -
mastery of the 1st and 2nd and 3rd principles of thermodynamics.
- The application of thermodynamic principles
- The study of chemical equilibria, chemical potential, as well as real gases.

Recommended prior knowledge: Differential equations, Basic chemical thermodynamics (S2 of the ST common base).

Material content:

Chapter I: Reminders in thermodynamics I.1 **(2 weeks)**
Mathematical reminder on partial derivatives I.2
State variables and functions
I.3 Quantities and thermodynamic systems
I.4 The different principles of thermodynamics
I.5 Criterion for the evolution of a chemical system and potential

Chapter II: Thermodynamic properties of pure substances II.1 The ideal gas II.2 **(4 weeks)**
Intermolecular forces and real behavior of gases II.3
Equations of state of real gases
II.4 Corresponding states, residual deviations and
fugacity II.5 Thermodynamic properties of condensed states

Chapter III: Phase equilibria of a pure substance II.1 **(4 weeks)**
General equilibrium relations (Clapeyron and Clapeyron-Clausius)
II.2 Liquid-vapor, liquid-solid and solid-vapor equilibria II.3
Stable and unstable equilibria and phase transition II.4
Generalized diagrams

Chapter IV: Chemical Equilibria IV.1 **(5 weeks)**
The affinity of a chemical reaction
IV.2 Monotherm-monobaric and monochoric
systems IV.3 Heat of a chemical reaction and the laws of Hess
and Kirchoff IV.4 Law of mass action and shift in chemical equilibrium

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

References

Smith, EB, Basic Chemical Thermodynamics, second ed., Clarendon Press, Oxford, 1977.
Rossini, FD, Chemical Thermodynamics, Wiley, New York, 1950.
Florence, Stanley I. Sandler, Chemical and Engineering Thermodynamics, Wiley, New York, 1977.
Elliot, J, Lira CT, Introductory chemical engineering ThermodynamicPsr,entice-Hall (1999)
Lewis GN, Randal M., Thermodynamics, Mac Graw
Hill Hougen OA, Watson KM, Chemical process principles, Vol II: thermodynamics John Wiley and sounds

Semester:4

Course unit: UEF 2.2.2 Subject 1:
Digital methods VHS: 45h00 (Course:
1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
Familiarization with numerical methods and their applications in the field of mathematical calculations.

Recommended prior knowledge:
Mathematics 1, Mathematics 2, Computing 1 and Computing 2, fortran,

Material content:

Chapter 1: Solving nonlinear functions 3 weeks Introduction to calculation errors and approximations, Introduction to methods for solving nonlinear equations, Bisection method, Method of successive approximations (fixed point), Newton-Raphson method.

Chapter 2: Polynomial interpolation **2 weeks**
General introduction, Lagrange polynomial, Newton polynomials.

Chapter 3: Function approximation : **1 week**
Approximation methods and quadratic average, Orthogonal or pseudo-Orthogonal systems, orthogonal polynomials, by Trigonometric approximation. Fit and correlation (linear, parabolic, polynomial and arbitrary) **Approximation** of the

Chapter 4: Numerical integration **2 weeks**
General introduction, Trapezium method, Simpson's method, Quadrature formulas.

Chapter 5: Method for direct resolution of systems of linear equations 3 weeks

Introduction and definitions, Gaussian method and pivoting, LU factorization method, Choeleski MMt factorization method, Thomas algorithm (TDMA) for tri-diagonal systems.

Chapter 6: Method for iterative resolution of systems of linear equations 2 weeks
Introduction

and definitions, Jacobi method, Gauss-Seidel method, Use of relaxation.

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

Reference:

1- C. Brezinski, Introduction to the practice of numerical calculation, Dunod, Paris 1988.
2- G. Allaire and SM Kaber, Numerical Linear Algebra, Ellipses, 2002.
3- G. Allaire and SM Kaber, Introduction to Scilab. Corrected practical exercises in linear algebra, Ellipses, 2002.
4- G. Christol, A. Cot and C.-M. Marle, Differential calculus, Ellipses, 1996.
5- M. Crouzeix and A.-L. Mignot, Numerical analysis of differential equations, Masson, 1983.
6-S. Delabrière and M. Postel, Approximation methods. Differential equations. Scilab Applications, Ellipses, 2004.
7- J.-P. Demailly, Numerical analysis and differential equations. Grenoble University Press, 1996.
8- E. Hairer, SP Norsett and G. Wanner, Solving Ordinary Differential Equations, Springer, 1993.
9- PG Ciarlet, Introduction to matrix numerical analysis and optimization, Masson, Paris, 1982.
10. Boumahrat, Gourdin, H.Veysseyre, applied numerical methods

Semester:4

Teaching unit: UEF 2.2.3 Subject 1:

Chemical kinetics VHS: 22h30

(Course: 1h30)

Credits: 2

Coefficient: 1

Objectives of the subject:

To provide the student with the essential bases for any kinetic study of a chemical process and affects both the elementary notions of formal kinetics and the mathematical bases concerning the notion of the rate of a chemical reaction and its evolution over time, the parameters influencing the rate of a reaction, the determination of the order of a reaction by physico-chemical methods, the rate constant and the activation energy.

Recommended prior knowledge: Mathematics (derivative, integral), knowing how to express the concentration of a solution, mastering unit systems, knowing how to draw and use graphs.

Content of the subject:

Chapter I. Homogeneous chemical reactions (1 week)

I. Rate of reaction (Absolute rate, specific rate)

II. Experimental kinetic study of a reaction (Chemical and physical methods III. Experimental factors influencing the rate

Chapter II. Influence of concentrations and temperature on the rate I. (2 weeks) Influence of concentration (Order of a reaction, Molecularity and Stoichiometry of a reaction, VANT'HOFF rule II.

Influence of temperature

Chapter III. Formal kinetics, simple reaction (6 weeks)

I. Determination of the rate constant of a reaction of given order (Order 0,1,2,3 and n)

II. Determination of reaction orders

- Methods for determining order by Integration (variation of concentrations as a function of time, methods of partial reaction times), example of calculation - Differential method, example of calculation - Methods based on the degeneracy of order, example of calculation - Method using dimensionless parameters, example of calculation Chapter IV. (6 weeks)

Compound reactions 1. Opposite or balanced

reactions - General - Examples of opposite reactions (the two opposite reactions are of order 1, of reactions of order 2 opposed to reaction of order1, reactions of order 1 opposed to reaction of order2)

-Balance and speed of reactions

-Principle of microreversibility

2. Parallel reactions : general information, twin reactions, concurrent reactions, example, 3. Successive reactions : determination of rate constants, radioactive equilibrium, example of calculation.

Assessment method: Final exam: 100%.

References:

1- Claude Moreau, Jean-Paul Payen, Chemical kinetics, Edition Belin 1999

2-Michel Destriau, Gérard Dorthe, Roger Ben-Aïm, Kinetics and chemical dynamics Edition Technip1981.

3- P. Morlaes, Chemical kinetics: Structure of matter 1978 4- B. Frémaux, Elements of kinetics and catalysis, Tec Editor and 1998 5. M. Robson Wright, An Introduction to Chemical Kinetics, John Wiley & Sons Ltd Editions , Chichester, 2004

6. P. William Atkins, Elements of Physical Chemistry, Editions DeBoek University, Brussels, 1997

7. E. James House, Principles of Chemical Kinetics, 2nd edition, Editions Elsevier Inc., London, 2007

8. A. Azzouz, Chemical Kinetics, Editions Berti, Tipaza, 1991

9. A. Derdour, Cours de Kinétique Chimique, Editions OPU, Algiers, 1988 10. G. Scacchi, M. Bouchy, JF Foucaut and O. Zahraa, Kinetics and Catalysis, Technical Editions & Documentation, Paris, 1996 11. Chemical Thermodynamics, MA OTiuran and M. Robert., University Presses of Grenoble, 1997, 245 pages.

12. General Chemistry, R Ouahès, B Devallez, PUBLISUD 4th Ed, 1997, 504 pages.

13. General Chemistry, SS ZUMDAHL., De Boeck University 2nd Ed, 1999, 514 pages.

14. Elements of physical chemistry, PW ATKINS., De Boeck University 2nd Ed, 1996, 512 pages.

15.. General Chemistry, Elisabeth Bardez, Dunod Paris, 2009, 258 pages.

16. Les cours de Paul Arnaud, Resolute exercises in physical chemistry., Dunod Paris 3 rd Ed, 2008, 386 pages.

17. General chemistry at the PCEM, volume 1, C. Bellec, G. Lhommet., Vuibert, 1996, 307 pages.

Semester: 4

Course unit: UEM 2.2 Subject 1:
Solution chemistry lab

VHS: 10:30 p.m. (PT: 1:30 a.m.)
Credits: 2

Coefficient: 1

Teaching objectives :
Understand and properly assimilate knowledge.

Recommended prior knowledge Notions of
general chemistry and thermodynamics. The student has already been familiarized with laboratory equipment and glassware.

Material content:

TPN°1. Determination of water hardness by complexometry.
TPN°2. Experimental verification of Nernst's law.
TPN°3. Conductometric dosage of vinegar.
TPN°4. Determination, followed by pH-metry, of the alkalinity of an aqueous solution by a hydrochloric acid solution. Gran's method.
TPN°5. Dosage, followed by pH-metry and conductimetry of a sodium hydroxide solution.

TPN°6. Search for cations of the first group.
TPN°7. Determination of the solubility product of a sparingly soluble salt.
TPN°8. Measurement of the formation constant of a complex.
TPN°9. Potential-pH diagram of Iron.

Evaluation mode :
Continuous control: 100%.

Reference:

1- G. Milazo. Electrochemistry. Dunod
1969 2-Brenet. Introduction to the electrochemistry of equilibrium and non-equilibrium. Mason 1980

Semester: 4

Course unit: UEM 2.2 Subject 1:

Organic chemistry lab VHS:

15h00 (TP: 1h00)

Credits: 1

Coefficient: 1

Teaching objectives:

Preparation and analysis of organic products presenting the main functions encountered in organic chemistry (alcohols, acids, aldehydes, ketones, etc.)

Recommended prior knowledge: organic chemistry

Material content:

TPN°1. Esterification (Synthesis of aspirin).

TPN°2.Purification by recrystalisation of Benzoic acid.

TPN°3. Extraction of an organic product.

TPN°4.Determination of the composition of a mixture by refractometry.

TPN°5. Sublimation of Naphthalene.

TPN°6. Study of the properties of phenol or an organic substance.

TPN°7. Preparation of a soap.

TPN°98 transformation of an alcohol into a halogenated derivative (synthesis of 2-chloro-2-methylpropane from 2-methylpropan-2-ol).

TP n°09: Purification by distillation at atmospheric pressure and steam distillation TP n°10: Purification by fractional distillation on a column

Evaluation mode :

Continuous control: 100%.

Semester: 4

Teaching unit: UEM 2.2 Subject 1:

Practical work on fluid mechanics

VHS: 22h30 (TP: 1h30)
Credits: 2

Coefficient: 1

Teaching objectives: The
student puts into practice the knowledge of fluid mechanics taught in S3.

Recommended prior knowledge: Subjects:
fluid mechanics and physics 1.
Material content:

- Practical work N° 1.

Viscosimeter - Practical work N° 2. Determination of linear and singular
pressure drops - Practical

work N° 3. Flow rate measurement - Practical work
N° 4. Water hammer and mass oscillations -

Practical work N° 5.
Verification Bernoulli's theorem - TP N°
6.Impact of the jet - TP N° 7.Flow through an orifice - TP N°

8.Visualization of flows around an obstacle - TP N° 9.Determination of the Reynolds number: Laminar

Evaluation mode :
Continuous control: 100%.

Semester: 4

Teaching unit: UEM 2.2 Subject 1:

Practical work on digital methods VHS:

22h30 (TP: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives: Programming of the various numerical methods with a view to their applications in the field of mathematical calculations using a scientific programming language (matlab, scilab, etc.).

Recommended prior knowledge: Numerical Method, Computer Science 2 and Computer Science 3.

Material content:

Chapter 1: Solving nonlinear equations 3 weeks 1.Bisection method. 2. Fixed point method, 3. Newton-Raphson method

Chapter 2: Interpolation and approximation 1. Newton's interpolation, 2. Chebyshev's approximation — 3 weeks

Chapter 3: Numerical integrations 1. Method of Rectangle, 2. Method of Trapezes, 3. Method of Simpson — 3 weeks

Chapter 4: Differential equations 1.Euler method, 2. Runge-Kutta methods — 2 weeks

Chapter 5: Systems of linear equations 1. Gauss-Jordon method, 2. Crout decomposition and LU factorization, 3. Jacobi method, 4. Gauss-Seidel method — 4 weeks

Assessment mode: Continuous monitoring: 100% .

References:

1. Algorithms and numerical computation: resolved practical work and programming with Scilab and Python software / José Ouin, . - Paris: Ellipses, 2013 . - 189 p.

2. Mathematics with Scilab: calculation guide programming graphical representations; conforms to the new MPSI / Bouchaib Radi program; Abdelkhalak El Hami. - Paris: Ellipses, 2015 .- 180 p.

3. Applied numerical methods: for scientists and engineers / Jean-Philippe Grivet, . - Paris: EDP sciences, 2009 .- 371 p.

Semester: 4

Teaching unit: UEM 2.2 Subject 1:

VHS **chemical kinetic practical**

work : 22h30 (practical work: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives :

-Measurement of the reaction rate from the relation "Concentration = f(t)"
-Determination of the order; Evaluation of the rate constant and the activation energy.
- Use linear regression to process curves

Recommended prior knowledge:

Material content :

- **Chemical method (monitoring by volumetric method):**
  - **Saponification of an ester (ethyl ethanoate with sodium hydroxide):**
    RCOOR' + NaOH = RCOOR' + R'OH

- Physical method
  - Polarimetry: kinetics of sucrose inversion.
  - Spectrophotometry: Decomposition of a Mn3+ complex **-**
  Conductimetric method: Saponification of an ester (ethyl ethanoate by sodium hydroxide)
  - Volume measurement: Decomposition of hydrogen peroxide (hydrogen peroxide)

Evaluation mode :

Continuous control: 100%.

Semester: 4

Course unit: UED 2.2 Subject 1:

Introduction to refining and petrochemicals.

VHS: 10:30 p.m. (class: 1:30 a.m.)

Credits: 1

Coefficient: 1

Teaching objectives:

Explain the genesis of fossil fuels. Master the nomenclature and specifications of petroleum products. Know the main refining and petrochemical processes and their products.

Prior knowledge recommended

Organic chemistry

Material content:

Chapter 1: Formation and Exploitation of Oil and Natural Gas 4 weeks

Definition and origin of oil, Oil deposits and characteristics, Exploitation techniques

Chapter 2: Oil Refining Schematics 6 weeks

Nomenclature and characteristics of petroleum products, Main diagrams of manufacturing processes, Environmental constraints and evolution of refining

Chapter 3: Petrochemical Process Diagrams 5 weeks

Diversity of petrochemical industry products, Main petrochemical manufacturing routes, Examples of processes (PVC, Ammonia)

Assessment method :

Final exam: 100%.

Reference:

1- Petroleum refining in 5 volumes, Technip, 1998.
2- P. Wuithier, petroleum, refining and chemical engineering. VOLUME 1, technip, 1972.
3- A. Fahim, Taher A. Al-Sahhaf, A Elkilani, Fundamentals of Petroleum Refining, Elsevier, 2010.

Semester: 4

Teaching unit: UED 2.2 Subject 1:

Notions of **VHS transfer phenomena :** 22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Objectives of the subject:

- Demonstrate the balance equations for equilibrium and for the flow of fluids - Give the basic notions of heat transfer then introduce the students to calculations - Give the basic laws which describe the processes of material transfer.

Recommended prior knowledge:
Thermodynamics and notions of kinetics

Material content:

Chapter 1: Introduction to Transfer Modes	**3 weeks**
Chapter 2: Heat Transfer **Conduction, Convection, Radiation**	**6 weeks**
Chapter 3: Momentum Transfer **Properties of fluids, Statics of fluids, General conservation equations**	**6 weeks**

Assessment method: Final exam: 100%.

Reference :

1- Transport Phenomena; BIRD(RB). STEAWART(WE)., J. Wiley and Sons. Inc., 1960.
2- Mass Transfer Operations; TREYBAL(RE). McGraw-Hill book Cy, Inc, 1955.
3- Petroleum, Refining and Chemical Engineering; P. WUITHIER, 1965 Edition Technip. Paris.
4-Chemical Engineering; COULSON and RICHARDSON. Pergamon Press. Lim., London 1955.

Semester: 4

Teaching unit: UET 2.2 Subject

1: Techniques of Expression and Communication VHS:

22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives: This
teaching aims to develop the student's skills, on a personal or professional level, in the field of communication and expression techniques.

Recommended prior knowledge:
Languages (Arabic; French; English)

Material content:

Chapter 1: Research, analyze and organize information Identify — 3 weeks
and use places, tools and documentary resources, Understand and analyze documents, Compile and update documentation.

Chapter 2: Improving the capacity for expression — 3 weeks
Take into account the Communication situation, Produce a written message, Communicate orally, Produce a visual and audiovisual message.

Chapter 3: Improving communication skills in interactive situations — 3 weeks

Analyze the process of Interpersonal communication, Improve face-to-face communication skills, Improve group communication skills.

Chapter 4: Developing autonomy, organizational and communication skills within the framework of a project approach Being — 6 weeks
part of a project and communication approach, Anticipating action, Implementing a project: Presentation of a report of a practical work (homework).

Assessment method: Final exam: 100%.

References:

1-Jean-Denis Commeignes 12 methods of written and oral communication – 4th edition, Michelle Fayet and Dunod 2013.
2- Denis Baril; Sirey, Techniques of written and oral expression; 2008.
3-Matthieu Dubost Improve his written and oral expression all the keys; Edition Ellipses 2014.

Semester 5

Subject: UEF 3.1.1 Subject 1: Heat Transfer

VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4

Coefficient: 2

Teaching objectives: -Study

of the different modes of transfer: conduction, convection and radiation.
-Applications of the laws governing these different types of transfer.

Recommended prior knowledge:

Thermodynamics, Differential equations.

Material content:

Chapter 1 :

General introduction to the different modes of heat transfer, (1 weeks)

Chapter 2 : (6 weeks)
Heat transfer by conduction: Fourier's law Case: simple wall, composite walls, cylindrical layer, composite cylindrical layers (electrical analogy, overall resistance); Insulation of cylindrical layers (critical insulation thickness); Insulation of spherical layers. general conduction equation, fin problems,

Chapter 3 : (5 weeks)
Convection Heat Transfer: Definitions; Expression of heat flux (Newton's law); heat transfer coefficient by convection, dimensional analysis, empirical correlations (natural and forced convection), calculation of heat flux in natural convection; Calculation of heat flux in forced convection.

Chapter 4 : (3 weeks)
Heat transfer by radiation: Laws of radiation; Lambert's law; Kirchhoff's law; Black body radiation; Radiation from non-black bodies; Reciprocal radiation of several surfaces (exchange of heat by radiation between black and gray surfaces).

Assessment method:

Continuous control: 40%; Review: 60%.

Bibliographic references:

1. J. Krabol, "Heat transfer", Masson, 1990.
2. Martin Becker, "Heat transfer: a modern approach". Plenum, 1986.
3. JF Sacadura, "Initiation to thermal transfer", TEC-DOC, 1980.
4. Pierre Wuithier, "Petroleum, refining and chemical engineering".
5. Y. Jannot, thermal transfer course, 2nd edition, school of mines Nancy.
6. Incorpera, Dewwitt, Bergmann, Lavine, "Fundamentals of heat and mass transfer" , 6th edition Ed. Wiley (2010)

Semester:5

Course Unit: UEF 3.1.1 Subject 2:
Subject Transfer

VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4

Coefficient: 2

Teaching objectives:

Understand the mechanisms and the formalism allowing to describe the transfer of matter; Know how to write a material balance sheet necessary for the calculation of equipment.

Recommended prior knowledge:

Thermodynamics; chemical kinetics; Differential equations.

Material content:

Chapter 1: Mass transfer mechanism Introduction; (3 weeks)
Definition of molecular diffusion; Nomenclature: mass and molar, total and individual concentrations, diffusion and transport flux density (convection + diffusion); Definition of average mass and molar velocities; Fick's law and Stefan Maxwell's law (multicomponent gas systems); Diffusion coefficients (gaseous phase, liquid phase, order of magnitude of diffusion coefficients in different media (gas, liquids, solids); Diffusion coefficients in porous solids; Concept of effective diffusion coefficients.

-Chapter 2: Stationary and quasi-stationary one-dimensional diffusion (3 weeks)
Material balance-Continuity equation (global and partial); Reminders on the gradient and divergence operators of a vector; Balances of the total mass and for a constituent i on an element of fixed volume; Boundary conditions and initial condition; Examples of univariate diffusion problems (case of a gas through a stagnant gas film, evaporation problem, equimolar diffusion, applications for different geometries (plane, cylinder, sphere)); Diffusive transfer with homogeneous and heterogeneous chemical reaction.

Chapter 3: Transient diffusive transfer: (5 weeks)
Transient diffusive transfer: Fick's 2nd law; **Instantaneous source problems (quantity of diffusing material limited); Continuous source problems (fixed boundary condition (Learn to pose a problem with its adapted equation and its initial and boundary conditions).**

-Chapter 4: Mass transfer at an interface (between phases) (4 weeks)
Reminders of the balances between two phases; Theory of 2 films, penetration, surface renewal; Individual and global mass transfer coefficients; Concept of dimensional analysis: ÿ-Buchingham theorem; Dimensionless numbers relating to mass transfer (Sherwood, Reynolds, Schmidt); Estimates of mass transfer coefficients (dimensionless correlations)

Assessment method:

Continuous control: 40%; Review: 60%.

Bibliographic references:

1. **Bird, Stewart, Lightfoot, "Transport phenomena", Second Edition, J Wiley, 2002.**
2. **Treybal, "Mass transfer operations", McGraw-Hill.**
3. **Incorpera, Dewwitt, Bergmann, Lavine, "Fundamentals of heat and mass transfer" , 6th edition Ed. Wiley (2010)**
4. **Welty, Wicks, Wilson, Rorer, "Fundamentals of momentum, heat and mass transfer" 5th edition, Ed; Wiley (2007)**

Semester 5

Course unit: UEF 3.1.1 Subject 3:

Motion Quantity Transfer VHS: 22h30 (Course:

1h30)

Credits: 2

Coefficient: 1

Teaching objectives: Learn to

analyze the typical problems encountered in fluid mechanics (statement of the problem, formulation and analytical solution); Make momentum and mechanical energy balances for simple unidirectional systems; Obtain the velocity profile and deduce the other quantities of interest (flow rates, forces, pressure drops, etc.).

Recommended prior knowledge: Basics in

mathematics; Notions in MDF.

Material content:

Chapter 1: (02 weeks)

Reminders: A- Properties of fluids, Statics of fluids, Dynamics of perfect fluids.

Chapter 2: (03 weeks)

Mass, momentum and energy balances: 1. Mass conservation equation; 2. Conservation of momentum equation; 3. Energy conservation equation.

Chapter 3: (05 weeks)

Fluid dynamics: 1. Stresses and strains in continuous media; 2. Equation of motion of real fluids; 3. Flow regime Applications of the Navier and Stockes equations (poiseuille flow, quilt flow, free surface flow)

Chapter 4: (02 weeks)

Simple shear flow of non-Newtonian fluids, case of BINGHAM fluid, case of OSTWALD fluid

Chapter 5 : (03 weeks)

Pumps and pumping: Calculation of networks.

Assessment method :

Review: 100%.

Bibliographic references:

1. Laszlo, "The scientific bases of chemical engineering", Dunod, 1972.
2. Robert E Treybal, "Mass transfer operation". Mc Graw-Hill, 1981.
3. RB Bird, WE Stewart, and EN Lightfoot, "Transport Phenomena", Wiley 1960.
4. Midoux Noel, Mechanics of fluids in chemical engineering, Coll. Process engineering from the school of Nancy.
5. R. Comolet, Mechanics of real fluids - Volume 2, *Ed. Dunod, 2006.*
6. M. Fourar, General equations, elastic solids, fluids, turbomachines, similitude, *Ed. Ellipses, 2nd Edition 2015.*

Semester :

5 **Course unit: UEF 3.1.2 Subject 1: Electrochemistry**

VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4

Coefficient: 2

Teaching objectives: To
acquire the basic notions of electrochemistry, thermodynamics and electrochemical kinetics necessary for the understanding of electrochemical phenomena.

Recommended prior knowledge: Chemistry
of solutions. Chemical thermodynamics and notions of kinetics.

Material content:

Chapter 1 : **(1 week)**
Reminders on electrolytic solutions: Conductivity, ion mobility, Oswald's dilution law, Kohlrausch's relationship).

Chapter 2 : **(3 weeks)**
Properties and physical quantities of electrolytes: Debye-Huckel theory: applications to calculations of activity coefficients; Solvation and hydration of ions; Faraday's laws (Spreads and returns).

Chapter 3 : **(5 weeks)**
Thermodynamics of electrochemical reactions: Definition and preliminary reminders; Notions of chemical potential; Electrode voltage and equilibrium potential; Notions of electrochemical double layer and Stern model; Nernst relation and its applications; Predictions of RedOx reactions; Different types of electrodes; Electrochemical cells and notions of junction voltage (Henderson's law).

Chapter 4 : **(4 weeks)**
Kinetics of electrochemical reactions: Definitions; Speed of an electrochemical reaction; Electrochemical assemblies, Butler-Vollmer law; Approximation of Tafel.

Chapter 5 : **(2 weeks)**
Electrochemical methods and techniques: Voltammetry; Chronopotentiometry, ...

Assessment method:
Continuous control: 40%; Review: 60%.

Bibliographic references:

1. Genévrière ML Dumas, Roger Benaîm, essential in electrochemistry, Breal, 2001.
2. G. Milazo, "Electrochemistry", Dunod, 1969.
3. Brenet, "Introduction to the electrochemistry of equilibrium and non-equilibrium", Masson, 1980.
4. Allen J. Bard, "Electrochemistry: principles, methods and applications", Masson, 1983.
5. Fabien Miomandre, SaïdSadki, PierreAudebert, "Electrochemistry from concepts to applications", Dunod, 2005.
6. F.Cœuret, A. Stock, "Elements of electrochemical engineering", Lavoisier Tech. &.Doc, 1993.

Semester *:5*

Teaching unit: UEF 3.1.2 Subject 2:

Instrumentation – VHS sensors: 22h30

(Course: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives: Acquire

the knowledge allowing the mastery and the exploitation of the physical effects brought into play in the instrumental devices for collecting information in the measurement medium: machines, environment, etc.

Recommended prior knowledge:

Thermodynamics; Fluid mechanics ; Transfer phenomena.

Material content:

Chapter 1 : (2 weeks)

Principles of a measurement: Function of a measuring or control device; Overall composition of a measuring device; Qualities of a measuring device (Zero, Scale, Linearity); Performance of a measurement chain.

Chapter 2 : (2 weeks)

Pressure measurements: Absolute and differential pressures; Empty ; Pressure measuring devices; Use and assembly.

Chapter 3 : (2 weeks)

Flow measurements: Differential pressure, variable orifice and variable area flows; Counters.

Chapter 4 : (2 weeks)

Level measurements: Optical device, spirit level; Level measurement by the pressure due to the height of the liquid.

Chapter 5 : (2 weeks)

Temperature measurements: Thermometers and thermocouples, thermistors.

Chapter 6 : (5 weeks)

Sensors: Physics of sensors: Simple sensors; Transduction functions; Energy and electrical aspects; Sensor devices with multiple transductions: test body, acting quantity and measured quantity; Conditioning circuits: Differential bridges Integrated conditio,ners, Offset and drift compensation; Applications to measurements with thermal, mechanical, electromagnetic effects and to the dosage of chemical species.

Assessment method:

Review: 100%.

Bibliographic references:

1. M. Cerr, JC. Engrand, F. Rossman, “Industrial Instrumentation”, Ed Paris Technique & documentation Lavoisier impr., 1990 Paris Impr. Jouve.
2. Michel Grout, Patrick Salaun, "Industrial Instrumentation", Collection: Technique and Engineering, Dunod - The New Factory.
3. Michel Capot, “The principles of measurement: pressures, flow rates, levels, temperature”, TECHNIP Editions.

Semester: ***5***

Teaching unit: UEF 3.1.2 Subject 3:

Chemical kinetics and homogeneous catalysis VHS:

22h30 (Course: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives:

Consolidate the basic notions of chemical kinetics (kinetic law: order, activation energy, rate constant). Acquire notions of approach to treatment of reaction mechanisms.
To make known a branch of chemical kinetics important in different sectors: catalysis.

Recommended prior knowledge: The basics

of general chemistry (atomistics, chemical bonding, thermochemistry) and the fundamental notions of chemical kinetics.

Material content:

Chapter 1: (2 weeks)
Reminders: Simple laws of chemical reaction rates; Activation energy; Molecularity.

Chapter 2 : (4 weeks)
Reaction mechanisms: Approximation of the quasi-steady state; Staged mechanisms; Chain mechanisms.

Chapter 3 : (4 weeks)
Kinetic theories: Theory of molecular collisions; Activated complex theory; Pseudo-monomolecular reactions.

Chapter 4 : (5 weeks)
Homogeneous catalysis: General information on homogeneous catalysis; Mechanisms; Acid-base catalysis; Enzymatic catalysis.

Assessment method:

Review: 100%.

Bibliographic references:

1. B. Fremaux, "Elements of kinetics and catalysis", technique and doc. Lavoisier.
2. G. Scacchi, M. Bouchy, JF Foucaut, O. Zahraa, R. Fournet, "Kinetics and catalysis", Lavoisier, 2011.
3. P. Morlaes, JC Morlaes, "Chemical kinetics", Vuibert 1981.
4. Michelle Soustelle; chemical kinetics, fundamental elements, Lavoisier, 2011

Semester: ***5***

Teaching unit: UEM 3.1 Subject 1:

VHS analysis techniques: 37h30

(Course: 1h30, Lab: 1h00)
Credits: 3

Coefficient: 2

Teaching objectives: To know

the main physical methods of analysis: principle, interest and field of application in the field of process engineering in particular. Acquire the basics of analysis and control of raw materials and formulated products.

Recommended prior knowledge: Basics of

wave-particle duality; chemical bonds; Electronic Transitions; Notions of analytical chemistry; Chemistry of solutions.

Material content:

Chapter 1 : **(8 weeks)**
Chromatographic methods: General information on chromatographic methods; General principle of chromatographic separation; liquid chromatography; Gas chromatography.

Chapter 2 : **(3 weeks)**
UV – Visible Molecular Spectroscopy: Principle; Theoretical notions; Apparatus; Interpretation of a UV-Visible absorption spectrum.

Chapter 3: **(4 weeks)**
Infrared (IR) Spectroscopy: Principle; Theoretical notions; Apparatus; Interpretation of an IR absorption spectrum.

Applications:

- **Identifications and quantifications by HPLC and CPG**
- **Verification of the Beer-Lambert law**
- **Identification of organic functions by IR.**

Evaluation mode:

Continuous control: 40%; Review: 60%.

Bibliographic references:

1. **Francis Rouessac , Annick Rouessac , Daniel Cruché, "Chemical analysis: Methods and techniques instruments", 7th Edition Dunod, 2009.**
2. **Gwenola Burgot, Jean-Louis Burgot, "Instrumental methods of chemical analysis and applications: chromatographic methods, electrophoresis, spectral methods and thermal methods", 3rd Edition, Tech & Doc, 2011.**
3. **R.Rosset, "Chromatography in liquid phase", Masson, 1995**
4. **M. Dalibart, L. Servant, "Spectroscopy in the infrared, Techniques of the Engineer, treaty Analysis and Characterization", P2845, 2000.**

Semester ***:5***

Course unit: UEM 3.1 Subject 2:

Physical Chemistry Lab 1 VHS:

22h30 (TP: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives:

Observation of physical phenomena studied during lectures; Validate and correctly present the results obtained; Formulate and communicate conclusions.

Recommended prior knowledge: - Chemistry

of solutions, notions of kinetics, basics of thermodynamics.

- Be informed of the safety instructions in a laboratory and be willing to work in a group.

NB: ***List for information only, adapt according to means;***

Number of practical work to be carried out = Seven(7): 4 in electrochemistry; 3 in homogeneous catalysis.

Material content:

Practical work

Electrochemistry • Dissociation constant; Low electrolytes; Activity coefficient. • Production of an electrochemical cell. • Drawing intensity-potential curves. • Battery voltage versus temperature measurements and error calculations.

• Corrosion of a metal. • Electrolysis lab

Kinetics and homogeneous catalysis

practical work • Effect of the nature of the catalyst on the chemical reaction: disproportionation of H2O2 in the presence of: iron(III) chloride, platinum wire, enzyme (piece of turnip) (demonstrative practical work to observe the catalytic effect and distinguish between homogeneous, heterogeneous, and enzymatic catalysis). • Determination of the catalytic constant of the reaction of the persulfate ion with the iodide ion in the presence of CuSO4. • Kinetic study of the iodination (bromination or a base.

Evaluation mode:

Continuous control: 100%.

Bibliographic references:

1. Allen J. Bard, "Electrochemistry: principles, methods and applications", Masson, 1983.
2. Fabien Miomandre, Said Sadki, Pierre Audebert, “Electrochemistry from concepts to applications”, Dunod, 2005.
3. B. Fremaux, “Elements of kinetics and catalysis, technique and documentation”, Lavoisier.
4. G. Scacchi, M. Bouchy, JF Foucaut, O. Zahraa, R. Fournet, “Kinetics and catalysis”, Lavoisier, 2011.
5. Genévrière ML Dumas, Roger Benaîm, essential in electrochemistry, Breal, 2001.

Semester 5

Course unit: UEM 3.1 Subject 3:

Chemical engineering 1 VHS:

22h30 (TP: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives:

Observation of physical phenomena studied during lectures; Understand an experimental technique; Validate and correctly present the results obtained; Formulate and communicate conclusions.

Recommended prior knowledge: - Basics of thermodynamics, notions of transfer phenomena.

- Be informed of the safety instructions in a laboratory and be willing to work in band.

NB: ***List for information only, adapt according to means; Number of labs to perform = Seven(7): 3 in Heat Transfer; 2 in Mass Transfer; 2 in TQM.***

Material content:

1- Measurement of transfer coefficient, KLa, in a mechanically stirred reactor.
2- Diffusion of liquids.
3- Study of heat transfer by axial and radial conduction.
4- Study of heat transfer by convection.
5- Study of heat transfer by radiation.
6- Measurement of linear head losses in pipes of different diameters.
7- Measurement of the coefficient of friction in smooth pipes.
8- Calibration of a measuring device
9- Study of the performance of a measuring sensor (class, fidelity, accuracy, speed, etc.)

Assessment method:

Continuous control: 100%.

Bibliographic references:

1. J. Krabol, "Heat transfer", Masson, 1990
2. Bird, Stewart, Lightfoot, "Transport phenomena", Second Edition, J. Wiley and Sons, 2002.
3. Laszlo, "The scientific bases of chemical engineering", Dunod, 1972.
4. Robert E. Treybal, "Mass transfer operation", McGraw-Hill, 1981.

Semester *:5*

Teaching unit: UEM 3.1 Subject 4:

Process simulators VHS: 22h30 (TP: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives: - Become familiar with the concepts of process modeling and simulation.
- Know the main process engineering simulation software.
- Learn the basics of designing equipment and processes using software.

Recommended prior knowledge: Mathematics. Physical chemistry. Notions of transfer phenomena.

Material content:

Chapter 1 : **(2 weeks)**
General: Definition of simulation; Mathematical modeling; Commercial simulators (HYSYS, Aspen, Prosim, etc.); Components of a process simulator; presentation of the chosen software.

Chapter 2 : **(3 weeks)**
Getting started with the chosen Software: Creating a simulation; Selection from the list of compounds; Selection of the thermodynamic model; Become familiar with the simulation sheet; Installation and specification of material streams.

Chapter 3 : **(3 weeks)**
Thermodynamic models of the chosen software: Equations of state; Prediction of the physical properties of pure substances and mixtures; Calculation of liquid-vapor equilibria.

Chapter 4 : **(3 weeks)**
Simulation of some equipment: Simulation of pumps; Compressors; Regulators; Flash separator; Heat exchanger ; Furnaces and reactors.

Chapter 5 : **(4 weeks)**
Examples of process simulation

Assessment method:
Continuous control: 100%.

Bibliographic references:

1. Michael E. Hanyark Jr., “Chemical Process Simulation and the Aspen HYSYS Software”, CreateSpace Independent Publishing Platform, 2012.
2. Hossein Ghanadzadeh Gilani, Katia Ghanadzadeh Samper, Reza Khodaparast Haghi, “Advanced Process Control and Simulation for Chemical Engineers”, CRC Press, 2012.
3. Alexandre Dimian, “Integrated Design and Simulation of Chemical Processes”, Elsevier, 2003.
4. Amiya K. Jana, “Chemical Process Modeling & Computer Simulation”, PHI Learning Pvt. Ltd., 2008.

Semester *:5*

Teaching unit: UED 3.1 Subject 1:

Pharmaceutical processes VHS: 22h30

(Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives:

Descriptively introduce the basic notions on the processes of synthesis, treatment and purification of therapeutic molecules, their shaping in galenic formulations including the processes implemented, namely : The processes and technologies related to the formulation and industrial production of drugs.

Recommended prior knowledge: Basics of Chemistry; Notions of chemical engineering.

Material content:

Chapter 1: Medication (5 weeks) •
Introduction
• Definitions •
Stages of drug development • Different drug classifications • Active ingredients • Excipients
• Packaging

• Drug activity and toxicity • Becoming active principles in the body

Chapter 2: synthetic operations (3 weeks) • Sources of active principles • Methods for obtaining natural substances • Synthetic methods
• Biotechnological methods

Chapter 3: Preformulation (3 weeks) •
Routes of administration
• Choice of galenic forms •
Biopharmaceutical classification (solubility, permeability) •
Dissociation coefficient, partition coefficient

Chapter 4: Manufacturing Environment (3 weeks)
• Pharmaceutical company •
Manufacture of pharmaceutical water • Air treatment
• Concept of quality in the pharmaceutical industry

Assessment method: Exam: 100%.

Bibliographical references: 1. K.

Peter C. Vollhardt, Neil E. Schore, “Treatise on organic chemistry”, 5th edition, De boeck, 2009.

2. Graham L. Patrick, “Pharmaceutical Chemistry”, De Boeck, 2002.

3. WEHRLE P. – PharmacieGalénique, Formulation et technologiepharmacieque, January 2008. *MALOINE*

4. LE HIR A. – PharmacieGalénique, Good practices for the manufacture of medicinal products, 8th edition, April 2001. Abbreviated by MASSON

Semester 5

Teaching unit: UED 3.1 Subject

2: Agro-food processes VHS: 22h30

(Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives: To

introduce an important specialty of process engineering by presenting the notions of process engineering specific to this branch of economic activity. ; Briefly list the processes applied to the food industry.

Recommended prior knowledge: Notions on

separation techniques and transfer phenomena.

Material content:

Chapter 1 : (2 weeks)

Processing and preservation processes: Optimization of thermal processes: Pasteurization; Canning; Cooking ; Aseptic processes; Optimization of refrigeration processes, Refrigeration; Freezing; Refrigerated transport; Dehydration and combined processes: Drying; Smoking; Dehydration-impregnation by immersion (DII).

Chapter 2 : (3 weeks)

General information on separation processes: Phase separation: Pressing; Settling, Filtration; centrifuging; Molecular scale separation: Extraction; Distillation, Evaporation, Entrainment...; Membrane processes.

Chapter 3 : (4 weeks)

Engineering of the reaction: Engineering of the physico-chemical reaction: Coagulation, Gelling, Formation of mixed networks, Heat-induced reactions; Biological reaction engineering: Biomass production, Metabolites production, Fermentation, Bioconversion.

Chapter 4 : (3 weeks)

Structuring operation; Emulsification; Cooking-extrusion; Expansion.

Chapter 5 : (3 weeks)

Mechanical and manufacturing operations: Grinding; Sieving; Flow (especially of powders); Transfer ; Cutting ; Assembly and formatting; Packing and packaging.

Assessment method:

Exam: 100%.

Bibliographic references:

1. Laurent Bazinet, François Castaigne, "Food engineering concepts: Associated processes and applications to food preservation", Tec & Doc, 2011.
2. Jean-Jacques Bimbenet, Albert Duquenoy, Gilles Trystram, "Food process engineering: From basics to applications", Dunod, 2007.

Semester ***:5***

Teaching unit: UET 3.1 Subject 1:

Air, Water and Soil Pollution VHS:

22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives: To

discover the problems of pollution and management of our environment (causes, consequences, remedies, influences of the management of our environment); The "soil pollution" part is constructed in such a way as to be accessible without prior knowledge of soil sciences.

Recommended prior knowledge: Basic
knowledge of chemistry.

Material content:

Chapter 1 : (5 weeks)

Water Pollution: Water Cycle; Measurement of water quality; Sources, mechanisms and symptoms of pollution of running waters and lakes; Influence of pollution on living beings; Oxygenation and deoxygenation; Eutrophication; Notions on the treatment and purification of wastewater; Prevention of water pollution.

Chapter 2 : (5 weeks)

Soil Pollution: Basics in Soil Science; Causes and consequences of soil degradation/pollution; Behavior of trace elements in soil; Behavior of organic pollutants in the soil; Risk analysis and legislation; Decontamination techniques and case studies.

Chapter 3 : (5 weeks)

Air Pollution: Scenario: Environment-Pollution-Sustainable Development-Energy Primary energy consumption and CO2 emissions ; Report ; Basic notions of the atmosphere and meteorological parameters; Evolution of air quality and effect on organisms; Chemical constituents of atmospheric air; chemical pollutants; NO2 pollution ; Formation of pollutants; Some consequences of air pollution: Greenhouse effect; Photochemical smog; Ozone hole.

Assessment method:

Review: 100%.

Bibliographic references:

1. Olivier Atteia, “Chemistry and groundwater pollution”, Ed. Lavoisier & Doc, 2015.
2. Emilian Koller, “Treatment of industrial pollution: Water, air, waste, soil, sludge”. Ed. Dunod, 2009.
3. Françoise Nési, “Soil Pollution: Soil Pollution”, 2010.
4. Louise Schriver-Mazzuoli, "Indoor Air Pollution: Sources, Health Effects, Ventilation", Ed. Dunod, 2009.

Semester ***:6***

Course unit: UEF 3.2.1 Subject 1:

VHS unit operations: 67h30

(Course: 3h00, Tutorial: 1h30)
Credits: 6

Rating: 3

Teaching objectives: Know

the main unit operations and understand the process diagrams of the different process engineering industries (chemical, electrochemical, food-processing, pharmaceutical, etc.); Write and control the material balances of these processes.

Recommended prior knowledge:

Thermodynamics; Differential equations ; Transfer phenomena.

Material content:

Chapter 1: (1 week)
General information on unit operations: Absorption; extract; adsorption; Distillation, etc.

Chapter 2 : (3 weeks)
Absorption: Liquid-gas equilibrium; Isothermal absorption, Mass balances; Theoretical stage concept; Method of Mac Cabe and Thièle, notions of contactors (packed columns and trays), hydrodynamics of flows

Chapter 3 : (4 weeks)
Liquid-to-Liquid Extraction: Introduction; definition (solvent, solute, diluent), Equilibrium diagram; Single stage extraction; multistage extraction: graphical method of Mac Cabe and Thièle, number of theoretical trays

Chapter 4 : (3 weeks)
Liquid-solid extraction (Leaching): Solid-liquid equilibrium; Janeck diagram: Determination of the number of theoretical stages, case of counter-current and cross-current extraction.

Chapter 5 : (4 weeks)
Distillation: Distillation of a binary mixture; Distillation in discontinuous, continuous mode; Calculation of the efficiency of a rectification column (Graphical methods of Mac Cabe and Thièle and of Ponchon and Savarit).

Assessment method:

Continuing control: 40%, Review: 60%.

References: 1. Robert E.

Treybal, "Mass transfer operations", MC Graw Hill.
2. MC Cabe and Smith, "Chemical engineering operations", MC Graw Hill.
3. COULSON JM, JF RICHARDSON, JR BACKHURST and JH HARKER, "Chemical Engineering", vol. two, Fifth edition, 2002.

Semester *:6*

Teaching unit: UEF 3.2.1 Subject 2:

Thermodynamics of equilibria VHS: 45h00

(Course: 1h30, TD: 1h30)

Credits: 4

Coefficient: 2

Teaching objectives: Master

the application of the three principles of thermodynamics; Distinguish the different states of a gas; Predict the direction of a chemical reaction.

Recommended prior knowledge: Chemical

thermodynamics; Differential equations.

Material content:

Chapter 1: Thermodynamics of solutions I.1 **(2 weeks)**
Behavior of a constituent in a mixture; I.2 Partial molar quantities; I.3 Excess quantities and activity; I.4 Models of non-electrolytic liquid solutions; I.5 Real gas mixtures and pseudo-critical properties

Chapter 2: Liquid-vapor equilibrium (5 weeks)
II.1 Equilibrium of an ideal binary mixture; II.2 Equilibrium of any solutions with miscible and immiscible constituent; II.3 Liquid-vapor diagram at constant pressure and temperature; II.4 Application to fractional distillation and steam entrainment; II.5 Extension to the ternary system

Chapter 3: Thermodynamics of Liquid-Liquid and Liquid-Solid Equilibria (5 weeks)
III.1 Binary liquid-liquid mixture; III.2 Application to liquid-liquid extraction; III.3 Liquid-solid mixture; III.4 Diagram of activities and solubilities; III.5 Application to ternary mixtures; III.6 Surfaces and Interfaces

Chapter 4: Thermodynamics of chemical equilibria (3 weeks)
IV.1 Equilibrium of a system in chemical reaction; IV.2 Homogeneous and heterogeneous chemical reactions; IV.3 Phase equilibria associated with a chemical reaction

Assessment method:

Continuing control: 40%, Review: 60%.

References: 1. Smith, EB, Basic,

Chemical Thermodynamics, 2nd ed., Clarendon Press, Oxford, 1977.

2. Stanley I. Sandler, Chemical and Engineering Thermodynamics, Wiley, New York, 1977.

3. Lewis GN, Randal M., Thermodynamics, Mac Graw Hill 4.

Hougen OA, Watson KM, Chemical process principles, Vol II: Thermodynamics, John Wiley and sounds

5. Brodyanski V., Sorin M., Le Goff P. The efficiency of industrial processes, exergy analysis and optimization, Amsterdam, Elsevier, (1994).

6. Wuithier, P, Petroleum, Refining and Chemical Engineering, Technip

Edition 1972 7. Abbott M; Theory and applications of thermodynamics, Schum series,

Paris 1978 8. Kireev, V. Cours de chimie physique, Edition Mir, Moscow 1975

Semester ***:6***

Course unit: UEF 3.2.2 Subject 1:

Homogeneous reactors VHS: 45h00

(Course: 1h30, Tutorial: 1h30)
Credits: 4

Coefficient: 2

Teaching objectives: Highlight
the influence of the choice of chemical reactors and their operating conditions on the reaction products obtained. Dimensioning of ideal reactors.

Recommended prior knowledge:
Thermodynamics, basics of mathematics; transfer phenomena.

Contents: Chapter 1 :

(1 week)

Stoichiometry: Concept of conversion rate; Concept of advancement; Case of a single reaction; Case of several reactions.

Chapter 2: Classification of chemical reactors **(1 week)**
Classification of chemical reactors: Perfectly stirred batch reactor (RDPA); Perfectly stirred stationary continuous reactor (RCPA); Tubular stationary plug-flow (RCP) continuous reactor.

Chapter 3: Material balances in ideal reactors Single **(2 weeks)**
reaction: Perfectly agitated closed reactor; Perfectly stirred reactor continuously in steady state; Piston reactor in steady state.

Chapter 4: Study of isothermal homogeneous chemical reactors with one reaction: (4 weeks)
1-RDPA; ACPR; CPR; 2- Association of chemical reactors: Association of stationary continuous reactors in plug flow (series / parallel); Association of perfectly stirred stationary continuous reactors (series/parallel); 3- Comparative performances of ideal reactors.

Chapter 5: Study of isothermal homogeneous chemical reactors with several reactions

(4 weeks)

Consecutive irreversible reactions; Competitive reactions. Selectivity and yield ;

Chapter 6: Non-isothermal ideal reactors Notions **(3 weeks)**
of heat balances in non-isothermal ideal reactors.

Assessment method:
Continuing control: 40%, Review: 60%.

Bibliographical references: 1.
O. Levespiel, "Chemical reaction engineering", Wiley, 1972.
2. G.Antonini, Benaim, "Engineering of reactors and reactions". Nancy 1991.
3. Trambouze, "Chemical reactors, Design".
4. J. Villermaux, "Chemical reaction engineering, Design and operation of reactors", Edition Technical and Documentation. 1982.
5. Froment GF Chemical reactor analysis and design 2nd edition (1990) J.
Wiley 6. Schweich D. Chemical reaction engineering. Tec&Doc Lavoisier, (2001) Paris

Semester ***:6***

Course unit: UEF 3.2.2 Subject 2:

Surface phenomena and heterogeneous catalysis VHS: 45h00

(Course: 1h30, TD: 1h30)

Credits: 4

Coefficient: 2

Teaching objectives: To make

known the existence of surface tension as an essential parameter intervening in interfacial interactions. Description of the phenomenon of adsorption of gases on the surface of solids through the laws of thermodynamics. Application to the determination of the surface and the porous volume of solids.

Give the basics of heterogeneous catalysis and the different techniques for developing catalysts. Briefly show the complexity of the catalytic act and the importance of modeling the kinetics.

Recommended prior knowledge: Mathematics;

chemical kinetics; basics of thermodynamics.

Material content:

Chapter 1 : (3 weeks)

Liquid-gas interface, Surface tension: Notion of surface tension; Thermodynamic functions; Effect of temperature; Effect of concentration; Gibbs relationship; Measurement of molecular area; Physico-chemical study of surfactant: Adhesion and cohesion; Wetting and contact angle.

Chapter 2: (5 weeks)

Adsorption of gases at the solid-gas interface: Types of adsorption; Thermodynamic study; Heat of adsorption; Physisorption equilibrium: adsorption in monolayer (modelling), in multilayers (modelling); Application to the determination of the surface of a solid. Hysteresis phenomena: Porosity; Kelvin's law; Porous volume.

Chapter 3: (2 weeks)

Gas chemisorption equilibria: chemisorption isotherms. Langmuir, Temkin, and Freundlich models.

Chapter 4: (2 weeks)

Introduction and general information on catalysts: Preparation methods; Characterization ; Classification.

Chapter 5 : (3 weeks)

Kinetics of reactions in heterogeneous catalysis: Mechanisms and models

Assessment method:

Continuous assessment: 40%, Examination: 60%.

Bibliographical references: 1.

CE Chitour, "Physico-chemistry of surfaces", OPU. Volumes 1 and 2.

2. JM Coulson, JF Richardson, Backhurst, Harker, "Chemical engineering", Pergamon Press. 3.

J. Fripiat, J. Chaussidon, A. Jelli, "Chemistry-physics of surface phenomena", Masson.

4. M. Boudart, "Kinetics of reactions in heterogeneous catalysis", Masson.

5. Fauvelle. JL (1989). Physico-chemistry; its role in natural, astronomical, geological, and biological. Edition: *Reinwald,* 512 p.
6. Friedli, C. (2005). General Chemistry for Engineers, Edition: *Polytechnic and University Presses Romandes.* 750p.
7. Fripiat, J. Chaussidon J, Jelli A. (1971) Chemistry-physics of surface phenomena, Edition: *Masson,* 387 p.
8. Landolt, D. (1993) Corrosion and surface chemistry of metals. Edition: *PPUR polytechnic presses.* 552 p.
9. Lalauze, R. (2006). Physico-chemistry of solid-gas interfaces 1: concepts and methodology for the study of solid-gas interactions (Coll. Sensors and instrumentation). *Hermes Science* edition , 240 p.
10. Somorjai, GA, Marie-Paule Delplancke, MP (1995). Surface chemistry and catalysis Edition: *Ediscience International.* 713 p.
11. Peter William Atkins, Julio De Paula, Physical Chemistry, Publisher: De Boeck, 4th Edition , 2013
12. Sidney FA Kettle, Inorganic Physical Chemistry, Publisher: De Boeck, 4th Edition 2013
13. Moore WJPhysical Chemistry, 2nd Edition Dunod (1965)

Semester ***:6***

Course unit: UEM 3.2 Subject 1:

VHS End of Cycle Project: 45h00

(TP: 3h00)
Credits: 4

Coefficient: 2

Teaching objectives:

Assimilate in a global and complementary way the knowledge of the different subjects. Concretely put into practice the concepts inculcated during the training. Encourage the sense of autonomy and the spirit of initiative in the student. Teach him to work in a collaborative setting by arousing intellectual curiosity in him.

Recommended prior knowledge: The entire

License program.

Material content:

The theme of the End of Cycle Project must come from a concerted choice between the tutor and a student (or a group of students: pair or even trinomial). The content of the subject must be consistent with the objectives of the training and the real aptitudes of the student (Bachelor's level). It is also preferable that this theme take into account the social and economic environment of the establishment. When the nature of the project requires it, it can be subdivided into several parts.

Note :
During the weeks during which the students are in the process of soaking up the purpose of their project and its feasibility (bibliographic research, research of software or materials necessary for the conduct of the project, revision and consolidation of teaching having a direct link with the subject, etc.), the person in charge of the subject must take advantage of this face-to-face time to remind students of the essential content of the two subjects "Writing methodology" and "Presentation methodology " addressed during the first two semesters of the common base.

At the end of this study, the student must submit a written report in which he must explain as explicitly as possible:

- **Detailed presentation of the subject of study, emphasizing its interest in its environment socioeconomic.**
- **Means implemented: methodological tools, bibliographical references, contacts with professionals, etc**
- **Analysis of the results obtained and their comparison with the initial objectives.**
- **Critique of the discrepancies noted and possible presentation of other additional details.**
- **Identification of the difficulties encountered by highlighting the limits of the work carried out and the follow-up to be given to the work carried out.**

The student or group of students finally present their work (in the form of a brief oral presentation or on a poster) in front of their tutor and a teacher examiner who can ask questions and thus evaluate the work accomplished on the technique and that of the presentation.

Assessment method:
Continuous control: 100%

Semester ***:6***

Teaching unit: UEM 3.2 Subject 2:

VHS macroscopic assessments:

37h30 (Course: 1h30, Tutorial: 1h00)
Credits: 3

Coefficient: 2

Teaching objectives: The

various operations of Process Engineering require the writing of material and energy balance sheets to control the operation and sizing of equipment. The objectives of this subject are to provide all the fundamental concepts for carrying out the material and energy balances of a process in order to model the processes.

Recommended prior knowledge: Physical

chemistry, transfer phenomena, basics in math and computer science.

Material content:

- **Fundamental concepts – black box analysis**
- **Processes with or without chemical reaction**
- **Determination of the degrees of freedom**
- **Diagram with recycling**
- **Diagram with recycling and purging**
- **Examples of illustration (Continuous reactor; Separation column; Heat exchanger; Cooling tower; Boiler, etc.)**

Assessment method:

Continuous assessment: 40%, Examination: 60%.

Bibliographic references:

1. **PC Wankat, "Separation Process Engineering Includes Mass Transfer Analysis", Third edition, Prentice Hall publisher, 2011.**
2. **RK Sinnott, Coulson & Richardson's Chemical Engineering, Vol 6, Fourth edition, Elsevier publisher, 2005.**
3. **D. Ronze, "Introduction to process engineering", Editions Tec & Doc Lavoisier, 2008.**
4. **Joseph Lieto, "Chemical engineering for use by chemists", Tec & Doc (Editions), 2004.**

Semester *:6*

Teaching unit: UEM 3.2 Subject 3:

Physical Chemistry 2 and Chemical Engineering 2 VHS: 22h30

(TP: 1h50)

Credits: 2

Coefficient: 1

Teaching objectives: Observation

of physical phenomena studied during lectures; Validate and correctly present the results obtained; Formulate and communicate conclusions.

Recommended prior knowledge: Notions of kinetics,

basics of thermodynamics, Being informed of safety instructions in a laboratory and being willing to work in a group.

NB: ***List for information only, adapt according to means.***

Number of practical work to be carried out = eight (8): 2 in Thermodynamics; 2 in surface chemistry; 4 in Chemical Engineering.

Material content:

TP1. Thermodynamics

- **-Determination of the heat of dissolution.**
- **- Thermodynamic functions of an acid-base equilibrium.**
- **-Heat of vaporization of a pure liquid (Determination of the latent heat of vaporization of acetone.)**

- **-Diagrams of thermodynamic phases: Liquid-vapor equilibrium. Liquid-liquid balances.**
- **-Heat of ionic reaction.**
- **-Determination of partial molar volumes of a binary solution.**
- **-Diagram of a ternary mixture.**

TP2. Surface phenomena

- **-Adsorption of a dye (methylene blue) on an adsorbent material (CA).**
- **-Adsorption of an organic compound (acetic acid/phenol) on activated carbon**
- **-Measurement of surface tension.**

TP3. chemical engineering

- **-Discontinuous distillation.**
- **-Continuous distillation of the Ethanol/Water mixture.**
- **- Simple distillation**
- **- Solvent extraction -**
Partition coefficient

Assessment method:

Continuous control: 100%.

Semester ***:6***

Teaching unit: UED 3.2 Subject 1:

Cryogenic processes VHS: 22h30

(Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives: To

present the different processes in the field of refrigeration and cryogenics; Some applications in the field of low temperatures.

Recommended prior knowledge: Heat transfer

phenomena; Thermodynamics and mathematical tools (differential equations and integral calculus).

Material content:

General introduction: Cryogenics and its fields of application (1 week)

Chapter 1: (2 weeks)

Vacuum technology: Importance of vacuum in cryogenics; Vacuum production systems.

Chapter 2 : (4 weeks)

Separation and purification processes for cryogenic fluids: Separation process: ideal system; Separation processes – Rectification; Role and description of the Joule Thomson valve; Air separation processes.

Chapter 3 : (5 weeks)

Permanent gas liquefaction processes: Linde-Hampson liquefaction process; Linde-Hampson double compression liquefaction process; Claude liquefaction process.

Chapter 4 : (3 weeks)

Cryogenic applications: Discovery of superconductivity; Application in the food industry.

Assessment method:

Review: 100%.

Bibliographic references:

1. RF BARRON, “Cryogenic Systems”, 2nd Edition, Oxford University Press, NY, 1985.
2. PETIT, "Oxygen, Nitrogen, Rare Gases In The Air", Engineering Techniques, Treatise on Engineering and Processes Chemicals, J 6020,1973.
3. F.Ayela, P. Decool, JLDuchateau, P.Gandit, F.Kircher, A.Sulpice, L.Zani, “Cryogenic and Fluid Temperatures”, Engineering Techniques, R2811, 2004.
4. A. Rojey, B. Durand, C. Jaffret, S. Jullian and M. Valais, “Natural gas”, Ed. Technip, 1994.
5. P. Wuittier, Volume II, “Refining and chemical engineering”, Technical Edition, France 1972.
6. Engineering Data Book, “Physical properties”, Section 23, Edition 1994.
7. RC Reid, JM Prausnitz, TK Sherwood, “The Properties of gases and liquids”, Third Edition Mc. Graw Hill 1977.
8. KD Timmerhaus, TM Flynn "cryogenic process engineering" Springer Science + business media, LLC 1989.

Semester *:6*

Course unit: UED 3.2 Subject 2:
Corrosion

VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1

Coefficient: 1

Objectives of the lesson: To

make known the phenomenon of corrosion: To give the theoretical bases, and to present the various techniques of protection against corrosion.

Recommended prior knowledge: Basics of

electrochemistry, surface phenomena.

Material content:

Chapter 1: (6 weeks)
Different types of corrosion: Electrochemical corrosion: Generalized corrosion (uniform and galvanic); Localized corrosion; Stress corrosion; Intergranular corrosion, …, etc. ; Chemical corrosion; Bacterial corrosion.

Chapter 2 : (3 weeks)
Phase diagrams: Potential-pH diagram, Applications

Chapter 3: (6 weeks)
Different means of protection: Coatings; Inhibitors; Cathodic protection.

Assessment method:
Review: 100%.

Bibliographical references: 1.

Dieter Landolt, "Corrosion and chemistry of metal surfaces" , Treatise on Materials, process polytechnic and university, Romandes, 1997.

2. C.Rochaix, "Thermodynamic-kinetic electrochemistry", Edition Nathan, 1996.
3. B.Baroux, "The corrosion of metals; passivity and localized corrosion", Dunod, 2014.
4. G.Béranger, H.Mazille, "Corrosion of metals and alloys: mechanisms and phenomena"; MIM Treated, Series Metallic alloys, Lavoisier, 2002.
5. F.Ropital, "Corrosion and degradation of metallic materials", Ed. Technip, 2009.

Semester: 6

Teaching unit: UET 3.2 Subject

1: Professional project and business management VHS:

22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives: To

prepare for professional integration at the end of studies through a process of maturation that is both individual and collective. Implement a post-licence project (continuation of studies or job search). Master the methodological tools needed to define a post-licence project. Prepare for the job search. Become aware of entrepreneurship through the presentation of an overview of management knowledge useful for the creation of activities.

Recommended prior knowledge: Basic

knowledge + Languages.

Skills targeted: Ability

to analyze, synthesize, work in a team, communicate well orally and in writing, be autonomous, plan and meet deadlines, be reactive and proactive.

Material content:

Chapter 1. Cover Letter Writing, Resume Writing (3 weeks)

Chapter 2. Documentary research on trades in the sector (3 weeks)

Chapter 3. Conducting interviews with trade professionals (3 weeks)

Chapter 4. Simulation of job interviews (2 weeks)

Chapter 5. Individual and/or group presentation and discussion (2 weeks)

Chapter 6. Projecting an idea, a collective research to give meaning to the individual journey (2 weeks)

Sequence 1. Plenary session

Presentation of the objectives of the module, Inventory of the sources of information available on professions and studies, Delivery of an individual sheet to be completed on the sector and the chosen professi

Sequence 2. Preparation of group work Creation

of working groups (4 students/group), Delivery of instructions for documentary research, Establishment of an action plan for carrying out interviews with professionals, Presentation of a questionnaire- kind.

Sequence 3. Documentary research and interviews in the field Free

time. Each student must provide a certificate signed by a professional which he will include in his final report.

Sequence 4. Sharing in groups Individual

presentation and exchange of results in groups, Preparation of a group summary which will be appended to each student's final report.

Sequence 5. Preparation for job search Writing a CV and cover letters, Examples of recruitment tests (interviews, tests).

Sequence 6. Focus on the creation of activities Presentation of the management elements linked to entrepreneurship.

Alternative - plan two sessions on the subject: Creating your business: from design to implementation (Content: the job of entrepreneur, project definition, market and competition analysis, tools for develop a draft business plan, the administrative procedures for installation, an overview of the main management principles, etc.).

Sequence 7. Development of the individual post-licence project Presentation of the outline of the individual final report, Preparation supervised by the supervisors.

Assessment method:

Review: 100%.

Bibliographic references:

1. Patrick Koenblit, Carole Nicolas, Hélène Lehongre, "Building your professional project", ESF Publisher, 2011.
2. Lucie Beauchesne, Anne Riberolles, "Building your professional project", L'Etudiant, 2002.

IV- Agreements / Agreements

STANDARD LETTER OF INTENT

(In case of license co-sponsored by another academic institution)

(Official paper on the letterhead of the university concerned)

Subject: Approval of the co-sponsorship of the license titled:

Hereby, the university (or the university center) license declare to co-sponsor the above mentioned during all the period of authorization of the license.

To this end, the university (or university centre) will assist this project by:

- Giving their point of view in the development and updating of teaching programs, - Participating in seminars
organized for this purpose, - By participating in
defense juries, - By working to pool human
resources and materials.

SIGNATURE of the legally authorized person:

FUNCTION :

date :

STANDARD LETTER OF INTENT

(In case of license in collaboration with a company of the user sector)

(Official letterhead of the company)

SUBJECT: Approval of the project to launch a Bachelor's degree course entitled:

Dispensed at:

The company hereby declares its desire to manifest its supports this training as a potential user of the product.

To this end, we confirm our support for this project and our role will be to :

- **Give our point of view in the development and updating of programs teaching,**
- **Participate in seminars organized for this purpose,**
- **Participate in defense juries,**
- **Facilitate as much as possible the reception of trainees either within the framework of memories of end of studies, or within the framework of tutored projects.**

The means necessary for the execution of the tasks incumbent on us for the achievement of these objectives will be implemented on the material and human level.

Mr (or Mrs)*… ....is designated as external coordinator of this project.

SIGNATURE of the legally authorized person :

FUNCTION :

Date :

OFFICIAL STAMP or COMPANY SEAL

V-Notices and Visas of the Administrative and Consultative Bodies

Title of the License: Process Engineering

Head of Department + Area Team Leader	
Date and stamp:	**Date and visa:**

Faculty Dean (or Institute Director)
Date and stamp:

Head of university establishment
Date and stamp:

VI – Opinion and Visa of the Regional Conference

VII – Opinion and Visa of the National Domain Educational Committee

الجمهورية الجزائرية الديمقراطية الشعبية
People's Democratic Republic of Algeria
وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education and Scientific Research

جامعة 20 أوت 1955- سكيكدة
University 20 août 1955-Skikda

Academic Master Degree

Materials in Civil Engineering

Institution	*Faculty*	*Department*
University 20 août 1955-Skikda	**Faculty of Technology**	***Civil Engineering***

Domain	*Branch*	*Speciality*
Science and Technology	***Civil Engineering***	***Materials in Civil Engineering***

Objective

The master's degree in "specialty materials in civil engineering" aims to provide students with high-level scientific and technical training in the fields of building materials.

Master's program Content

Branch
Civil Engineering

Specialty
Materials Civil Engineering

Semester 1

Teaching Unit	Program content Title	Credits	Coefficient	Weekly hourly volume Course	Tutorial	Practical work	Semester hourly volume (15 weeks)	Complementary work consulting (15 weeks)	Evaluation method Progressive assessment	Exam
Fundamental Teaching Unit Code : FTU 1.1.1 Credits : 8 Coefficients : 4	Elasticity	4	2	1h30	1h30		45h00	55h00	40%	60%
	Building materials 1	4	2	1h30	1h30		45h00	55h00	40%	60%
Fundamental Teaching Unit Code : FTU 1.1.2 Credits : 10 Coefficients : 5	Concrete technology	4	2	1h30	1h30		45h00	55h00	40%	60%
	Reinforced concrete structures	6	3	3h00	1h30		67h30	82h30	40%	60%
Methodology Teaching Unit Code: MTU 1.1 Credits : 9 Coefficients: 5	Physics of materials	4	2			3h00	45h00	55h00	100%	
	Binder	3	2			2h30	37h30	37h30	100%	
	Concrete technology	2	1			1h30	22h30	27h30	100%	
Discovery Teaching Unit Code : DTU 1.1 Credits : 2 Coefficients : 2	Building thermal	2	2	1h30	1h30		45h00	05h00	40%	60%
Transversal Teaching Unit Code:TTU 1.1 Credits : 1 Coefficients : 1	Technical english and terminology	1	1	1h30			22h30	02h30		100%
Total semester 1		**30**	**17**	**10h30**	**7h30**	**7h00**	**375h00**	**375h00**		

Semester 2

Teaching Unit	Program content – Title	Credits	Coefficient	Weekly hourly volume – Course	Weekly hourly volume – Tutorial	Weekly hourly volume – Practical work	Semester hourly volume (15 weeks)	Complementary work consulting (15 weeks)	Evaluation method – Progressive assessment	Evaluation method – Exam
Fundamental Teaching Unit *Code : FTU 1.2.1* *Credits : 10* *Coefficients : 5*	*Plasticity and damage*	*6*	*3*	*3h00*	*1h30*		*67h30*	*82h30*	*40%*	*60%*
	Building materials 2	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
Fundamental Teaching Unit *Code : FTU 1.2.2* *Credits : 8* *Coefficients : 4*	*Innovative concretes 1*	*4*	*2*	*3h00*			*45h00*	*55h00*		*100%*
	Matal structures	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
Methodology Teaching Unit *Code : MTU 1.2* *Credits : 9* *Coefficients : 5*	*Mechanics of materials*	*2*	*1*			*1h30*	*22h30*	*27h30*	*100%*	
	Applied computing	*3*	*2*			*2h30*	*37h30*	*37h30*	*100%*	
	Experimental methods	*4*	*2*	1h30		*1h30*	*45h00*	*55h00*	*40%*	*60%*
Discovery Teaching Unit *Code : DTU 1.2* *Credits : 2* *Coefficients : 2*	*Pathology of constructions* *Enterprise organisation and management*	*1* *1*	*1* *1*	*1h30* *1h30*	*1h30* *1h30*		*22h30* *22h30*	*2h30* *2h30*		*100%* *100%*
Transversal Teaching Unit *Code : TTU 1.2* *Credits : 1* *Coefficients : 1*	*Ethics, deontology and intellectual property*	*1*	*1*	*1h30*			*22h30*	*02h30*		*100%*
Total semester 2		**30**	**17**	*13h30*	*6h00*	**5h30**	**375h00**	**375h00**		

Semester 3

Teaching Unit	Course content	Credits	Coefficient	Weekly hourly volume			Semester hourly volume (15 weeks)	Complementary work consulting (15 weeks)	Evaluation method	
	Title			Course	Tutorial	Practical work			Progressive assessment	*Exam*
Fundamental Teaching Unit *Code : FTU 2.1.1* *Credits : 12* *Coefficients : 6*	*Composite materials*	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
	Recycled materials	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
	Prestressed concrete	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
Fundamental Teaching Unit *Code : FTU 2.1.2* *Credits : 6* *Coefficients : 3*	*Durability of materials*	*4*	*2*	*3h00*			*45h00*	*55h00*		*100%*
	Innovatrive concrete 2	*2*	*1*	*1h30*			*22h30*	*27h30*		*100%*
Methodology Teaching Unit *Code : MTU 2.1* *Credits : 9* *Coefficients : 5*	*Finite elements*	*4*	*2*	*1h30*		*1h30*	*45h00*	*55h00*	*40%*	*60%*
	Durability of materials	*3*	*2*			*2h30*	*37h30*	*37h30*	*100%*	
	Innovative concrete	*2*	*1*		*1h30*		*22h30*	*27h30*		*100%*
Discovery Teaching Unit *Code : DTU 2.1* *Credits : 2* *Coefficients : 2*	*Material rheology*	*1*	*1*	*1h30*			*22h30*	*02h30*		*100%*
	Site organisation and mangement	*1*	*1*	*1h30*			*22h30*	*02h30*		*100%*
Transversal Teaching Unit *Code : TTU 2.1* *Credits : 1* *Coefficients : 1*	*Documentary research and dissertation conception*	*1*	*1*	*1h30*			*22h30*	*02h30*		*100%*
Total semester 3		**30**	**17**	*15h00*	*6h00*	*4h00*	**375h00**	**375h00**		

Semester 4

	Semester Hourly Volume (SHV)	*Coeff*	*Credits*
Personnel work	*550*	*09*	*18*
Enterprise internship	*100*	*04*	*06*
Seminars	*50*	*02*	*03*
Other (Supervision)	*50*	*02*	*03*
Total Semester 4	*750*	*17*	*30*

People s Democratic Republic of Algeria'

وزارة التعليم العالي والبحث العلمي

Ministry of Higher Education and Scientific Research

اللجنة البيداغوجية الوطنية لميدان العلوم و التكنولوجيا

National Pedagogical Committee for Science and Technology

HARMONIZATION

TRAINING OFFER

ACADEMIC MASTERS

2016 - 2017

Domain	Sector	Speciality
Science And Technology	*Process Engineering*	*Polymer Engineering*

People s Democratic Republic of Algeria'
وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education and Scientific Research
اللجنة البيداغوجية الوطنية لميدان العلوم و التكنولوجيا
National Pedagogical Committee for Science and Technology

مواءمة

عرض تكوين
ماستر أكاديمي

2017-2016

التخصص	الفرع	الميدان
هندسة المبلمرات	الطرائق هندسة	علوم و تكنولوجيا

I – Identity card of the Master

Access conditions

Sector	Harmonized master	Access Licenses at the masters	Classification according to license compatibility	Coefficient assigned to the license
Process Engineering	Polymer Engineering	Process Engineering	**1**	**1.00**
		Materials Engineering	**1**	**1.00**
		Materials Chemistry (Domain SM)	**2**	**0.80**
		Physics of materials (Domain SM)	**3**	**0.70**
		Organic Chemistry (Domain SM)	**4**	**0.65**
		Other ST domain licenses	**5**	**0.60**

II – Half-yearly lesson organization sheets specialty

Semester 1

Teaching unit	Materials Entitled	Credits	Coefficient	Weekly hourly volume Course	 TD	 TP	Semester Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Assessment method Continuous monitoring	 Review
Fundamental EU Code: UEF 1.1.1 Credits: 8 Coefficients: 4	Deep heat and mass transfer	4	2	1h30	1h30		45:00	55:00	40%	60%
	Thermodynamics and equilibrium diagrams	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental EU Code: UEF 1.1.2 Credits:10 Coefficients: 5	Macromolecular chemistry	4	2	1h30	1h30		45:00	55:00	40%	60%
	Physico-chemistry of macromolecules	4	2	1h30	1h30		45:00	55:00	40%	60%
	Surfaces and interfaces	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
Methodological Unit Code: EMU 1.1 Credits: 9 Coefficients: 5	Synthesis and formulation of polymers	6	3	1h30	1h30	1h30	67:30	82:30	40%	60%
	Polymer rheology	3	2	1h30		1h00	37:30	37:30	40%	60%
Discovery Teaching Unit Code: UED 1.1 Credits: 2 Coefficients: 2	Classes of materials and polymers	1	1	1h30			10:30 p.m.	02:30		100%
	Electrochemistry	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 1.1 Credits: 1 Coefficients: 1	Technical English and Terminology	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 1		**30**	**17**	**3:00 p.m.**	**7:30 a.m.**	**2h30**	**375h00**	**375h00**		

Semester 2

Teaching unit	Materials	Credits	Coefficient	Weekly hourly volume			Semester Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Assessment method	
	Entitled			**Course**	**TD**	**TP**			**Continuous monitoring**	**Review**
Fundamental EU Code: UEF 1.2.1 Credits: 10 Coefficients: 5	Implementation of polymers	6	3	3:00	1h30		67:30	82:30	40%	60%
	Blending polymers	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental EU Code: UEF 1.2.2 Credits: 8 Coefficients: 4	Conductive polymers	4	2	1h30	1h30		45:00	55:00	40%	60%
	Polymer membranes	4	2	1h30	1h30		45:00	55:00	40%	60%
Methodological Unit Code: EMU 1.2 Credits: 9 Coefficients: 5	Characterization of polymers	6	3	1h30	1h30	1h30	67:30	82:30	40%	60%
	Applied software	3	2	1h30		1h00	37:30	37:30	40%	60%
Discovery Teaching Unit Code: UED 1.2 Credits: 2 Coefficients: 2	**Subject of choice 1**	1	1	1h30			10:30 p.m.	02:30		100%
	Subject of choice 2	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 1.2 Credits: 1 Coefficients: 1	Ethics, deontology and intellectual property	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 2		**30**	**17**	**3:00 p.m.**	**7:30 a.m.**	**2h30**	**375h00**	**375h00**		

Semester 3

Teaching unit	Materials	Credits	Coefficient	Weekly hourly volume			Semester Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Assessment method	
	Entitled			**Course**	**TD**	**TP**			**Continuous monitoring**	**Review**
Fundamental EU Code: UEF 2.1.1 Credits: 10 Coefficients: 5	Properties of polymers	4	2	1h30	1h30		45:00	55:00	40%	60%
	Polymer mechanics	4	2	1h30	1h30		45:00	55:00	40%	60%
	Bio-polymers	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental EU Code: UEF 2.1.2 Credits: 8 Coefficients: 4	Industrial applications	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
	Aging and degradation of polymers	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
	Recycling and recovery of polymers	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
Methodological Unit Code: EMU 2.1 Credits: 9 Coefficients: 5	Physical analysis methods	6	3	1h30	1h30	1h30	67:30	82:30	40%	60%
	Process modeling	3	2	1h30		1h00	10:30 p.m.	11:30 p.m.	40%	60%
Discovery Teaching Unit Code: UED 2.1 Credits: 2 Coefficients: 2	Innovative composite materials	1	1	1h30			10:30 p.m.	02:30		100%
	Polymers and the environment	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 2.1 Credits: 1 Coefficients: 1	Documentary research and dissertation design	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 3		**30**	**17**	**4:30 p.m.**	**6:00 a.m.**	**2h30**	**375h00**	**375h00**		

Semester 4

Internship in a company sanctioned by a dissertation and a defence.

	VHS	coefficient	Credits
Personal work	550	09	18
Company internship	100	04	06
Seminars	50	02	03
Other (Framing)	50	02	03
Total Semester 4	750	17	30

This table is given for information only.

Evaluation of the End of Master Cycle Project

- Scientific value (Jury assessment) /6
- Dissertation writing (Jury assessment) /4
- Presentation and answer to questions (Jury assessment) /4
- Appreciation of the supervisor /3
- Presentation of the internship report (Jury assessment) /3

General guidelines on the choice of discovery materials:

1- Industrial Security
2- Glasses and Ceramics
3- Application on Numerical Codes
4- Servicing and regulation
5- Communication technique
6- Materials for Optics, Electronics and Optoelectronics
7- Nanotechnology and Nanomaterials
8- Computer Aided Design
9- Biocompatible Materials
10- Management of Technological Resources
11- Welding and NDT
12- Surface Treatments
13- Environment, Protection, Control
14- Business Strategy and Management
15- Recovery and Recycling of Materials
16- Management and Economy
17- Health & Safety
18- Safety and Environment
19- Industrial Equipment Vibration Study
20- Industrial Security
21- Electron Microscopy and Spectroscopy

III - Detailed program by subject of semester S1

Semester: 1
Course Unit: UEF 1.1.1
Material: Deep heat and mass transfer
VHS: 45h (class: 01h30, tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
Master the basic notions of the three modes of heat transfer
Know how to write a balance sheet and build an elementary model

Recommended prior knowledge:
Education in mathematics and physics or mechanics
Knowledge of applied thermodynamics

Material content:

Chapter 1: Conduction (4 weeks)
- Fourier's law and generalized Fourier's law, tensor of thermal conductivities, thermal conductivities, thermal diffusivities and effusivities.
- Conduction equation (EC), linear boundary conditions and examples of nonlinear conditions.
- One-dimensional transient solutions: Use Fourier analysis and Laplace transformation.
- The longitudinal and transverse fins, show the establishment of the equations in both cases.
- Suggest some solutions
- Job opportunity and optimization.
- The most common profiles (rectangular, trapezoidal).

Chapter 2: Radiant Heat Transfer (5 weeks)
- Laws and definitions in radiative transfer. Planck's law, Kirchhoff's law, Bouguer's formula.
- The radiative properties of surfaces. Exchanges between surfaces separated by a transparent medium.
- Beer's law. Radiative properties of gases (MST). Radiative properties of particles. Establishment of the radiative transfer equation (ETR).
- Some approximate solutions of the simplified RTE.

Chapter 3: Convection (3 weeks)
- Reminders of dimensional analysis, usefulness of dimensionless numbers.
- Mechanical and thermal boundary layers, integral methods.
- Convection equations, modeling of a convection problem.
- Solutions to some convection problems. Forced convection in a cylinder. Natural convection on a flat vertical plate and in a rectangular cavity .

Chapter 4: Heat transfers during phase changes (2 weeks)
- Condensation on a vertical flat plate and on a horizontal cylinder, Nusselt film theory. Practical use of correlations.
- Boiling of pure substances, main parameters involved in boiling. Evaluation of transfer rates in this mode and inherent errors.

Chapter 5: Mass Transfer (1 week)

- Diffusion equation, Fick's law
- Simultaneous heat and mass transfer
- Mass diffusion mechanism
- convective diffusion

Assessment method:
Continuous Control: 40%, Review: 60% .
Bibliographic references :

1. *H. _ S. Carslaw, Introduction to the mathematical theory of the conduction of heat in solids, Mc Millan and Co ed., 1921, , 2nd edition.*
2. *HS Carslaw and JC Jaeger, Conduction of heat in solids, 2nd edition, Clarendon press ed., 1959*
3. *Latif Jiji, Heat Conduction, Jaico Publishing House, 2003.*
4. *Ozisik, MN, 1980, Conduction Heat Transfer, John Wiley and Sons, New York.*
5. *Gebhart, Heat transfer, McGraw Hill editor, 1971*

A. *B. De Vriendt, The transmission of heat, Volume 2, Introduction to thermal radiation, Gaetan Morin, 1983*

6. *Bejan, AD Kraus, Heat transfer handbook, John Wiley Editor, 2003*
7. *Vedat S. Arpaci, Conduction Heat transfer, 1966 by Addison-Wesley publishing.*
8. *R. Ghez, A Primer of Diffusion, John Wiley and Sons Editor, 1988, 2nd edition*
9. *Chandrasekhar, radiative transfer, Dover publication, 1960*
10. *MF Modest, Radiative heat transfer, Academic Press, 3rd edition, 2012*
11. *M. Quinn Brewster, Thermal radiative transfer and properties, Wiley Inter-science Publication, 1992*
12. *Hottel, H. C, and AF Sarofim, Radiative Transfer, McGraw-Hill, New York, 1967*
13. *R. Siegel and JR Howell, Thermal Radiation Heat Transfer, 5th Edition , Ed. Taylor and Francis, 2010.*
14. *M. Necati Osizik, Radiative transfer and interactions with conduction and convection, Ed. J. Wiley and Sons*
15. *RB Bird, WE Stewart, EN Lightfoot, Transport phenomena, Wiley editor, 1960*
16. *Rjucsh K. Kundu, IM Cohen, Fluid Mechanics, 2nd Edition, Academic Press, 2002*
17. *DP Kesseler and RA Greenkorn, Momentum, Heat, and Mass transfer: Fundamentals, M. Dekker, 1999.*
18. *Kreith, F.; Boehm, RF et al., Heat and Mass Transfer, Mechanical Engineering Handbook Ed. Frank Kreith, CRC Press LLC, 1999.*
19. *HD Baehr and K. Stephan, Heat and Mass transfer, 2nd revised edition, Springer Verlag editor, 2006.*

Semester : 1
Course Unit: UEF 1.1.1
Subject: Thermodynamics and equilibrium diagrams
VHS: 45 h (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The student must be able to use thermodynamic tools in order to carry out the concrete study of physico-chemical systems in equilibrium or in the process of evolution.
The tool and concepts developed in this course will be directly applied to the reading course using phase diagrams

Recommended prior knowledge:

Structure of matter, probability and statistics, crystallography, thermodynamics

Material content:

Thermodynamics: (4 weeks)

1- reminders of basic definitions: system, phase, constituent, variables and state functions, expressions of compositions, first and second principle,
2- fundamental reminders of equilibrium conditions: chemical potential and Gibbs relations, true and apparent equilibrium, stability, metastability,
3- multi-constituted systems: partial quantities, models of ideal, regular and interstitial solutions **.**

Balance diagrams:

1- Balance **(1 week)**
2- One component system
3- Binary solutions **(1 week)**
4- Balances in heterogeneous systems **(1 week)**
5- Binary phase diagrams **(3 weeks)**
6- Ternary phase diagrams **(3 weeks)**
7- Case studies: reading and using equilibrium diagrams between phases (polymers, metals, ceramics, oxides, etc.) **(2 weeks)**

Evaluation mode: Continuous control 40%; Review 60%.

Bibliographic references:

1. *P. Perez, Thermodynamics: Foundation and applications, Masson et Cie, 1997 .*
2. *M. Karapetianz, Chemical Thermodynamics, Ed. Mir, Moscow, 1975 .*
3. *L. Sewing; C. Chahine; R. Zitoun, Thermodynamics: lessons and exercises and solved problems, Dunod, Paris, 1989*

Course unit: UEF 1.1.2
Subject: Macromolecular Chemistry
VHS: 45h00 (Class: 1h30 , TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The purpose of this course is to present in detail the architecture of macromolecular chains as well as the possibilities of development of these chains. Assimilate the degree of polymerization of polymers (chain length)...etc.

Recommended prior knowledge:

Basics of chemical kinetics and organic chemistry as well as notions of the structure of matter

Material content:

Introduction :
1. Positioning of macromolecular synthesis as an essential tool for controlling the final properties of the material
2. Understanding the differences between chain polymerization techniques and step polymerizations
3. Description of the different structures and morphology accessible during macromolecular synthesis
4. Limitations of macromolecular synthesis
A/ Radical polymerization:
1. Kinetic Reminders
2. Priming
3. Spread
4. Termination
5. Transfer
6. Control of molecular weights
7. Statistical copolymerization
B/ Polycondensation:
1. General introduction
1.1. Reminders of basic definitions
1.2. Average molar masses
2. General information on the synthesis of polymers
2. 1. Polycondensation – polyaddition versus chain polymerization (reminders)
2. 2. Examples of polycondensations and polyadditions
3. Degree of polymerization and molar masses
3.1. Number-average degree of polymerization. Carothers approach
3.2. Distribution of molar masses. Flory's statistical theory
4. Polymerization kinetics
5. Cross-linked polycondensates. Frost point prediction
5.1. Carothers theory.

5.2. Flory–Stockmayer theory
6. Examples of industrial syntheses of polycondensates
6.1. Polyamides
6.2. Polycarbonates
6.3. Polyurethanes (intervention of an industrialist)
C/ Anionic and cationic polymerization:
1. Anionic polymerization: principle, reaction mechanisms, kinetics of reactions, examples
2. Cationic polymerization: principle, reaction mechanisms, kinetics of reactions, examples

Evaluation mode: Continuous control: 40%; Review: 60%.

Bibliographic references :

- *Chemistry of GFP Polymers Vol 3*
- *Introduction to polymers RJ Young, PA Lovell Chapman & Hall*
- *Principles of polymerization, G. Odian Wiley*
- *Comprehensive polymer science; Anionic polymerization (Schwarz)*
- *Exercises and problems of macromolecular chemistry M. Bartholin, T. Hamaide Lavoisier.*

Semester: 1
Course unit: UEF 1.1.2
Subject: Physico-chemical macromolecules
VHS: 45h (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
Understand the basic notions of the statistical behavior of polymers and see how these notions are involved in the behavior of polymer systems.

Recommended prior knowledge:
Matrix calculation, numerical methods, resistance of materials.

Material content:

- Chain statistics, radius of gyration, Gaussian chain, introduction to excluded volume
- physical origin of the elasticity of chains, elasticity of a rubber material
- application of linear response theory to rubber elastic
- Measurement of single chain elasticity, measurement of force on a single chain, physical significance of a ligand/receptor force measured by AFM
- radial distribution function of colloids, light scattering and relationship with the radial distribution function, application to the case of polymers, Zimm plott
- Flory theory, phase separation, osmotic pressure
- LCST polymers

Evaluation mode: Continuous control 40%; Review 60%.

Bibliographic references:

- *Introduction to the science of GFP polymers Volumes 2, 8, 10 and 17*
- *Treatise on materials Polytechnic and university press Volumes 1 and 14*
- *From macromolecule to polymer material J. L Halary & F. Lauprêtre Belin*
- *Physics of polymers volume I P. Combette & I. Ernoult Hermann*
- *Introduction to Physical Polymer Science LH Sperling Wiley*

Semester: 1
Course unit: UEF1.1.2
Material: Surfaces and interfaces
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

Acquire basic knowledge on the fundamental notions of surface phenomena and interfacial tension. At the end of this teaching, the student must be able to assimilate the phenomena of superficial retention and to link them to the surface energy of matter.

Recommended prior knowledge:

Basic notions of chemistry, states of matter, surface activity, adsorption.

Material content:

This course covers the following topics:
Surface phenomena
Interfaces, films and membranes
Molecular systems organized at interfaces ,
Capillarity and wetting
Langmuir films at the water-air interface
Physico-chemistry of surfactant activity, detergency.

Assessment method: Examination: 100 % .

Bibliographic references :

K. Oura, Lifshits VG, Surface science, Springer, New York, 2003
Chems Eddine Chitour, Physico – surface chemistry , 2nd expanded edition, university publications office, Algiers, 2004
Dervichian, Surfactant, emulsifiers, wetting agents (engineering technique), Paris France
Fripiat, Physical chemistry of surface phenomena, Ed Masson, Paris 1971
Boudart, Kinetics of reactions - heterogeneous catalysis, Ed. Masson, Paris, 1982
www.techniquedelingenieur.com

Semester: 1
Course unit: UEM1.1
Subject: Synthesis and formulation of polymers
VHS: 62h30 (Class: 1h30, TD: 1h30, TP: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

Acquire the basic techniques for the preparation of polymers, assimilate the ingredient formulation systems. After understanding the different types of polymer synthesis, the objective will be to understand the modes of action of stabilizers and additives used in a formulation.

Recommended prior knowledge:

Basic notions of organic chemistry, chemical reaction, chemical bonding, macromolecular chemistry

Material content:

Synthesis:
1- Definitions, classification, nomenclature, importance of the discipline.
2- Polycondensations: definitions, kinetic study, three-dimensional structures, molecular distributions.3- Polyadditions: definitions, kinetic study, three-dimensional structures, molecular distributions.4- Radical copolymerizations.5- Polymerizations in the dispersed state

Formulation:
1- Study of systems formulated from emulsions (normal and inverse):
- study of surfactants (structure, classification, choice of surfactant suitable for the application, interface properties, organization in solution). - nature, stability and characterization of emulsions, 2- study of encapsulation (micro, nano) from the three main families of processes (physical, physico-chemical, chemical).

Practical work: According to the capacities of the establishments

Assessment method: Continuous Assessment: 40%, Examination: 60% .

Bibliographic references:

- *Mark & Herman, Plastics, Time Inc., USA, 1973*
- *Ehrenstein, Gottfried W., Polymer materials: structure, properties and applications Nouv. ed. Hermes science publications, Paris, 2000.*
- *Polymers: from polymerization to properties first Franco-Mexican conference, Grenoble, 1995, Polytechnica, Paris, 1996*

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Semester: 1
Course unit: UEM1.1
Material: Polymer Rheology
VHS: 37h30 (Class: 1h30, Lab: 1h00)
Credits: 3
Coefficient: 2

Teaching objectives:
Allow the student to know the main types of rheological behavior of fluids and particularly polymers in the liquid state and in the melting state and their applications to shaping.

Recommended prior knowledge:
Basic knowledge in chemistry and physics.

Material content:

Liquid rheology
- Principles of operation of the different rheometers.
- Newtonian fluids
- Non-Newtonian fluids
  • Non-Newtonian fluid with behavior independent of time (Fluid without critical stress, (pseudoplastic or shear-thinning, dilating), Fluid with critical stress (Bingham, Casson, etc.)
  • Time-dependent viscous fluid (thixotropic fluid, rheopexe fluid
- Purely elastic linear solids
- Viscoelasticity of molten polymers
  • Viscoelastic behavior (highlighting, the Weissenberg effect, etc.).

Rheology of solid polymers
- Reminders on tensors and index notations
- Reminders on the stress/strain relations in linear elasticity
- Different viscoelastic behaviors of polymers
- Behavior under static loads (creep, relaxation)
  • Boltzman's principle of superposition
  • Models: Models of Maxwell, Kelvin-Voigt, ...
  • Creep and relaxation experiments
  • Notion of relaxation time
- Viscoelastic behavior of polymers under dynamic loads
  (Complex module)
- Solid State Testing (Creep and Relaxation, Tensile, Torsion, Shock, Fatigue, Rupture, Dynamic Mechanical Analysis)

TP: (Depending on the capacity of the establishment)
- Practical work Viscometry: determination of the viscosity and rheological behavior of different fluids (Newtonian and non-Newtonian)
- Practical work in rheometry (rheology of complex properties, measuring the viscosity of dilute polymer solutions, measuring the viscoelasticity of polymers, etc.)

Assessment method: Continuous Control: 40%, Review: 60% .

Bibliographic references:

RI TANNER "Engineering rheology" Oxford Science Publications, 1992.
CL ROHN "Analytical polymer Rheology" Hanser, New York, 1995. JM PIAU and JF AGASSANT "Rheology for polymer melt processing", Elsevier, 1996. DEALY / SAUCIER "Rheology in plastics quality", SPE – Hanser, 2000
CW MACOSKO, Rheology: principles, measurements and applications, ed. VHC, 1994.
IM WARD "Mechanical properties of solid polymers" John Wiley and sons, London 1971
*JD FERRY "Viscoelastic properties of polymers" John Wiley Eds. New-York, 1980 AD JENKINS "Polymer science" Vol 1 and 2, North Holland Pub, Amsterdam, 1972 M.DOÎ and SF EDWARDS "The phenomenological theory of linear viscoelastic behavior" Springer**

Semester: 1
Course unit: UED 1.1
Material 1: Classes of materials and polymers
VHS: 45h00 (Class: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

The knowledge and characterization of solids with perfectly controlled shapes, sizes and structures has become essential, due to their wide use in industry: catalysts for cracking or hydrocarbon synthesis, fillers introduced into elastomers or paints, pigments , adsorbents used for purification or chemical analysis (molecular sieves, adsorbents for chromatography), hydraulic binders (concretes), powders intended for the preparation of emulsions (emulsions of products for agricultural treatments)…

The objective of the course is to provide the student with a clear vision of the major classes of materials, their physico-chemical characteristics in order to be able to give their limit of use.

Recommended prior knowledge:

General chemistry, organic chemistry, thermodynamics

Material content:

Chapter 1. Inorganic Materials **(5 Weeks)**

I- Introduction: cohesion in crystalline solids, physical properties of materials.
II- Metals and alloys
III- Ceramics and glasses
IV- Damage to materials over time

Chapter 2. Organic materials **(5 weeks)**

I- Presence of polymers in the environment
II- Classification of synthetic and natural polymers
III- Place of polymeric materials compared to ceramic metals

Chapter 3. Classification of polymers by their properties **(5 Weeks)**

I- Thermal properties
II- Mechanical properties
III- Electrical properties
IV-Optical properties

Assessment method: Exam: 100%.

Bibliographic references :

1- Microstructure and properties of materials.
Press Collective of the National School of Bridges and Roads (ENPC)
Presses of the National School of Bridges and Roads (ENPC)

2- Properties of natural materials
3- Materials (box of 4 volumes) - AMC, special issue
Steel - Wood - Terracotta - Glass, Collectif Groupe Moniteur

Semester: 1
Course unit: UED 1.1
Subject 1: Electrochemistry
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

Teaching objectives: The student must be able to apply the knowledge acquired in electrochemistry and more particularly in electrochemical kinetics, to materials. This EU also allows him to discover the importance of electrochemical phenomena that occur in the materials industries.

Recommended prior knowledge:

Basic notions of chemistry.

Material content:

A- Fundamental electrochemistry:
1- brief reminders of electrochemical systems at equilibrium
2- electrochemical kinetics,
3- introduction to cyclic voltammetry and impedance spectrometry

B- Electrochemistry applied to materials:
1- application of electrochemical kinetics to corrosion: mechanisms, protection against corrosion,
2- electrochemical surface treatments: electrolytic polishing, electrolytic deposits, electropolymerization,
3- Impedance spectrometry

Assessment method: Exam: 100%.

Bibliographic references :

- *Pannietier –Souchay, General chemistry – Chemical kinetics Ed. Masson -1974*
- *Rochaix, Electrochemistry, Nathan, Paris, 1996*
- *G. Charlot, Electrochemical and absorptiometric methods, Masson et Cie, Paris, 1971*
- *C. Antropov, Theoretical Electrochemistry, Ed. Mir, Moscow, 1975*

Semester: 1
Course unit: UET 1.1
Subject 1: Technical English and Terminology
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

To introduce the student to technical vocabulary. Strengthen your knowledge of the language. Help him understand and synthesize a technical document. Enable him to understand a conversation in English held in a scientific setting.

Recommended prior knowledge:

Vocabulary and basic grammar in English

Material content:

- Written comprehension: Reading and analysis of texts relating to the specialty.

- Oral comprehension: Based on authentic popular science video documents, note taking, summary and presentation of the document.

- Oral expression: Presentation of a scientific or technical subject, elaboration and exchange of oral messages (ideas and data), Telephone communication, Gestural expression.

- Written expression: Extraction of ideas from a scientific document, Writing of a scientific message, Exchange of information in writing, writing of CVs, letters of application for internships or jobs.

Recommendation: It is strongly recommended that the person in charge of the subject present and explain at the end of each session (at most) about ten technical words of the specialty in the three languages (if possible): English, French and Arabic.

Assessment method:

Review: 100%.

Bibliographic references:

1. *PT Danison, Practical guide to writing in English: customs and rules, practical advice, Editions d'Organisation 2007*
2. *A. Chamberlain, R. Steele, Practical Guide to Communication: English, Didier 1992*
3. *R. Ernst, Dictionary of techniques and applied sciences: French-English, Dunod 2002.*
4. *J. Comfort, S. Hick, and A. Savage, Basic Technical English, Oxford University Press, 1980*

III - Detailed program by subject of semester S2

Semester: 2
Course Unit: UEF 1.2.1
Matter : Implementation of polymers
VHS: 67h30 (class: 3h00, tutorial: 1h30)
Credits: 6
Rating: 3

Teaching objectives:
The aim of this module is to learn about the techniques for transforming polymers and plastics. It is a question of assimilating the different states of transformation of the polymer and of designing and predicting the rheology.

Recommended prior knowledge:
Basic notions of macromolecular chemistry and the physico-chemistry of polymers.

Material content:

I- Introduction: Influence of the structure of polymers on their transformation

II- Storage and pre-treatment of polymers: Storage of materials to be transformed, Pre-treatment (pre-drying, pre-forming and pre-heating).

III- Implementation of liquid systems: molding processes by dipping, coating, casting, injection-reaction (RIM).

IV- Transformation of polymers in the plastic state: extrusion and molding processes: extrusion of tubes and profiles, plates, sheets, films, fibers and filaments, blow molding of sheaths. Injection molding, transfer, compression, calendering, coatings.

V- Transformation of polymers in the viscoelastic state: Thermoforming, extrusion-blow molding of hollow bodies, injection-blowing of hollow bodies.

VI- Application of rheology to design: Extrusion dies, injection moulds, compression moulds, calenders.

VII- Regeneration of polymer waste: Industrial waste, non-industrial waste.

Assessment method :
Continuous control: 40%; Review: 60%.

Bibliographic references :

CG Gogos and Z. Tadmor: Principles of Polymer Processing, John Wiley, New York (1978)
J. Bost: Plastics - Technology and Plastics, Lavoisier, Paris (1982)
P. Dubois: Modern Plastics, Lavoisier, Paris (1963)
L. Mascia: Thermoplastics - materials Engineering, Elsevier publishing Co. Inc, New York (1989)
JF Agassant, P. Avenas and J. Ph. Sergent: Shaping of Plastic Materials, Lavoisier, Paris (1986)

Semester: 2
Course Unit: UEF 1.2.1
Material: Polymer blend
VHS: 45 h (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The objective of the Polymer Blending course is to provide the most comprehensive information on all aspects of polymer blending science and plastics technology. Accordingly, this module can be considered to have two parts: Fundamentals and Technology.

Recommended prior knowledge:

Basic notions of organic chemistry, macromolecular chemistry and polymer physics

Material content:

1. Introduction to polymer blends: Resins and their blends, Specialty polymers and their blends, biodegradable blends, blending and recycling.
2. Thermodynamics of polymer blends: liquid polymer blends. Phase separation. Measurement methods.
3. Crystallization, morphological structure and melting of polymer blends: miscible blends, immiscible blends.
4. Compatibilization of polymer blends: Types of polymer blends. Compatibilization by addition of a compatibilizing agent: formation of graft copolymers, formation of block copolymer, covalent crosslinking.
5. Morphology of polymer blends: microscopic methods
6. Preparation of polymer blends: Fundamentals of blending, mixing methods and equipment, reactive treatment (compatibilization).
7. Properties and performance of polymer blends
8. Application of polymer blends

Assessment method:

Continuous control: 40%; Review: 60%.

Bibliographic references :

LA Utracki, Polymers blends Handbook, vol.1, Kluwer Academic Publishers, (2002), Dordrecht, The Netherlands.
LA Utracki, Polymer Alloys and Blends, Hanser Publishers, (1989), Munich, Germany.
MM Coleman, JF Graf and PC Painter, Specific Interactions and the Miscibility of Polymer Blends, Technomics Publishing, (1991), Lancaster, UK
Datta, S., and Lohse, DJ, Polymeric Compatibilizers: Uses and Benefits in Polymer Blends, Hanser Pub., (1996), Munich, Germany.
O. Olabishi, LM Robeson and MY Shaw, Polymer-Polymer Miscibility, Academic Press, (1979), New York.

Semester: 2

Course Unit: UEF 1.2.2
Material: Conductive Polymers
VHS: 45h00 (Class: 1h30 , TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The objective of the Conducting Polymers course is to provide students with the most comprehensive information on this new aspect of polymer science, through the presentation of a class of organic compounds which are given electrically conductive properties by different chemical treatments (doping) or by structuring the material.

Recommended prior knowledge:

Basic notions in electrochemistry, electricity and macromolecular chemistry.

Material content:

1. Introduction: Theory of conjugated polymers, Electronic delocalization, Doping methods, Synergy of optical and electronic properties, Evolution of the electrical conductivity of polymers

2. Classification of electrochemically active polymers: Redox polymers, polymers derived from aromatic amines, conductive composites.

3. Chemical and electrochemical syntheses of conductive polymers: helical polyacetylene, poly(arylene vinylenes), polyaniline, polypyrrole, polythiophenes.

4. Redox transformations and transport processes: transport of electrons, ions, coupling, relaxation and hysteresis phenomena.

5. Application of conductive polymers: Deposition by thin film and microstructuring (antistatic coatings, microwave absorption, Microelectronics), electroluminescent and electrochromic devices, corrosion protection, sensors, gas detectors, Electroanalysis and biosensors, Materials for energy technologies.

Assessment method :

Continuous control: 40%; Review: 60%.

Bibliographic references :

G.Inzelt, Conducting Polymers. A New Era in Electrochemistry, Springer, (2012), Dordrecht, The Netherlands
TA Skotheim and JR Reynolds, Handbook of Conducting Polymers. Conjugated Polymers, Theory, Synthesis, Properties and Characterization, CRC Press Taylor & Francis, (2007), Boca Raton, FL, USA.
F. Monfort-Windels, Making Polymers Conductive: State of the Art, Lavoisier, (1999), France.
P. Chandrasekhar, Conducting Polymers, Fundamentals and Applications: A Practical Approach, Springer Science+Business Media, (1999), New York, USA.
L. Rupprecht, Conductive Polymers and Plastics In Industrial Applications, Plastics design Library, (1999), Norwich, USA.

Semester: 2
Course Unit: UEF 1.2.2

Material: Polymer membranes
VHS: 45h (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Membranes have gained an important place in chemical technology and are increasingly being used in a wide range of biomedical applications. The objective of this course is to present one of the most important industrial uses of polymers.

Recommended prior knowledge:

Basic notions of surface chemistry, solution chemistry and physical chemistry of polymers.

Material content:

1. Introduction, types of membranes: symmetric porous membranes, dense membranes, charged membranes, asymmetric membranes, ion exchange membranes.
2. Microfiltration: manufacture and structure of the membrane, determination of pore size, retention characteristics, applications (sterilization, filtration of particles, heavy metals, etc.)
3. Ultrafiltration: manufacture and structure of the membrane, determination of pore size, retention characteristics, applications (pharmaceutical industries, water-oil separation, decontamination, treatment of industrial effluents, etc.)
4. Reverse Osmosis: manufacture of reverse osmosis membranes (flat, spiral, tubular, hollow fiber), applications: Industrial reverse osmosis in refineries, reverse osmosis and pollution control, reverse osmosis and desalination of water from sea, …
5. Electrodialysis: typical membranes (homogeneous, heterogeneous), retention characteristics, applications: bipolar membranes, electrodes and power cells, etc.
6. Gas separation membranes: gas transport, manufacture and structure of membranes, applications: carbon dioxide separation, oxygen/nitrogen separation, dehydration, etc.

Assessment method :

Continuous control 40%; Review 60%.

Bibliographic references:

MC Porter, Handbook of Industrial Membrane Technology, Noyes Publications, (1990), Westwood, USA.
D. Bouyer, C. Faur, C. Pochat, Processes for producing membranes by phase separation, Engineering Techniques, Article / Ref: J2799 V1, (2011).
L. Auvray, F. Devreux, B. Duplantier, Physics of membranes and biological polymers, Ed. École polytechnique, (2003), Paris, France.
M. Mulder, Basic Principles of Membrane Technology, Kluwer Academic Publishers, (1991), Dordrecht, The Netherlands.
RW Baker, Membrane Technology and Applications, McGraw-Hill, (2000), New York, USA.

Semester: 2
Course unit: UEM1.2
Matter : Characterization of polymers
VHS: 67h30 (Class: 1h30, TD: 1h30, TP: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

The aim of this module is to know the techniques for characterizing polymeric materials and to assimilate the basic notions in the synthesis and behavior of macromolecules.

Recommended prior knowledge:

Basic notions of organic and macromolecular chemistry as well as the physico-chemistry of polymers.

Material content:

1. Concept of molecular mass, Concept of average: Definitions of Mn, Mw, Mz and Mv.
2. Polymolecularity, Molecular mass distribution of a polymer.
3. Fractionation, gel permeation chromatography. Osmometry.
4. Hydrodynamic measurements: viscometry, ultracentrifugation.
5. Spectrometric characterization techniques: Infrared and Raman spectroscopy, NMR and mass spectrometry,
6. Microscopic techniques for characterizing materials: optical microscopy, scanning and transmission electron microscopy,
7. X-ray diffraction techniques,
8. Thermal analysis methods: differential thermal analysis, Thermogravimetry.
9. Mechanical methods and rheometry: static and dynamic tests.

TP : (Depending on the capacity of the establishment)
- Practical work Viscometry: determination of the molecular weight of a polymer by viscometry (Relation of Mark–Houwink) or by gel permeation chromatography (GPC).
- Practical work in infrared spectroscopy: synthesis of a polymer and analysis of its structure by FTIR spectroscopy.
- Thermal analysis practical work: Study of the thermal stability of a polymer by thermogravimetric analysis or Study of the phase transitions of a plastic by differential thermal analysis (DTA).
- Practical work in mechanical analysis: Study of the behavior in traction (in compression) of a polymer, breaking load, deformation, modulus of elasticity. Study of the flow of a polymer solution by rheometry.

Assessment method:

Continuous Control: 40%, Review: 60% .

Bibliographic references:

J. Prud'homme, RE Prud'homme: Synthesis and characterization of macromolecules. The presses of the University of Montreal, 1981, Canada.
PJ Flory: Principles of polymer chemistry, Cornell. University Press, 1953, Ithaca New York
IM Ward, Mechanical properties of solid polymers. Wiley-Interscience, 1971, London
JR BILLEYER, Text book of polymer science. John Wiley, 1971, New York
F. Rouessac, A. Rouessac, Chemical analysis: modern instrumental methods and techniques, Ed. Dunod, 2004, Paris

Semester: 2
Course unit: UEM1.2
Subject: Applied Software
VHS: 37h30 (Class: 1h30, Lab: 1h00)
Credits: 3
Coefficient: 2

Teaching objectives:

- Course on numerical methods (finite element method and finite volume methods).
- Become familiar with simulation software for the implementation of polymers and the flows of these non-Newtonian materials.

Recommended prior knowledge:

Material content:

According to the capacities of the establishment

Course: Discretization methods used in digital simulation software (Finite element method, finite volume method)

Practical work: Simulation using computer codes used by mold makers and plastics makers (simulation of simple filling: Visualization of material flow, maps of temperatures, speeds, pressures, shear stresses, etc.)
Practical work: Numerical simulation of non-Newtonian fluids (in particular viscoelastic and viscoplastic fluids)

Assessment method: Continuous Assessment: 40%, Examination: 60% .

Bibliographic references:

Semester: 2
Course unit: UED 1.2
Subject 1: Subject of choice 1 (Example: Industrial safety)
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

This course allows you to assimilate the technical aspects of the safety of chemical processes. He must make students aware of preventive measures to reduce major risks linked to explosive atmospheres in the company.

Recommended prior knowledge:

Basic notions in chemistry in general and in industrial chemistry, in particular. Students in chemistry or physico-chemistry holding a license in technical sciences in process engineering will be able to follow.

Material content:

1. The main chemical risks in the workplace: Risks linked to reactions and risks linked to stocks. The risks associated with gases and gaseous media. Dust explosions. Corrosive and toxic gases.

2. Analysis and management of technological risks: Definition and characteristics of major technological risks. The sources of risk, evaluation of the probabilities and consequences of a risk. Acceptable risk. Risk interdependencies. Technological risks in business strategies. Legislation concerning technological risks. Disaster management.

3. Risk reduction measures: Preventive measures, corrective measures, post-incident intervention measures, major crisis management. Technical, regulatory and human aspects. The residual risk.

4. Ergonomics and safety: Reliability, human error and prevention. Designing systems to withstand human error. Human reliability assessment issues. Representation of accidents and risks by logical trees.

Assessment method:

Review: 100%.

Bibliographic references :

- Safety recommendations: laboratories, Ed.Technip, Paris, 1976.
- Y. Dacosta, Food bio-protection: microbial antagonism in the service of microbiological safety and quality, Ed. Dacosta, Paris, 2000.
- J. Boisselier, Hygiene and safety, who is responsible? Ed. Organization, Paris, 1982.
- JL. Pomian, T. Pradère, I. Gaillard, Engineering and ergonomics: elements of ergonomics for use in industrial projects, Ed. Cépaduès, Toulouse, 1997.
- G. Gautret de la Moricière, The chemical risk, Ed. Dunod, Paris, 2008
- N. Margossian, Reminder of the chemical risk 2nd edition, Ed. Lavoisier, Paris, 2007.

Semester: 2
Course unit: UED 1.2
Subject 2: Subject of your choice 2

VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

Recommended prior knowledge:

.

Material content:

Assessment method:

Review: 100%.

Bibliographic references :

Semester: 2
Course unit: UET 1.2
Subject 1: Ethics, deontology and intellectual property
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

Develop student awareness of ethical principles . Introduce them to the rules that govern life at the university (their rights and obligations vis-à-vis the university community) and in the world of work. Make them aware of the respect and valuation of intellectual property. Explain to them the risks of moral evils such as corruption and how to combat them.

Recommended prior knowledge:

None

Material content:

A- Ethics and deontology

I. Notions of Ethics and Deontology **(3 weeks)**

1. Introduction
   1. Definitions: Morality, ethics, deontology
   2. Distinction between ethics and deontology
2. Charter of ethics and professional conduct of the MESRS: Integrity and honesty. Academic freedom. Mutual respect. Requirement of scientific truth, objectivity and critical thinking. Equity. Rights and obligations of the student, teacher, administrative and technical staff.
3. Ethics and deontology in the world of work
   Legal confidentiality in business. Loyalty to the company. Responsibility within the company, Conflicts of interest. Integrity (corruption in work, its forms, its consequences, methods of fighting and sanctions against corruption)

II. Integral and responsible research **(3 weeks)**

1. Respect for the principles of ethics in teaching and research
2. Responsibilities in teamwork: Professional equality of treatment. Conduct against discrimination. The search for the general interest. Inappropriate conduct in the context of collective work
3. Adopting responsible conduct and combating excesses: Adopting responsible conduct in research. Scientific fraud. Conduct against fraud. Plagiarism (definition of plagiarism, different forms of plagiarism, procedures to avoid unintentional plagiarism, detection of plagiarism, sanctions against plagiarists, etc.). Falsification and fabrication of data.

B- Intellectual property

I- Fundamentals of intellectual property (1 week)

1. Industrial property . Literary and artistic property.
2. Rules for citing references (books, scientific articles, communications in a congress, theses, dissertations, ...)

II- Copyright (5 weeks)

1. Copyright in the digital environment
Introduction. Database copyright , software copyright . Specific case of free software.

2. Copyright in the internet and e-commerce
Domain name rights. Intellectual property on the internet. Law of the e-commerce site. Intellectual property and social networks.

3. Patent
Definition. Rights in a patent. Usefulness of a patent. Patentability . Patent application in Algeria and worldwide .

4. Trademarks, designs and models
Definition. Trademark Law. Designs and models law . Denomination of origin. The secret. Counterfeit .

5. Geographical Indications Law
Definitions. Protection of Geographical Indications in Algeria. International Treaties on Geographical Indications **.**

III- Protection and enhancement of intellectual property (3 weeks)

How to protect intellectual property. Violation of rights and legal tool. Valuation of intellectual property. Protection of intellectual property in Algeria.

Assessment method:
Review: 100%

Bibliographic references :

1. Charter of ethics and university deontology, https://www.mesrs.dz/documents/12221/26200/Charte+fran__ais+d__f.pdf/50d6de61-aabd-4829-84b3-8302b790bdce
2. Orders No. 933 of July 28, 2016 setting the rules relating to the prevention and fight against plagiarism
3. The ABCs of Copyright, United Nations Educational, Scientific and Cultural Organization (UNESCO)
4. E. Prairat, On teacher ethics. Paris, PUF, 2009.
5. Racine L., Legault GA, Bégin, L., Ethics and Engineering, Montreal, McGraw Hill, 1991.
6. Siroux, D., Deontology: Dictionary of Ethics and Moral Philosophy, Paris, Quadrige, 2004, p. 474-477.
7. Medina Y., Ethics, what will change in the company, editions of Organization, 2003.
8. Didier Ch., Thinking the ethics of engineers, Presses Universitaires de France, 2008.

9. Gavarini L. and Ottavi D., Editorial. of professional ethics in training and research, Research and training, 52 | 2006, 5-11.
10. Caré C., Morality, ethics, deontology. Administration and education, 2nd quarter 2002, n°94.
11. Jacquet-Francillon, Francois. Concept: professional ethics. Le Télémaque, May 2000, n° 17
12. Carr, D. Professionalism and Ethics in Teaching. New York, NY Routledge. 2000.
13. Galloux, JC, Industrial Property Law. Dalloz 2003.
14. Wagret F. and JM., Patents, trademarks and industrial property. PUF 2001
15. Dekermadec, Y., Innovating through patents: a revolution with the internet. 1999
16. AEUTBM. The engineer at the heart of innovation. Belfort-Montbeliard University of Technology
17. Fanny Rinck And léda Mansour, literacy in the digital age: copying and pasting among students, University of Grenoble 3 and University of Paris-Ouest Nanterre la Défense Nanterre, France
18. Didier DUGUEST IEMN, Citing your sources, IAE Nantes 2008
19. Similarity detection software: a solution to electronic plagiarism? Report of the Working Group on electronic plagiarism presented to the CREPUQ Sub-Committee on Pedagogy and ICT
20. Emanuela Chiriac, Monique Filiatrault and André Régimbald, Student Guide: Intellectual Integrity Plagiarism, Cheating and Fraud… Avoiding Them and, Above All, How to Cite Sources Properly, 2014.
21. Publication of the University of Montreal, Plagiarism prevention strategies, Integrity, fraud and plagiarism, 2010.
22. Pierrick Malissard, Intellectual property: origin and evolution, 2010.
23. The website of the World Intellectual Property Organization www.wipo.int
24. http://www.app.asso.fr/

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

COMPLIANCE FRAMEWORK

Training Offer

L.M.D

ACADEMIC BACHELOR DEGREE (LICENSE)

University	Faculty/ Institute	Department
20 August 1955 University Skikda	Letters and Languages	Letters and Foreign Languages

Domain	Field	Specialty
Letters and Foreign Languages	English Language	English Language

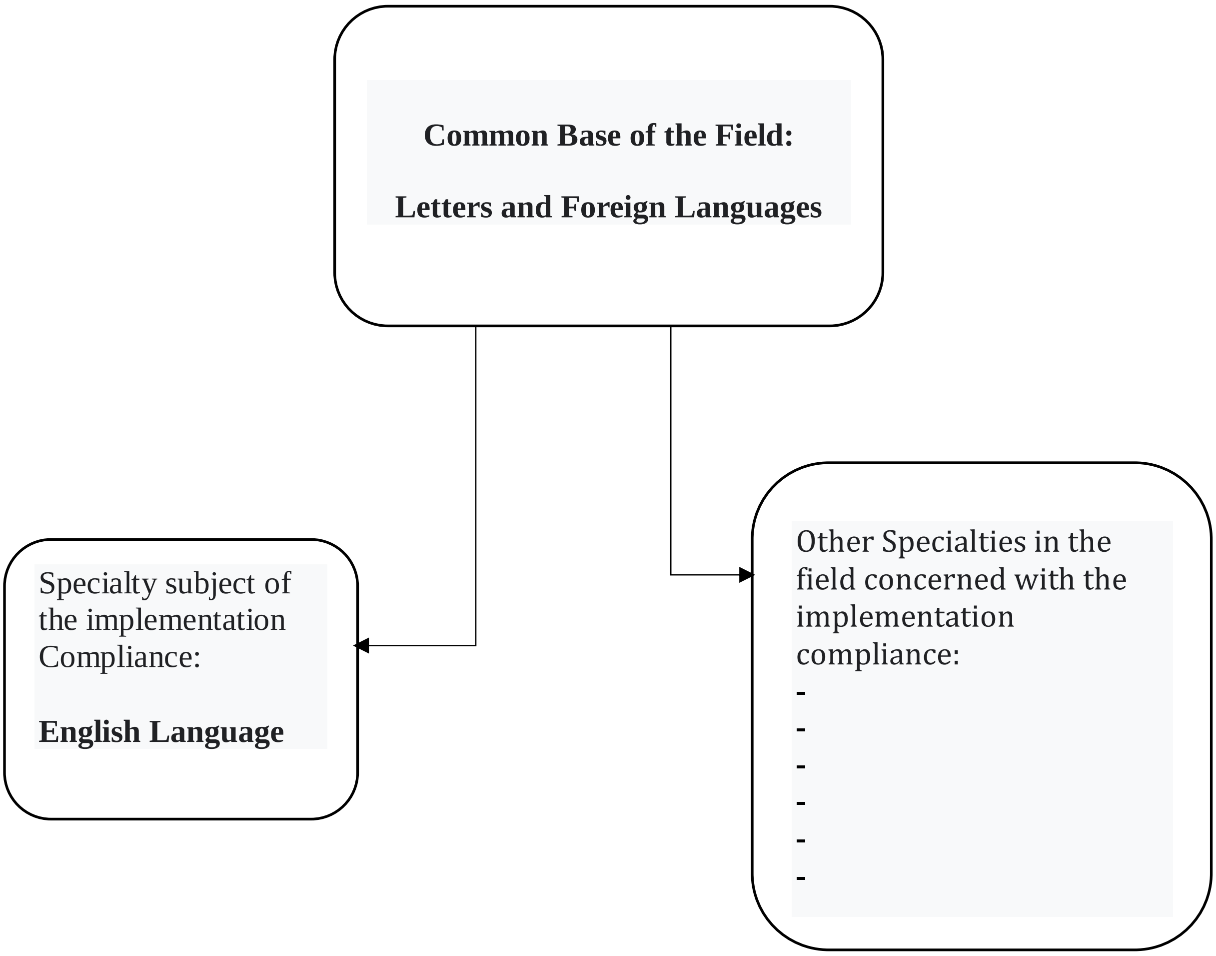
I. Bachelor’s Degree Description

- **CONTEXT AND OBJECTIVES OF THE TRAINING**

A – General organization of the training: position of the project

(Mandatory field)

If multiple licenses are offered or already supported at the institution level (same team training or other training teams), shown in the following diagram, the position of this project compared to other courses.



B. Training objectives (Mandatory field)

(Skills targeted, knowledge acquired at the end of the training - maximum 20 lines)

In today's world, dominated by communication technologies, learning of several foreign languages is necessary for our students. On the other hand, globalization at the economic level requires the mastery of several foreign languages on the part of the learners, in order to be able to easily integrate in the job market and especially in foreign companies.

On another level, and regarding the demographic growth of our country, the needs of teachers are always growing and especially in the field of foreign languages. At the end of this training, the learner will be equipped with theoretical and methodological tools, to master the foreign language.

The learner will be equipped with the knowledge that allows him to easily evolve in the target language.

The learner will be equipped with know-hows allowing him to evolve in a company or a company abroad (student mobility). The Algerian student will be able to pursue a master's degree in foreign languages in a foreign country.

C – Profiles and skills targeted (Mandatory field) (maximum 20 lines):

At the end of this training, the student will master the language especially the syntax and lexis.

This skill will enable him to communicate orally and in writing in everyday life and in professional teaching situations. Indeed, the student will be able to assume the teaching tasks of the target language.

He will also be able to present a point of view, orally, in front of an audience or in writing and argue it.

At the written level, he will also be able to read and analyze a more or less long text and write a comment.

They will be able, from an academic research perspective, to write in the target language of personal texts related to a research topic.

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

COMPLIANCE FRAMEWORK

ACADEMIC MASTER TRAINING OFFER

University	Faculty/ Institute	Department
20 August 1955 University Skikda	Letters and Languages	Letters and Foreign Languages

Domain	Field	Specialty
Letters and Foreign Languages	English Language	Civilization and literature

1. Objectives:

A. Pedagogical Objectives

Enhancement of knowledge in British and American literatures;

Enhancement of knowledge in British and American civilizations;

Development of literature/civilization methodology (Historical approach) in preparation for the completion of the M2 thesis and progression towards the next academic milestone, the doctorate.

B. Skills to be Acquired

The student will develop a high level of proficiency in the English language, encompassing both written and oral communication, as well as a deep understanding of Anglo-Saxon culture through the study of literature and civilization. At the completion of the master's program, the student should possess a comprehensive knowledge of the history of Great Britain and the United States. They should be able to critically analyze and address significant social, economic, political, and historical issues in these countries, while also demonstrating an understanding of institutional decision-making processes and the ability to make informed projections.

In summary, the student will have the capacity to formulate their doctoral research question proficiently in the fields of Anglo-Saxon literature and civilizations.

C. **Targeted Professional Skills**: (in terms of professional integration maximum 20 lines)

The Master's program proposed by the training team is designed as a natural progression from the undergraduate program in Foreign Language, Literature, and Civilization at the University of Skikda. It retains the essential modules taught at the undergraduate level, ensuring continuity and further depth of study in the Master's program.

- This Master's program prioritizes the literary dimension of the curriculum, providing our students with the opportunity to explore intercultural competence through universal literary and artistic movements. Consequently, students will acquire theoretical and methodological frameworks that enable them to engage with diverse cultural contexts and cultivate a reflective approach to various art forms.

- This approach has emerged as an epistemological pivot by successfully integrating various previously dissociated elements, such as individualized education and learner-centeredness, into a cohesive framework. Consequently, it empowers students within the Master's program to reevaluate their acquisition model and reshape their understanding of the learning process.
- Its objective is to foster the cultivation of critical thinking and analytical abilities by delving deeper into the aforementioned domains of knowledge.
- Its objective is to enable the acquisition of literary genres and discourses. The Master's program in Foreign Language, Literature, and Civilization provides a comprehensive education at an advanced research level, while also offering training for teaching positions and careers in the cultural field, particularly those related to emerging technologies.

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

COMPLIANCE FRAMEWORK

Training Offer

L.M.D

ACADEMIC LICENSE

University	Faculty/ Institute	Department
20 August 1955 University Skikda	Letters and Languages	Letters and Foreign Languages

Domain	Field	Specialty
Letters and Foreign Languages	English Language	English Language

1. OBJECTIVES:

In the contemporary world, which is heavily influenced by communication technologies, it is imperative for our students to acquire proficiency in multiple foreign languages.

Moreover, in the context of economic globalization, proficiency in several foreign languages is essential for learners to effectively enter the job market, particularly in foreign enterprises, facilitating their integration into a globalized workforce.

In addition, given the population growth in our country, there is a growing need for teachers, particularly in the field of foreign languages. Upon completing this program, learners will possess theoretical and methodological tools that will empower them to achieve fluency in a foreign language.

The learner will acquire the necessary knowledge and skills to proficiently navigate and operate within the target language.

The learner will develop competencies that will facilitate their adaptation and success within foreign enterprises or societies, emphasizing the potential for student mobility.

Algerian students will possess the necessary abilities to undertake a Master's program in foreign languages in a foreign country.

2. Targeted Professional Skills

Upon completion of this program, the student will attain a high level of proficiency in the language, particularly in terms of syntax and vocabulary. This competence will enable them to effectively communicate both orally and in writing in various everyday and professional teaching contexts. Notably, the student will be capable of assuming teaching roles in the target language. Furthermore, they will demonstrate the ability to articulate and support their viewpoints when presenting orally to an audience or in written form.

In terms of written proficiency, they will demonstrate the capacity to comprehend and analyze texts of varying lengths, and produce well-structured commentaries. From an academic research perspective, they will possess the skills to write personal texts in the target language that are relevant to a specific research theme.

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

COMPLIANCE FRAMEWORK

Training Offer

L.M.D

ACADEMIC LICENSE

University	Faculty/ Institute	Department
20 August 1955 University Skikda	Letters and Languages	Letters and Foreign Languages

Domain	Field	Specialty
Letters and Foreign Languages	French Language	Civilization and literature

1. Objectives:

Our Master's program in Foreign Literatures and Civilizations is a natural progression from the academic curriculum of the undergraduate program in Literature and Foreign Civilizations. With this in mind, the objective of this program is to further explore specific areas of knowledge that have already been covered during the undergraduate program and incorporate additional disciplines in order to broaden students' horizons. This will enable them to have a wider selection of topics to choose from when deciding on the subject of their dissertations.

The main goal of this Master's program is to provide students with a foundation in research. As part of this program, students will be required to write a thesis, which will be publicly defended, thereby adhering to the norms of academic research. With this intention, the program aims to provide the Master's candidates with methodological tools and allow them to apply the ones they have already acquired during their undergraduate studies.

Furthermore, this program will provide students with theoretical tools to approach their chosen theme. Building upon the foundations laid in the previous three years, the teaching of these tools will be further deepened during this program and may even expand to other fields related to this course of study. In fact, this Master's program will extend its scope to include other fields, such as the arts, specifically cinema and theater.

This program's broad scope will offer students valuable opportunities for professional development, even if they choose not to pursue a doctoral degree. It opens doors to various career paths, including education and journalism.

2. Targeted Professional Skills :

Upon completion of the Master's program, the student is expected to write a thesis and publicly defend it. In the first year (M1) of the program, the Master's candidate will acquire the ability to address a question by utilizing the theoretical and methodological tools provided during this initial year. In this regard, the student will be capable of producing progressively longer texts to communicate the outcomes of their research. They will also be capable of presenting and justifying these findings orally to a knowledgeable or specialized audience. Furthermore, they will be able to conceive and carry out a personal research project to its conclusion.

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

ACADEMIC MASTER TRAINING OFFER

University	Faculty/ Institute	Department
20 August 1955 University Skikda	Letters and Languages	Letters and Foreign Languages

Domain: Letters and Foreign Languages

Field: English Language

Specialty: Linguistics and Applied Language

University Year : 2016/2017

- **CONTEXT AND OBJECTIVES OF THE TRAINING:** *(targeted skills, pedagogical knowledge acquired at the end of the training - maximum 20 lines)*

1. **Pedagogical Objectives :**

Deepening of knowledge in British and American literatures;

Deepening of knowledge in British and American civilizations;

Methodology of literature/civilization (History) with a view to writing the dissertation at the end of the M2 and preparation for the third level, which is the doctorate.

2. **Skills to Acquire:**

- Mastery of the English language in its written and oral aspects and the Anglo-Saxon culture through the study of Anglo-Saxon literature and civilization.
- The student who completes his training must have a clear vision of the history of Great Britain and the United States;
- He must be able to ask questions about the big questions that affect social life, economic, political and historical perspectives of these countries and be equally capable of understanding the decision-making processes of the institutions of these countries and therefore able to make projections.
- In conclusion, the student must be able to formulate his doctoral research question in literature and Anglo-Saxon civilizations alike.

3. **Targeted job profiles and skills** (in terms of professional integration- max 20 lines)

- The Master proposed by the training team is part of the continuity of the training offer of a degree in language, literature and foreign civilization from the University of Skikda since most of the modules provided in graduation have been carried over to Masters.

- This master, which privileges the literary aspect of the course, allows our students to apprehend intercultural competences through universal literary and artistic movements. This will provide students with theoretical and methodological tools allowing them to move in different cultural areas and to develop a reflection on the different arts.
- This course majorly aims at the acquisition of methodological, linguistic, and literary skills in terms of knowledge, expertise and interpersonal skills. The intended audience being non-native speakers of the target language, we had deliberately favored the action-oriented approach in the acquisition of these skills because this innovative method, which is based on interaction between peers (chat, discussion forums, interactivity, etc.) in order to acquire the culture of the other in the selected texts offered.
- This approach, which has become an epistemological pivot due to its ability to integrate into a coherent whole a certain number of dynamism hitherto dissociated, namely the individualization of the training, the focus on the learner allows the student to rethink its obtainable model in the Master's course.
- It aims to develop critical thinking and analysis by deepening their knowledge in the above fields - It aims to acquire literary genres and discourses - The Master's in Foreign Literature and Civilization does not only offer a high-level research training level, but also training for teaching professions, for professions in the culture associated with new technologies.

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

COMPLIANCE FRAMEWORK
Training Offer
L.M.D

ACADEMIC LICENSE

University	Faculty/ Institute	Department
20 August 1955 University Skikda	Economic Sciences, Business and management sciences	Management

Domain	Field	Specialty
Economic sciences, management, and commercial sciences	management	Business Management

Training framework and objectives:

- Conditions for joining the Master's Degree

a. Conditions specified in decrees and ministerial decisions, including the basis of business administration;

b. The conditions set by the Scientific Committee of the Department of Management Sciences and the Scientific Council, such as the arrangement of students according to the average of the six semesters related to the bachelor's degree, a certificate of good conduct, or other objective conditions.

- Objectives of training (target competencies, knowledge gained at the end of training)

- Targeted competencies for undergraduate students in the LMD system, and this is in order to: Ensure that students are qualified to obtain a master's degree in business administration by deepening their theoretical economic and administrative studies, and strengthening their applied capabilities using methods And quantitative approaches to understanding and analyzing management problems.

Qualifications and abilities targeted at the end of training –

The aim of the Master of Business Administration project is to provide students with the necessary skills to exercise the tasks of teachers and managers in the field of various local or state businesses;

- Giving the student the necessary knowledge and introducing him to the perspectives that constitute the management and facilitation decisions of the institution;

- learn in the use of relevant technologies specialization to practice the professions of decision makers, control management and automation higher level ;

- Familiarity with the institutional and legal framework;

-Ability to network in a global professional setting;

- Keeping abreast of developments in the world of administration, management and business to ensure a high academic level in a science that is evolving and continuing with technological development;

- Qualify the student to continue his doctoral studies in the specialty or related majors;

- Rehabilitation and preparation of graduates for active and fruitful participation in advancing the economic development of the country and meeting its needs of qualified economic cadres;

- Encourage scientific research and participation in the service of society through training and spreading economic awareness in society.

Specialty subject of the implementation Compliance:

English Language

Other Specialties in the field concerned with the implementation compliance:

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PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

COMPLIANCE FRAMEWORK

ACADEMIC MASTER TRAINING OFFER

University	Faculty/ Institute	Department
20 August 1955 University Skikda	Human and Social Sciences	Social Sciences

Domain	Field	Specialty
Social and Human Sciences	Social Sciences	Sociology of organization and work

University Year 2017-2018

Training framework and objectives:

- **Objectives of the Formation**: *(targeted competencies and knowledge acquired at the end of the training, 20 lines maximum)*

Organization and work Sociology is one of the most important specialties in the social sciences. It offers the possibility of studying the organization with all its components.

This specialty aims to enable the student to understand technological, economic, managerial and social transformations and changes occurring in work spheres.

The latter could be realized through obtaining the necessary theoretical knowledge, and providing the student with the methodological tools to carry out field studies, in order to detect dysfunctions, for the good conduct of work and its organization.

The knowledge that the student acquires qualifies him to get closer to the organizational actualities and to know its problems and prospects for its development.

- **Targeted Qualifications and Abilities:** (concerning professional integration - 20 maximum)

The program of Organization and Work Sociology specialty aims at:

- Clarifying the dimensions and approaches of organization from a sociological point of view.
- Making the student able to realize the importance of the institution in the society.
- Understanding the social and human relations within the various institutions.
- Understanding the sociological practices within the Algerian institution.
- Linking the organization and work sociology to the economic and sociological reality of society, especially in light of the globalization and the challenges it poses.
- Obtaining a scientific qualification, which is master's degree in organization and work sociology.
- - Attempting to interpret theoretically acquired qualifications at the level of social action by making the student always close to reality.
- Providing a qualified workforce for the continuity of institutions in the local community.

- Developing university orientations towards openness to community institutions.
- Contributing in the understanding of the entrepreneurship project in the specialty of organization and work sociology.
- Forming officials who hold a master's degree in organization and work sociology, qualified for field work in various sectors.
- Giving the student the ability to employ the knowledge he acquired during his course of study.
- - Giving the student the ability to analyze social problems and provide appropriate solutions to them.
- Gaining the ability to do academic work and research, or go to work in various institutions.
- And quick adaptation to his work environment.
- Giving the student the ability to participate in group work.
- The formation of students who are able to enter the field of academic research and its relationship to the requirements of society.
- The formation of students specialized in the study of social mobility.
- The formation of students specialized in the study of the sociological development of society.
- The formation of students specialized in the sociological analysis of social structures.

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

COMPLIANCE FRAMEWORK

ACADEMIC MASTER TRAINING OFFER

University	Faculty/ Institute	Department
20 August 1955 University Skikda	Human and Social Sciences	Social Sciences

Domain	Field	Specialty
Social and Human Sciences	Social Sciences	Urban Sociology

University Year 2017-2018

Objectives of the Formation *(targeted competencies, acquired knowledge at the end of Formation)*

Targeted competencies are undergraduate students in the LMD system, and this is in order to: guarantee that students are qualified to obtain a Master's degree in Management by deepening their theoretical economic and administrative studies, and enhancing their practical abilities using quantitative methods and approaches to understand and analyze management problems.

Targeted Qualifications and Abilities:

At the end of the formation

- The aim of the Masters in Management project is to provide students with the necessary skills to carry out tasks of administrators and managers in various national or international businesses;

- Provide the student with the necessary knowledge and introduce him to the theories that form management and administrative decisions for the institution;

- Learn to use techniques which are relevant to the specialty to practice the professions of decision makers, observing management and computing at a higher level;

- Familiarity with the institutional and legal framework;

- Ability to communicate in a global professional setting;

- Keeping up with novelties in the world of administration, management and business to guarantee the high academic level in a science that is continuously evolving according to technological development;

- Qualify the student to continue his doctoral studies in the specialty or related disciplines;

- Rehabilitation and preparation of graduates for active and fruitful participation in advancing the economic development of the country and meeting its needs of qualified economic officials;

Encourage scientific research and participation in community service through training and raising economic awareness in the society;

Expanding job opportunities for graduates of the department by offering a methodology that provides them with the economic skills that are required in the Algerian work market .

Democratic Republic of Algeria and Popular

Ministry of Higher Education and Scientific Research

Skikda University

LMD TRAINING OFFER

ACADEMIC LICENSE

NATIONAL PROGRAM

2018 - 2019

Establishment	Faculty / Institute	Department

Domain	Sector	Specialty
Science And Technology	*Process Engineering*	*Process Engineering*

People 's Democratic Republic
of Algeria

Ministry of Higher Education and Scientific Research

Pedagogical Committee
National of the Domain
Science and Technology

2019 - 2018

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Degree title: Process Engineering		Year: 2018-2019

Summary

I – Identity card of the License

1 - Location of the training:

Faculty (or Institute):

Department:

References of the license authorization decree (attach copy of the decree)

2- External partners:

Other partner establishments:

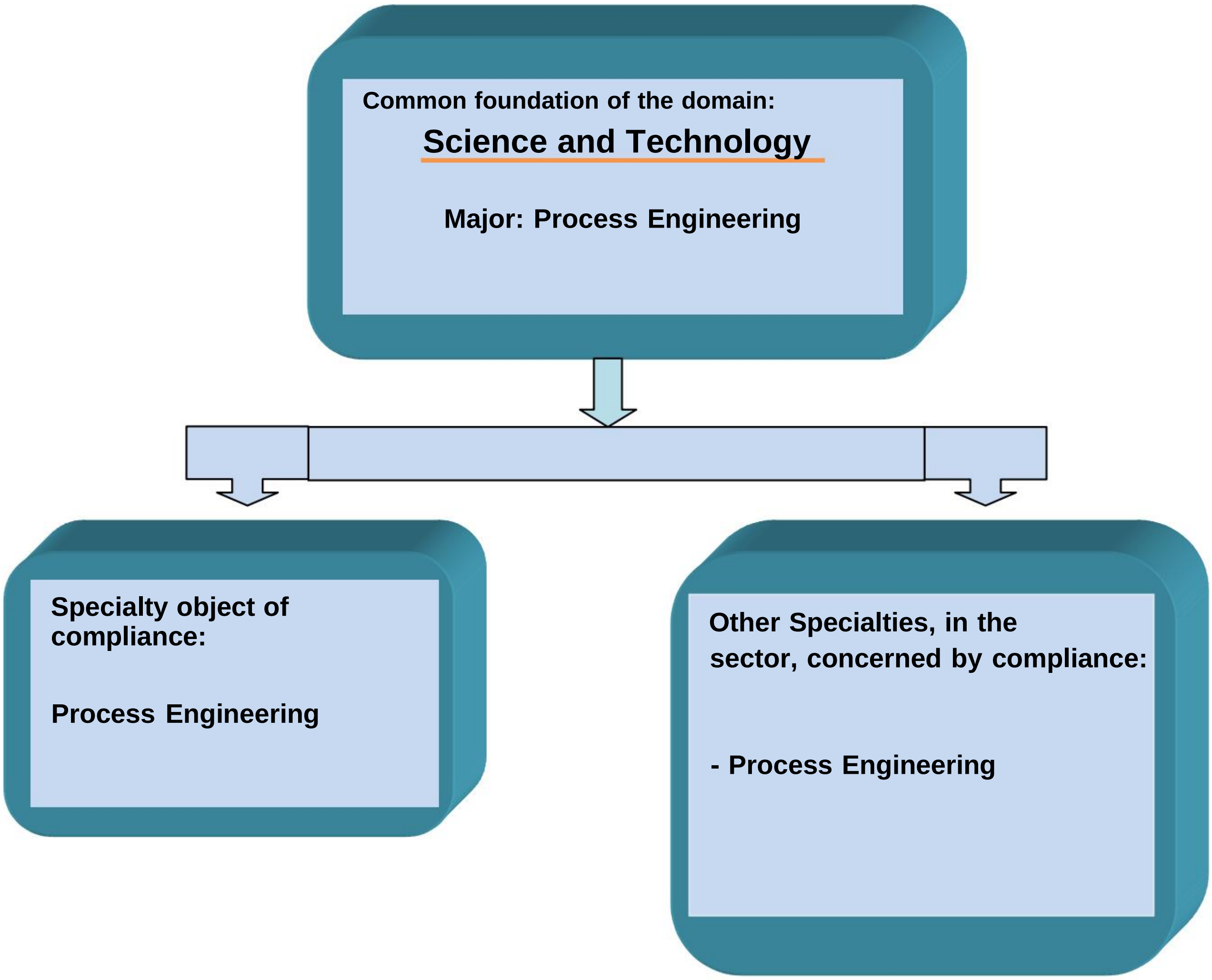
Companies and other socio-economic partners:

International partners:

3 – Context and objectives of the training

A – General organization of the training: position of the project

If several licenses are offered or already supported at the level of the establishment (same training team or other training teams), indicate in the following diagram, the position of this project in relation to the other courses.



B - Training objectives:

Process Engineering is an important sector in the field of science and technology (Domain ST). Indeed, this sector, which initially developed around fundamental Chemical Engineering, brings together a very wide range of specialties (Chemical Engineering, Environmental Engineering, Materials Engineering, Pharmaceutical Engineering, Electrochemical Engineering, Cryogenics, Energy , Agri-food, etc.).

Process Engineering is essential in all industrial processes for the transformation of matter and energy. To this end, it is essential to train people capable of mastering transformation processes on an industrial scale.
This bachelor's degree, whose curriculum contains the fundamental subjects of the sector *(physical chemistry, unit operations, transfer phenomena, reactors,* etc.) constitutes basic training for all the specialties of Process Engineering.

At the end of this multidisciplinary training, graduates will have acquired basic knowledge, not only in basic sciences *(Maths, Physics, Chemistry),* but also in technology and industrial processes *(Reactors, Process, Transfer Phenomena, Instrumentation, Industrial installations, etc.)* which are necessary for the understanding of process engineering and its various applications.

This training allows the graduate not only to pursue studies and prepare for various specialized masters, but also to integrate quickly into the socio-economic sector.

C – Profiles and skills targeted:

The general character of the license constitutes a basic training of the sector allowing access to masters in the different options (Chemical engineering, *Environmental engineering, Pharmaceutical engineering, Water treatment, Electrochemical engineering, Polymer engineering, Cryogenics* etc.), these aim to consolidate the basic notions of process engineering.

At the end of the 3rd year (L3), the graduate has acquired sufficient theoretical and practical knowledge *(Knowledge and Know-how)* which enables him to assimilate any process for the transformation of matter. He is thus capable of establishing processing balance sheets, sizing and controlling equipment and taking measurements in a production and processing chain.

The skills acquired make it possible to integrate different industrial sectors *(chemical, pharmaceutical, electrochemical, food industries, materials, cosmetics, water treatment, environmental protection,* etc.), and to meet the country's need for executives techniques.

D – Regional and national employability potential:

Process Engineering deals with the industrialization of chemistry and processes for transforming and purifying matter. The fields of application follow one another throughout the development of the manufacturing process: development in the laboratory, pilot scale, sizing of the equipment, construction of the unit then its operation.

This course in process engineering aims to train versatile executives with knowledge and

know-how that allows them to be involved at all levels of the process. They are intended to occupy positions of Study Manager, Project Manager, Process Technician, etc.

This course targets large companies operating in the fields of processes, chemistry, energy and the environment on a national scale, such as Sonatrach, Sonelgaz, ADE, cement factories, Saidal, etc. At the regional level, there is also a strong potential for outlets at the level of the SME-SMI fabric having activities of design offices, consulting firms, material transformation and treatment.

With the course offered as part of this license, graduates are able to integrate different *socio-economic sectors :*

Technical education in secondary; Research laboratories; Public bodies;
Design offices; The industrial sector.

For this last sector, these graduates constitute the backbone of the management in the production units *(Chemical Industries, Petrochemicals, Refining, Cement, Water Treatment, Drug Manufacturing Technology, Agrifood, etc.)*

E – Gateways to other specialties:

Common semesters 1 and 2	
Sector	Specialties
Aeronautics	Aeronautics
civil engineering	civil engineering
HVAC engineering	HVAC engineering
Maritime genius	Naval propulsion and hydrodynamics
	Naval construction and architecture
Mechanical Engineering	Energetics
	Mechanical construction
	Materials Engineering
Hydraulic	Hydraulic
transport engineering	transport engineering
Metallurgy	Metallurgy
Precision optics and mechanics	Optics and photonics
	Precision engineering
Public works	Public works
Automatique	Automatique
Electromechanical	Electromechanical
	Industrial maintenance
Electronic	Electronic
Electrical engineering	Electrical engineering
Biomedical genius	Biomedical genius
Industrial Engineering	Industrial Engineering
Telecommunication	Telecommunication
Process Engineering	Process Engineering
mining engineering	Mining
	Development of mineral resources
Hydrocarbons	Hydrocarbons
Industrial hygiene and safety	Industrial hygiene and safety
Petrochemical industries	Refining and petrochemicals

Table of courses and specialties in the field of Science and Technology

Die group A	Semester 3 common
Sector	**Specialties**
Automatique	Automatique
Electromechanical	Electromechanical Industrial maintenance
Electronic	Electronic
Electrical engineering	Electrical engineering
Biomedical genius	Biomedical genius
Industrial Engineering	Industrial Engineering
Telecommunication	Telecommunication

Die group B	Semester 3 common
Sector	**Specialties**
Aeronautics	Aeronautics
civil engineering	civil engineering
HVAC engineering	HVAC engineering
Maritime genius	Naval propulsion and hydrodynamics Naval construction and architecture
Mechanical Engineering	Energetics Mechanical construction Materials Engineering
Hydraulic	Hydraulic
transport engineering	transport engineering
Metallurgy	Metallurgy
Precision optics and mechanics	Optics and photonics Precision engineering
Public works	Public works

Die group C	Semester 3 common
Sector	**Specialties**
Process Engineering	Process Engineering
mining engineering	Mining Development of mineral resources
Hydrocarbons	Hydrocarbons
Industrial hygiene and safety	Industrial hygiene and safety
Petrochemical industries	Refining and petrochemicals

The sectors which present common basic lessons between them (semester 3) have been grouped into 3 groups: A, B and C. These groups correspond schematically to the families of Electrical Engineering (Group A), Mechanical Engineering and Civil Engineering (Group B) and finally Process Engineering and Mining Engineering (Group C).

This license offers multidisciplinary and transversal teaching programs:

Multidisciplinary, in the sense that the lessons in this specialty are 100% identical for semesters 1 and 2 with all the specialties of the Science and Technology field. On the other hand, the lessons of semester 3 for all the specialties of the same group of courses are also 100% identical.

Semester	Die group	Common lessons
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

In a transversal way, this License offers the choice to the student to join, if he expresses the desire and according to the teaching places available:

- All other specialties in the ST field at the end of semester 2.

- All specialties of the same group of courses at the end of semester 3.

- All the specialties of another group of courses at the end of semester 3 (Subject to conditions of equivalence and the opinion of the training team).

- All specialties of the same group of courses at the end of semester 4 (Subject to equivalence and advice from the training team).

F – Expected training performance indicators:

All training must meet the quality requirements of today and tomorrow. As such, to better appreciate the performance expected from the proposed training on the one hand and by exploiting the flexibility and adaptability of the LMD system on the other hand, it is proposed, for information purposes, for this license a certain number of mechanisms to evaluate and monitor the progress of teaching, training programs, student/teacher and student/administration relations, the future of graduates of this license as well as the assessments of the university's partners as to the quality of the graduates recruited and /or lessons taught. It is up to the training team to enrich this list with other criteria according to its means and its own objectives.

The methods of evaluation can be concretized by surveys, field monitoring of students in training and surveys of recruited graduates as well as with their employers. For this, a report must be drawn up, archived and widely distributed.

1. Evaluation of the course of the training:

In addition to the regular meetings of the teaching committee, a meeting at the end of each semester is organised. It brings together teachers and students from the promotion to discuss any problems encountered, possible improvements to be made to teaching methods in particular and to the quality of training in general.

To this end, a more or less exhaustive list is proposed below of the indicators and methods envisaged for the evaluation and monitoring of this training project by the educational committee:

Prior to training:

Evolution of the rate of students who have chosen this License (Ratio supply / demand).
Rate and quality of students who choose this license.

During the training:

Regularity of educational committee meetings.
Conformity of the themes of the End of Cycle Projects with the nature of the training.
Quality of the relationship between students and administration.
Support provided to struggling students.
Rate of student satisfaction with teaching and teaching methods.

After training:

Success rate of students per semester in this License.
Dropout rate (failures and dropouts) of students.
Identification of the causes of student failure.
Reorientation alternatives are offered to students in a situation of failure.
Rate of students graduating on time.
Rate of students who continue their studies after the bachelor's degree.

2. Evaluation of the teaching process:

The lessons in this course are subject to regular evaluation (once a year) by the training team which will, on request, be made available to the various institutions: National Pedagogical Committee for the Field of Science and Technology , Regional Conferences, Vice-rectorate in charge of pedagogy, Faculty, etc.

As a result, a system for evaluating programs and teaching methods can be put in place based on the following indicators:

Equipment of classrooms and educational laboratories with materials and supports necessary for educational improvement (projection systems (data shows), wifi connection, etc.).

Existence of a communication and teaching platform in which courses, TD and TP are accessible to students and their questions answered.
Equipment of educational laboratories with materials and equipment in line with the content of the lessons.

Number of effective teaching weeks provided during a semester and what about student absenteeism?

Rate of achievement of teaching programs.

Digitization and preservation of End of Studies and/or End of Cycles dissertations.

Number of practicals carried out as well as the multiplication of the type of practicals per subject (diversity of practicals).

Quality of the establishment's documentary fund in relation to the specialty and its accessibility.

Support from the socio-economic sector for training (company visit, internship, course-seminar provided by professionals, etc.).

3. Integration of graduates:

A coordination committee is created, made up of training managers and members of the administration, which is mainly responsible for monitoring the integration of graduates from the sector into professional life, compiling a file for monitoring graduates of the sector, to identify and/ or update the existing economic and industrial potential at regional and national level, to anticipate and encourage new professions in relation to the sector in association with the chamber of commerce, the various support agencies employment, public and private operators, etc., to participate in any action concerning the professional integration of graduates (organization of events with socio-economic operators).

To carry out these missions, this committee has all the latitude to carry out or order any study or survey on the employment and post-employment of graduates. Below is a list of indicators and methods that could be considered to assess and monitor this operation:

Recruitment rate of graduates in the socio-economic sector in a position directly related to training.

Nature of jobs held by graduates.

Diversity of outlets.

Installation of an association of former graduates of the sector.

Creation of small businesses by graduates of the specialty.

Degree of satisfaction of employers.

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4 - Available human resources:

A: Supervision capacity (expressed in number of students that can be supported):

Number of students:

B: Internal pedagogical team mobilized for the specialty: (To be informed and approved by the faculty or institute)

Full name	graduation diploma	Specialty diploma (Master, PhD)	Grade	Subjects to teach	sign-in

Visa of the department

Faculty or institute visa

Machine Translated by Google

C: External pedagogical team mobilized for the specialty: (To be informed and approved by the faculty or institute)

Full name	Establishment of attachment	graduation diploma	Specialty diploma (Master, PhD)	Grade	Subjects to teach	sign-in

Visa of the department

Faculty or institute visa

Machine Translated by Google

D: Overall summary of human resources mobilized for the specialty (L3):

Grade	Internal workforce	External Workforce	Total
Teachers			
Lecturers (A)			
Lecturers (B)			
Assistant Professor (A)			
Assistant Professor (B)			
Other (*)			
Total			

(*) Technical and support staff

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5 - Material resources specific to the specialty

A- Pedagogical Laboratories and Equipment : Sheet of existing pedagogical equipment for the practical work of the planned training (1 sheet per laboratory)

Title of the laboratory:

Capacity in students :

No.	Equipment designation	Number	Comments

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B- Internship sites and in-company training: (see agreements/agreements section)

Training place	Number of students	Training period

C- Documentation available at the level of the institution specific to the proposed training (Mandatory field):

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D- Spaces for personal work and ICT available at department and faculty level:

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II – Half-yearly organization sheets for the teaching of the specialty

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Semester 1

Teaching unit	Materials	Credits	Coefficient	Weekly hourly volume			Hourly volume Semester (15 weeks)	Work Additional in Consultation (15 weeks)	Assessment method	
	Entitled			course	TD	TP			Control Continued	Revi
Fundamental EU Code: UEF 1.1 Credits: 18 Coefficients: 9	Mathematics 1	6	3	3h00	1h30		67:30	82:30	40%	60%
	Physics 1	6	3	3h00	1h30		67:30	82:30	40%	60%
	Structure of matter	6	3	3h00	1h30		67:30	82:30	40%	60%
Methodological Unit Code: UEM 1.1 Credits: 9 Coefficients: 5	Physics 1	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	Lab Chemistry 1	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	IT 1	4	2	1h30		1h30	45:00	55:00	40%	60%
	Writing methodology	1	1	1:00			3:00 p.m.	10:00 a.m.		100
Discovery Unit Code: UED 1.1 Credits: 1 Coefficients: 1	Professions in science and technology 1	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 1.1 Credits: 2 Coefficients: 2	Foreign language 1 (French and/or English)	2	2	3:00			45:00	05:00		100%
1Total semester 1		30	17	4:00 p.m.	4:30 a.m.	4:30 a.m.	375h00	375h00		

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Semester 2

Teaching unit	Materials	Credits	Coefficient	Weekly hourly volume			Hourly volume Semester (15 weeks)	Work Additoinal in Consultation (15 weeks)	Assessment method	
	Entitled			TD TP course					Control Continued	Review
Fundamental UE Code: UEF 1.2 Credits: 18 Coefficients: 9	Mathematics 2	6	3	3h00 1h30			67:30	82:30	40%	60%
	Physics 2	6	3	3h00 1h30			67:30	82:30	40%	60%
	Thermodynamics	6	3	3h00 1h30			67:30	82:30	40%	60%
Methodological Unit Code: UEM 1.2 Credits: 9 Coefficients: 5	Physics Lab 2	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	Lab Chemistry 2	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	IT 2	4	2	1h30		1h30	45:00	55:00	40%	60%
	Presentation methodology	1	1	1h00			3:00 p.m.	10:00 a.m.		100%
Discovery Unit Code: UED 1.2 Credits: 1 Coefficients: 1	Professions in science and technology 2	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 1.2 Credits: 2 Coefficients: 2	Foreign language 2 (French and/or English)	2	2	3:00			45:00	05:00		100%
Total semester 2		30	17	4:00 p.m.	4:30 a.m.	4:30 a.m.	375h00	375h00		

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Semester 3

Unit teaching	Entitled	Credits		Hourly volume weekly			Volume Hourly Semester (15 weeks)	Work Complementary in Consultation (15 weeks)	Assessment method	
				TD TP course					Control Continued	Review
Fundamental EU Code: UEF 2.1.1 Credits: 10 Coefficients: 5	Mathematics 3	6	3	3h00 1h30			67:30	82:30	40%	60%
	Waves and vibrations	4	2	1h30 1h30			45:00	55:00	40%	60%
Fundamental EU Code: UEF 2.1.2 Credits: 8 Coefficients: 4	Fluid mechanics	4	2	1h30 1h30			45:00	55:00	40%	60%
	Mineral chemistry	4	2	1h30 1h30			45:00	55:00	40%	60%
Methodological Unit Code: UEM 2.1 Credits: 9 Coefficients: 5	Probabilities and statistics	4	2	1h30 1h30			45:00	55:00	40%	60%
	IT 3	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	Technical drawing	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	Practical work Waves and vibrations	1	1			1h00	3:00 p.m.	10:00 a.m.	100%	
Discovery Teaching Unit Code: UED 2.1 Credits: 2 Coefficients: 2	HSE Facilities industrial	1	1	1h30			10:30 p.m.	02:30		100%
	Regulations and standards	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 2.1 Credits: 1 Coefficients: 1	Technical English	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 3		30	17 1	:30 p.m. 7	:30 a.m. 4	:00 a.m.	375h00	375h00		

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Semester 4

Unit teaching	Materials	Credits		Hourly volume weekly			Hourly volume Semester (15 weeks)	Work Complementary in Consultation (15 weeks)	Assessment method	
	Entitled			TD TP course					Control Continued	Review
Fundamental UE Code: UEF 2.2.1 Credits: 8 Coefficients: 5	Chemistry of solutions	4	2	1h30	1h30		45:00	55:00	40%	60%
	Organic chemistry	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental EU Code: UEF 2.2.2 Credits: 8 Coefficients: 4	Chemical thermodynamics	4	2	1h30	1h30		45:00	55:00	40%	60%
	Numerical methods	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental UE Code: UEF 2.2.3 Credits: 2 Coefficients: 1	Chemical kinetics	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
Methodological Unit Code: UEM 2.2 Credits: 9 Coefficients: 5	Practical work Chemistry of solutions	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	organic chemistry	1	1			1h00	3:00 p.m.	10:00 a.m.	100%	
	Practical work Fluid mechanics	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	Practical work Numerical methods	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
	Practical work Chemical kinetics	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
Discovery Teaching Unit Code: UED 2.2 Credits: 2 Coefficients: 2	Introduction to refining and petrochemicals	1	1	1h30			10:30 p.m.	02:30		100%
	Notions of transfer phenomena	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 2.2 Credits: 1 Coefficients: 1	Techniques of expression and communication	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 4		30	17	12:00 p.m.	6:00 a.m.	7:00 a.m.	375h00	375h00		

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Semester 5

Teaching unit	Materials Entitled	Credits	Coefficient	Weekly hourly volume TD TP course			Volume Hourly Semester (15 weeks)	Work Complementary in Consultation (15 weeks)	Assessment method	
									Control Continued	Review
Fundamental EU Code: UEF 3.1.1 Credits: 10 Coefficients: 5	Heat transfer	4	2	1h30	1h30		45:00	55:00	40%	60%
	Material Transfer	4	2	1h30	1h30		45:00	55:00	40%	60%
	Transfer of Quantity of Movement	2	1	1h30			10:30 p.m.	11:30 p.m.	40%	60%
Fundamental UE Code: UEF 3.1.2 Credits: 8 Coefficients: 4	Electrochemistry	4	2	1h30	1h30		45:00	55:00	40%	60%
	Instrumentation - sensors	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
	Kinetics and homogeneous	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
analysis UE Methodology Code: UEM 3.1 TP Chemical Macroscopic balances	catalysis Techniques of	4	2	1h30		1h30	45:00	55:00	40%	60%
	Physical Chemistry 1 and Credits: 9 Engineering 1 Coefficients: 5	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
		3	2	1h30	1h00		37:30	37:30	40%	60%
Discovery Unit Code: UED 3.1 Credits: 2 Coefficients: 2	pharmaceutical processes	1	1	1h30			10:30 p.m.	02:30		100%
	Agro-food processes	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 3.1 Credits: 1 Coefficients: 1	Pollution: Air, water, soil	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 5		30		5:30 p.m.	5:30 a.m.	3:00 a.m.	375h00	375h00		

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Semester 6

Teaching unit	Materials: Entitled	Credits		Weekly hourly volume: TD TP course			Volume Hourly Semester (15 weeks)	Work Complementary in Consultation (15 weeks)	Assessment method: Control Continued	Review
Fundamental UE Code: UEF 3.2.1 Credits: 10 Coefficients: 5	Unit operations	6	3	3h00	1h30		67:30	82:30	40%	60%
	Thermodynamics of equilibriums	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental EU Code: UEF 3.2.2 Credits: 8 Coefficients: 4	Homogeneous reactors	4	2	1h30	1h30		45:00	55:00	40%	60%
	Surface phenomena and heterogeneous catalysis	4	2	1h30	1h30		45:00	55:00	40%	60%
Methodological Unit Code: UEM 3.2 Credits: 9 Coefficients: 5	End of cycle project	4	2			3:00	45:00	55:00	100%	
	Process simulators	3	2	1h30	1h00		37:30	37:30	40%	60%
	Physical chemistry 2 and chemical engineering 2	2	1			1h30	10:30 p.m.	11:30 p.m.	100%	
Discovery Unit Code: UED 3.2 Credits: 2 Coefficients: 2	Cryogenic processes	1	1	1h30			10:30 p.m.	02:30		100%
	Corrosion	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 3.2 Credits: 1 Coefficients: 1	Professional project and business management	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 6		30	17	1:30 p.m.	7:00 a.m.	4:30 a.m.	375h00	375h00		

The assessment methods presented in these tables are only indicative, the establishment's training team may suggest other weightings.

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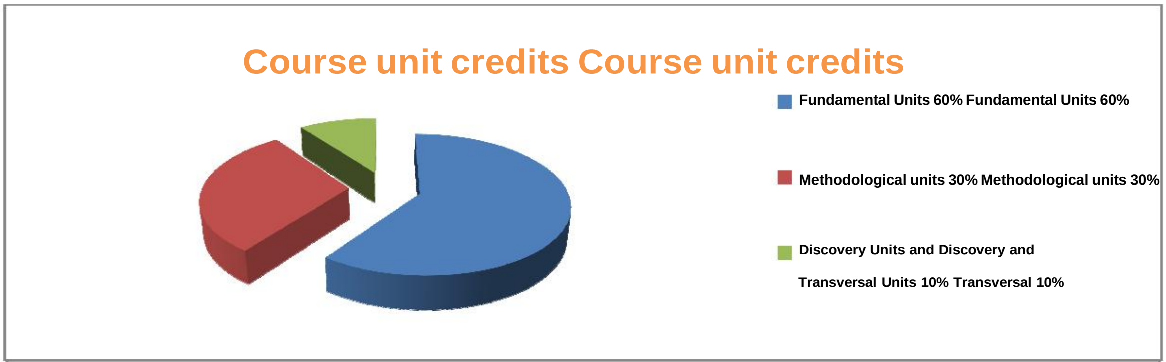
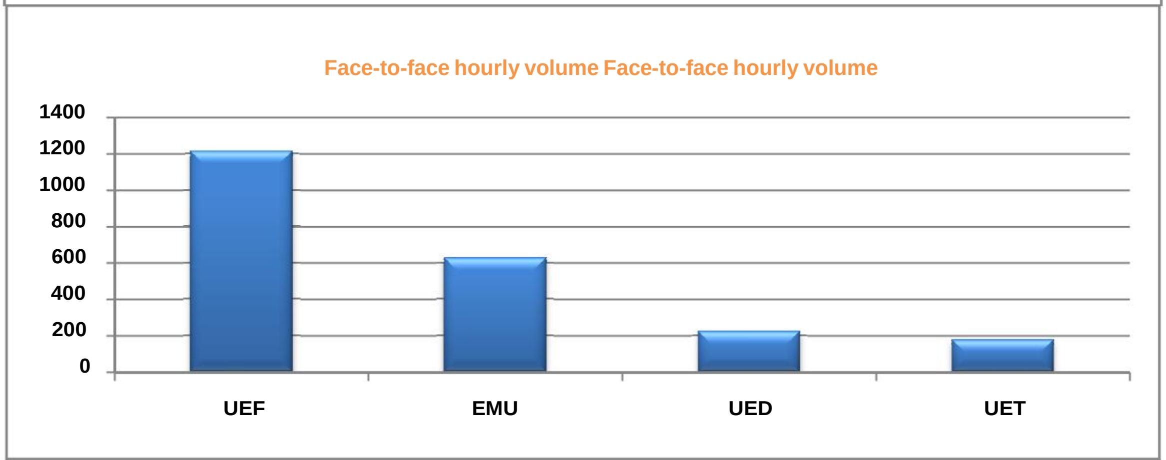
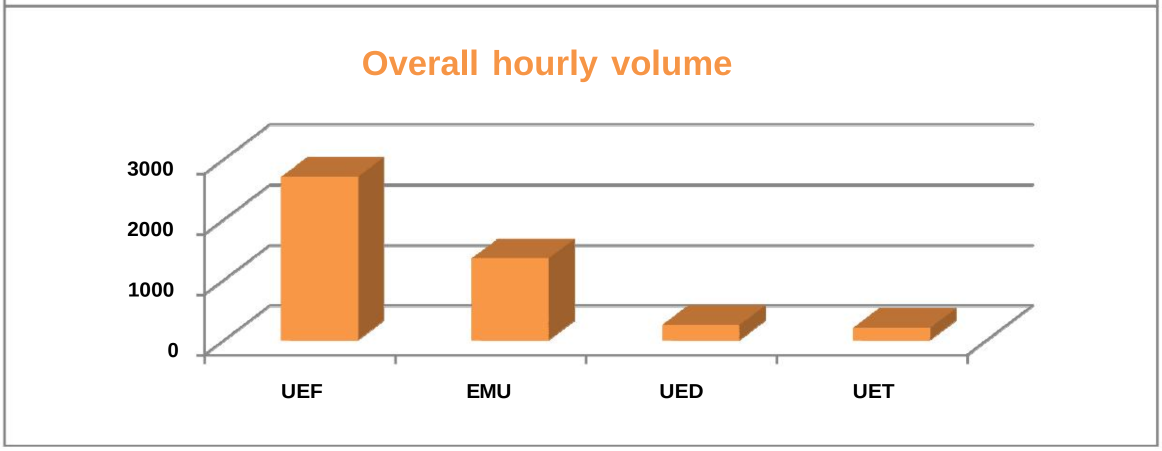
Overall training summary: Overall training summary:

EU / VH	UEF	EMU	UED	UET	Total
Course	742h30	4:00 p.m.	10:00 p.m.	6:00 p.m.	1:30 p.m.
TD	472h30	45:00	---	---	517:30
TP	---	420h00	---	---	420h00
Personal work	2:00 p.m.	720h00	25:00	8:00 p.m.	2250h00
other (explain, list,)	---	---	---	---	---
Total	2700h00	1350h00	250h00	200h00	4500h00
Credits	108	54	10	8	180
% in credits for each teaching unit	60%	30 %	10%		100%







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III - Detailed program by subject

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Semester: 1

Teaching unit: UEF 1.1 Subject 1:

Mathematics1 VHS: 67h30

(Course: 3h00, TD: 1h30)

Credits: 6

Coefficient: 3

Material content:

Chapter 1. Methods of mathematical reasoning 1-1 (1 week)
Direct reasoning 1-2
Reasoning by contraposition 1-3
Reasoning by contradiction
1-4 Reasoning by counterexample
1-5 Reasoning by induction
Chapter 2. Sets, relations and applications 2.1 Set theory (2 weeks)
2-2 Order relation,
Equivalence relations 2-3 Injective,
surjective, bijective application: definition of an application, direct image, reciprocal image, characteristic of an application.
Chapter 3 Real functions with one real variable 3-1 (3 weeks)
Limit, continuity of a function 3-2
Derivative and differentiability of a
function Chapter 4 Application to elementary (3 weeks)
functions 4-1 Power
function 4-2 Logarithmic
function 4-3 Exponential
function 4-4 Hyperbolic
function 4-5 Trigonometric
function 4-6 Inverse
function Chapter 5. Limit expansion (2 weeks)
5-1 Taylor's formula
5-2 Limit expansion 5-3
Applications
Chapter 6. Linear algebra (4 weeks)
6-1 Laws and internal
composition 6-2 Vector space, basis, dimension (definitions and elementary properties)
6-3 Linear mapping, kernel, image, rank.

Evaluation mode:

Continuous control: 40%; Review: 60%.

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Semester: 1

Teaching unit: UEF 1.1 Subject

2: Physics1 VHS:

67h30 (Course: 3h00, TD: 1h30)

Credits: 6

Coefficient: 3

Material content:

Mathematical reminders (2 weeks)
1- Dimensional equations 2-
Vector calculation

Chapter 1. Kinematics (5 Weeks)
1- Position vector in coordinate systems (Cartesian, cylindrical, spherical, curvilinear)-
law of motion - Trajectory 2- Velocity
and acceleration in coordinate systems.
3- Applications: Motion of the material point in the different coordinate systems.
4- Relative movement.

Chapter 2. Dynamics: 1- (4 weeks)
General: Mass - Force - Moment of force – Absolute and Gallilian
reference frame 2-
Newton's laws 3- Principle of conservation of
momentum 4- Differential equation of
motion 5- Kinetic
moment 6- Applications of the fundamental law for forces (constant, time dependent, velocity dependent, central force, etc).

Chapter 3 Work and energy (4 weeks)
1- Work of a force
2- Kinetic energy
3- Potential energy – Examples of potential energy (gravity, gravitational, elastic)
4- Conservative and non-conservative forces - Total energy theorem

Assessment mode:

Continuous control: 40%; Review: 60%.

Semester: 1

Course unit: UEF 1.1 Subject 3:
VHS material structure: 67h30

(Course: 3h00, TD: 1h30)
Credits: 6

Coefficient: 3

Material content:

Chapter 1. FUNDAMENTALS (2 Weeks)
States and macroscopic characteristics of the states of matter, changes in the states of matter, notions of atom, molecule, mole and Avogadro's number, atomic mass unit, atomic and molecular molar mass, molar volume, Weight law: Conservation mass (Lavoisier), chemical reaction, Qualitative aspect of matter, Quantitative aspect of matter:

Chapter 2. MAIN CONSTITUENTS OF MATTER (3 Weeks)
Introduction: Faraday's experiment: relationship between matter and electricity, Highlighting the constituents of matter and therefore of the atom, and some physical properties (mass and charge), Rutherford's planetary model, Presentation and characteristics of the atom (Symbol, atomic number Z, mass number A, number of protons, neutrons and electrons), Isotopy and relative abundance of the various isotopes, Separation of isotopes and determination of the atomic mass and the average mass of an atom: Mass spectrometry: Bainbridge spectrograph, Binding and cohesion energy of nuclei, Stability of nuclei:

Chapter 3 RADIOACTIVITY – NUCLEAR REACTIONS (1 Week)
Natural radioactivity (ÿ, ÿ and ÿ radiation), Artificial radioactivity and nuclear reactions, Kinetics of radioactive decay, Applications of radioactivity

Chapter 4 ELECTRONIC STRUCTURE OF THE ATOM (4 weeks)
Wave-particle duality, Interaction between light and matter, Bohr's atomic model: hydrogen atom, The hydrogen atom in wave mechanics, Polyelectronic atoms in wave mechanics

Chapter 5. THE PERIODIC CLASSIFICATION OF THE ELEMENTS (2 Weeks)
Periodic table of D. Mendeleiev,Modern periodic table, Evolution and periodicity of the physico-chemical properties of the elements, Calculation of the radii (atomic and ionic), successive ionization energies, electron affinity and electronegativity (Mulliken scale) by Slater's Rules

Chapter 6. CHEMICAL BONDINGS (3 Weeks)
The covalent bond in Lewis theory, The polarized covalent bond, dipole moment and partial ionic character of the bond, Geometry of molecules: Gillespie theory or VSEPR, Chemical bond in the quantum model

Assessment method:

Continuous control: 40%; Review: 60%.

Semester: 1

Teaching unit: UEM1.1 Subject
1: Physics1 VHS: 22h30
(TP: 1h30)
Credits: 2
Coefficient: 1

Material content:

5 manipulations at least (3H00 / 15 days): - (15 Week)
Methodology of presentation of report of TP and calculation of errors.

- Verification of Newton's 2nd law

- Free fall

- Simple pendulum

- Elastic collisions

- Inelastic collisions

- Moment of inertia

- Centrifugal force

Assessment method:

Continuous control: 100%

Semester: 1

Teaching unit: UEM1.1 Subject
2: Lab Chemistry 1 VHS:

22h30 (TP: 1h30)
Credits: 2

Coefficient: 1

Material content:

1. Safety in the laboratory - **(15 weeks)**

Concepts of danger and risk - General rules of safety, - Safety in the chemistry laboratory, - Pictograms, storage of chemical products, - Disposal of waste

- FIRST AID.

2. Preparation of solutions 3. Acid-base titration: - Strong acid, strong base.
- Weak acid strong base.
4. Iodometry: -

Theoretical elements on oxidation-reduction: -
Titration of an aqueous solution of iodine by an aqueous solution of sodium thiosulphate.
5. Manganimetry: -
Dosage of the permanganate ion in an acid medium using a solution of oxalic acid.
- Dosage in return of a solution of potassium dichromate using an aqueous solution of ferrous salt of known titer.

6. Construction of molecular buildings

Assessment method:

Continuous control: 100%

Semester: 1

Teaching unit: UEM1.1 Subject 3:

Computer science1 VHS:

45h00 (Course: 1h30, Lab: 1h30)
Credits: 4

Coefficient: 2

Objective and recommendations:
The objective of the subject is to allow students to learn to program with an evolving language (Fortran, Pascal or C). The choice of language is left to the discretion of each institution. The notion of algorithm must be supported implicitly during language learning.

The practicals aim to illustrate the notions taught during the course. The latter must begin with the courses according to the following schedule: • Initiatory practical sessions for familiarization with the computer machine from a hardware and operating systems point of view (exploration of the different functionalities of the OS) • Initiation practical sessions for the use of a programming environment (Editing, assembling, compiling, etc.) • Application practical work on the programming techniques seen in cl

Material content:

Chapter 1. Introduction to computing 1- (5 weeks)
Definition of computing 2-
Evolution of computing and computers 3-
Information coding systems 4- Operating principle of a computer 5- Hardware part of a computer
6- System part
The basic systems (operating systems (Windows, Linux, Mac OS, etc.)
Programming languages, application software Chapter
2. Notions of algorithm and program 1- Concept of an (7 Weeks)
algorithm 2- Representation
in flowchart 3- Structure of a
program 4- Approach and
analysis of a problem 5 - Data structure

Constants and Variables, Data Types
6- Operators
The assignment operator, Arithmetic operations, Relational operators, Logical operators, Priorities in operations
7- Entry/exit operations
8- Control structures
Conditional control structures, Repeating control structures
Chapter 3 Indexed variables (3 weeks)
1- One-dimensional tables
Representation in memory, Operations on arrays
2- Two-dimensional arrays
In-memory representation, Operations on two-dimensional arrays

Evaluation mode:
Continuous control: 40%; Review: 60%.

Semester: 1

Teaching Unit: UEM1.1 Subject
4: VHS Writing Methodology: 15h00
(Course: 1h00)
Credits: 1
Coefficient: 1

Material content:

Chapter 1. Concepts and general information on writing techniques - Definitions, **(2 weeks)**
standards Applications: writing a summary, a letter, a request

Chapter 2. Searching for information, synthesis and exploitation **(3 weeks)**
- Searching for information in the library (paper format: books, reviews)
-Search for information on the Internet (digital: databases, search engines, etc.).

- Apps

Chapter 3 Writing Technique and Procedures **(3 weeks)**
- Basic principle of writing - punctuation, syntax, sentences
- sentence length
- Division into paragraphs
- The use of a neutral style and writing in the third person
- Readability
- Objectivity
- Intellectual rigor and plagiarism

Chapter 4 Writing a Report **(4 weeks)**
Cover pages, Summary, Introduction, Method, Results, Discussion, Conclusion,
Bibliography, Appendices, Summary and Key Words

Chapter 5. Applications **(3 weeks)**
Report of practical work

Assessment method:
Control Review: 100%.

Semester: 1

Teaching unit: UED1.1 Subject
1: Science and technology professions1 VHS: 22h30
(Course: 1h30)
Credits: 1
Coefficient: 1

Material content:

Chapter 1.
1.1. Professions in electronics, electrical engineering, communication systems and new sensor technologies (3 weeks)
- Electronics industry, electrical engineering
- Instrumentation and microsystems - Technological advances in Electronics, Telecommunications and Sensor Technology (Home automation, Mobile telephony, Non-destructive testing, Ultrasonic imaging, Aeronautics, Road and rail transport, Video surveillance, Security of goods and people, transport safety)

I.2. Automation and industrial computing professions - History (2 weeks)
of automation and industrial computing - Applications of computing - programmable logic controllers - Fields of application (electricity production plants, continuous industrial systems, robots industrial and autonomous applications, on-board automotive applications)

Chapter 2. II.1 Introduction to process engineering (2 weeks)
- History of process engineering
- Industrial process, chemical engineering and major fields of industrial chemistry - Role of the process specialist

II.2. Introduction to Mining (2 weeks)
Engineering - Mining Industry and Mining Sectors; - Role of the mining specialist

II.3. Hydrocarbons and petrochemical industry - (2 weeks)
The different Hydrocarbons: from production to marketing - Definition of petrochemicals; Different axes of petrochemicals and petrochemical products - Role of the specialist in the oil and gas industry

II.4 Health and safety (2 weeks)
- Definition and different axes of the HSE sector - Sectors of activity - Role of the specialist and training of the specialist in HSE

Assessment method:
Control Review: 100%.

Semester: 1

Teaching unit: UET1.1 Subject

1: French language1 VHS:

22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Material content:

Chapter 1: The Library and the Books **(1 week)**

- Books – Searching for information
- Verbal communication
- Write, communicate with words

Chapter 2: Grammar and Style **(3 weeks)**

- Times and fashions
- Coordination and subordination
- Direct, indirect and free indirect speech
- The punctuation
- The enunciation

Chapter 3: Definition and basis of the typology **(2 weeks)**

- Text Definitions
- Definition of the typology
- Base of the typology

Chapter 4: Textual typologies **(3 weeks)**

- Textual or homogeneous typology
- Intermediate typology
- Functional typologies (general diagram of communication)
- Enunciative typologies
- Situational typologies
- Heterogeneous typology

Chapter 5: The Storytelling **(3 weeks)**

- Narrative modes
- Narrative voices
- Narrative Perspectives
- Narrative instance
- Time and space

Chapter 6: The argumentative text – structure **(3 weeks)**

- Modes of argument
- The ideas of the argument
- Objectivity and subjectivity
- The summary and the formulation
- Methodical reading

Assessment mode:

Review: 100%.

Semester: 1

Course unit: UET1.1 Subject 1:

English language1 VHS: 22h30

(Course: 1h30)

Credit: 1

Coefficient: 1

Objective:

The English syllabus consists of the following major parts. Sample texts are used to let students acquainted with both Scientific and Technical English as well as for both scientific and technical vocabulary and grammar acquisition.

The texts are selected according to the vocabulary built up, familiarization with both scientific and technical matters in English and further comprehension. Each text is therefore followed by a set of vocabulary concepts, a set of special phrases (idioms) and comprehension questions. There is also a terminology which means the translation of some words from English to French one. Besides, the texts are followed at the end by a translation of long statements which are selected from the texts.

Program Content:

A. Phonetics: **(3 weeks)**

-Consonant sounds: *eg :* / k/; /m/; /b/;/j/

- Vowels sounds: eg: /e/; /i/; /u:/

- Diphthongs: eg: /aI/; /eI/

- Triphthongs: eg: /eIa/; /aIa/

B. General Grammar: **(6 weeks)**

1- Parts of speech - Verb: definition, transitive, negative form, interrogative form, regular, irregular …

- Noun: definition, kind, singular, plural, compound nouns …

- Adverbs: definition

- Adjectives: definition

2- Types of sentences

- Simple sentences

- Compound sentences (using connectors eg.: but, …)

- Complex sentences (using relative pronouns eg. who, where, …)

C. Texts (6 Weeks)

Each semester may include scientific or technical texts in which we focus on the application of the previous lessons.

Assessment method:

Review: 100%.

Semester: 2

Teaching unit: UEF 1.2 Subject
1: Mathematics2 VHS: 67h30
(Course: 3h00, TD: 1h30)
Credits: 6
Coefficient: 3

Material content:

Chapter 1: Matrices and determinants (3 weeks)
1-1 Matrices (Definition, operation)
1-2 Matrix associated with a linear map
1-3 Linear application associated with a matrix
1-4 Base change, transition matrix
Chapter 2: Systems of Linear Equations (2 weeks)
2-1 General
2-2 Study of all the solutions
2-3 Methods of resolutions of a linear system
-Resolution by Cramer's method
-Resolution by the inverse matrix method
-Resolution by the method of Gauss
Chapter 3: Integrals (4 weeks)
3-1 Indefinite integral, property
3-2 Integration of rational functions
3-3 Integration of exponential and trigonometric functions
3-4 The integral of polynomials
3-5 Defined integration
Chapter 4: Differential equations 4-1 (4 weeks)
ordinary differential equations 4-2 first
order differential equations 4-3 second
order differential equations 4-4 second
order ordinary differential equations with constant coefficient
Chapter 5: Multivariate Functions (2 Weeks)
5-1 Limit, continuity and partial derivatives of a function
5-2 Differentiability
5-3 Double, triple integrals

Assessment method:

Continuous control: 40%; Review: 60%.

Semester: 2

Teaching unit: UEF 1.2 Subject

2: Physics2 VHS:

67h30 (Course: 3h00, TD: 1h30)

Credits: 6

Coefficient: 3

Material content:

Math reminders: (1 week)

1- Elements of length, surface, volume in Cartesian, cylindrical, spherical coordinate systems.

2- Multiple derivatives and integrals.

Chapter I. Electrostatics: (6 Weeks)

1- Electrostatic charges and fields.

2-Electrostatic potential.

3- Electric dipole.

4- Flow of the electric field.

5- Gauss's theorem.

6- Conductors in balance.

7- Electrostatic pressure.

8- Capacitance of a conductor and a capacitor.

Chapter II. Electrokinetics: (4 Weeks)

1- Electrical conductor.

2- Ohm's law.

3- Joule's law.

4- Electric Circuits.

5- Application of Ohm's Law to networks.

6- Kirchhoff's laws.

Chapter III. Electromagnetism: (4 Weeks)

1- Definition of a magnetic field.

2- Lorentz force.

3- Laplace's law.

4- Faraday's law.

5- Law of Biot and Savart.

6- Magnetic dipole.

Assessment method:

Continuous control: 40%; Review: 60%.

Semester: 2

Teaching unit: UEF 1.2 Subject

3: Thermodynamics VHS: 67h30

(Course: 3h00, TD: 1h30)

Credits: 6

Coefficient: 3

Material content:

CHAPTER I: General information on thermodynamics (2 weeks)

1-Fundamental properties of state functions

2- Definitions of thermodynamic systems and the external environment

3- Description of a thermodynamic system

4- Evolution and states of thermodynamic equilibrium of a system

5- Possible transfers between the system and the external environment

6-Transformations of the state of a system (operation, evolution)

7-Reminder of the ideal gas laws

CHAPTER II (2.5 weeks)

1- Concept of temperature

2- Notion of heat or quantity of heat Q

3- Calorimetry

4- Work

CHAPTER III: The First Law of Thermodynamics (2.5 weeks)

1) Equivalence between heat and work

2) Statement of the first principle

3) General expression of the first principle

4) Definition of internal energy U

5) Differential expression of internal energy

6) Differential expression of the first principle

7) Calculation of the variation of the internal energy ÿU

8) Concept of enthalpy H

CHAPTER IV: Applications of the first principle of thermodynamics to *thermochemistry*

Heats of reaction, standard state, standard enthalpy of formation, enthalpy of dissociation, enthalpy of change of physical state, enthalpy of a chemical reaction (1.5 weeks)

CHAPTER V: 2nd principle of thermodynamics (03 weeks)

1- Introduction

2- *Notion of entropy*

***3*- Thermal machines**

CHAPTER VI: 3rd Principle and absolute entropy **(01 week)**

1) Statement of the 3rd Principle, absolute entropy at zero Kelvin (°K)

2) The standard molar absolute entropy of a pure body

3) Standard molar absolute entropy at T Kelvin (TK)

4) ST standard molar absolute entropy of a pure (solid, liquid, gas)

5) The entropy variation of a chemical reaction ÿSR

6) The entropy variation of a chemical reaction has a temperature T; ÿSR (T)

CHAPTER VII: Free energy and enthalpy – Criteria for the evolution of a system (02.5 weeks)

1- Introduction,

2- Free energy and enthalpy

3- Chemical balances

Assessment method:

Continuous control: 40%; Review: 60%.

Semester: 2

Teaching unit: UEM1.2 Subject
1: Physics2 VHS: 22h30
(TP: 1h30)
Credits: 2
Coefficient: 1

Material content:

5 manipulations at least (3H00 / 15 days): (15 weeks)

- Presentation of measuring instruments (voltmeter, ammeter, rheostat, oscilloscopes, generator, etc.

- Equipotential surfaces in electrostatics.

- Association and Measurement of resistances

- Association and Measurement of capacities

- Voltage and current dividers

- Charging and discharging a capacitor

- Oscilloscope

- Practical work on magnetism

Assessment method:
Continuous control: 100%

Semester: 2

Course unit: UEM1.2 Subject 2:
Chemistry2 VHS: 22h30

(TP: 1h30)
Credits: 2

Coefficient: 1

Material content:

Chapter 1.

1. Ideal gas equation : **(15 weeks)**

- The gas system,

- Verification of the three empirical laws (Laws of Boyle-Mariotte, Gay Lussac, Charles-Amontons).

2. Determination of the mass capacity of solids

3. Determination of the mechanical equivalent of heat (J)

4. Application of the first principle of thermodynamics :

- Determination of the energy released by a chemical reaction (HCl / NaOH)

5. The heat pump (inverse Carnot cycle)

Assessment method:
Continuous control: 100%

Semester: 2

Teaching unit: UEM1.2 Subject

3: Computer science 2 VHS:

45h00 (Course: 1h30, Lab: 1h30)
Credits: 4

Coefficient: 2

Material content:

Chapter 1: Functions and Procedures (6 Weeks)
1- Functions

Types of functions, declaration of functions, calling of functions
2- Procedures
Notions of global variables and local variables, simple procedure, procedure with arguments

Chapter 2: Records and Files (4 weeks)
1- Structure of heterogeneous data
2- Structure of a record (concept of fields)
3- Manipulation of record structures
4- Notion of file
5- File access modes
6- Reading and writing to a file

Chapter 3: Advanced concepts (5 weeks)
1- Recursion
2- Modular programming
3- The graphics
4- Pointers

Assessment method:
Continuous control: 40%; Review: 60%.

Bibliographic references:

1- Algorithms for Dummies large format Book by John Paul Mueller (Informatiker, USA) and Luca Massaron

2017 2- Algorithmics: course with 957 exercises and 158 problems Book by Charles E. Leiserson, Clifford Stein and Thomas H. Cormen 2017

3- Algorithms: Basics Book by Thomas H. Cormen 2013

Semester: 2

Teaching Unit: UEM1.2 Subject

4: VHS Presentation Methodology: 15h00

(Course: 1h00)

Credits: 1

Coefficient: 1

Material content:

Chapter 1: The Oral Presentation (3 Weeks)
Communication

Preparation of an oral presentation

Different types of plans

Chapter 2: presentation of an oral presentation (3 Weeks)

Structure of an oral presentation

Presentation of an oral presentation

Chapter 3: Plagiarism and Intellectual Property (3 Weeks)
1- Plagiarism
Definitions of plagiarism, sanction of plagiarism, how to borrow the work of other authors, quotations, illustrations, how to be sure to avoid plagiarism?
2- Writing a bibliography Definition,
objectives, how to present a bibliography, writing the bibliography

Chapter 08: Presenting Written Work (6 Weeks)
- Present a written work

- Applications: presentation of an oral presentation

Assessment method:

Review: 100%.

Semester: 2

Teaching unit: UED1.2 Subject

1: Science and technology professions2 VHS: 22h30

(Course: 1h30)

Credits: 1

Coefficient: 1

Material content:

Chapter I. Mechanical Engineering and Metallurgy (6 Weeks)
- Origins (textiles, first mechanized industry, steam engine, etc.)
- Technical progress and its
adaptation - Fields of mechanics (transformation of metals, production and maintenance of industrial equipment, aeronautics, energy transformations, etc.)
- Trades in the mechanical industry (engineer in mechanical construction and mechanical manufacturing, thermal engineer, etc.)
- Trades in metallurgy and plastics Chapter II.
Maritime engineering sector - (2 weeks)
Naval and navigation architect
- Naval equipment engineer

Chapter III. Civil and Hydraulic Engineering (4 weeks)
sector - History of the construction and use of
concrete - Building
materials - Public Works and
Development - Road and rail infrastructure, bridges, retaining structures, dams,
- The various trades in civil engineering and
BTP - Introduction and history of
hydraulics - Fields of study of hydraulics (Drinking water supply
AEP and Sanitation, hydraulic flows)
- Jobs in hydraulics

Chapter 4: Renewable Energy Sector & Environmental Science
Engineering Sector (2 weeks)

Assessment method:
Review: 100%.

Semester: 2

Teaching unit: UET1.2 Subject
1: French language2 VHS:
22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Material content:

Chapter 1: The Explanatory (5 weeks)
Text - Definitions *(1 Lesson)*
- Presentation of an explanatory
text - Structure of an explanatory
text 1.1 Functions of the explanatory text *(1Course)*
- The informative function
- The didactic function
1.2 Characteristics of the explanatory text *(3 Courses)*
- Difference with a descriptive text
- Organizational characteristics
- Lexical and grammatical characteristics (personal pronoun, verbal form, logical connectors)
- Coherence and cohesion
- The operations required for the production of an explanation - The situation of enunciation of a text
Chapter 2: Reading Tools (5 weeks)
- Write a reading sheet
- To take notes
- Build a paragraph
Chapter 3: The Essay (3 weeks)
- Analyze a subject
- Identify a problem
- Build a plan
- Write an introduction
- Write a conclusion
- Do a resume
Chapter 4: Preparing for an oral (1 week)
Chapter 5: Analyzing a work, text, image and form (2 Weeks)
- Semiotics and semiology
- Rhetoric and stylistics
Chapter 6: Document Synthesis – Lectures (2 Weeks)

Assessment method:
Review: 100%.

Semester: 2

Teaching unit: UET1.2 Subject

1: English language2 VHS:

22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Objective:

The English syllabus consists of the following major parts. Sample texts are used to let students acquainted with both Scientific and Technical English as well as for both scientific and technical vocabulary and grammar acquisition.

The texts are selected according to the vocabulary built up, familiarization with both scientific and technical matters in English and further comprehension. Each text is therefore followed by a set of vocabulary concepts, a set of special phrases (idioms) and comprehension questions.

There is also a terminology which means the translation of some words from English to French one. Besides, the texts are followed at the end by a translation of long statements which are selected from the texts.

Program Content

A. Phonetics: (3 weeks)

- Pronunciation of the final (ed)

- Silent letters: definition, spelling + pronunciation of each letter B. General Grammar: (6 weeks)

1- Tenses

Simple present, simple past, simple future, present continuous, present perfect, past perfect

2- Modals

- eg: can, may, should, must …

3- Ask questions using "wh questions": (means all questions wich start with wh questions) - eg.: who, where, when, how …

C. Texts: (6 weeks)

Each semester may include scientific or technical texts in which we focus on the application of the previous lessons.

Assessment method:

Review: 100%.

Semester: 3

Teaching unit: UEF 2.1.1 Subject 1:
Mathematics 3 VHS: 67h30
(Course: 3h00, TD: 1h30)
Credits: 6

Coefficient: 3

Teaching objectives:

At the end of this course, the student should be able to know the different types of series and their convergence conditions as well as the different types of convergence.

Prior knowledge recommended

Mathematics 1 and Mathematics 2

Material content :

Chapter 1: Simple and multiple integrals 1.1 — **3 weeks**
Reminders on the Riemann integral and on the calculation of primitives.
1.2 Double and triple integrals.
1.3 Application to the calculation of areas, volumes…

Chapter 2: Improper integrals 2.1 — **2 weeks**
Integrals of functions defined on an unbounded interval.
2.2 Integrals of functions defined on a bounded interval, infinite at one end.

Chapter 3: Differential equations 3.1 — **3 weeks**
Review of ordinary differential equations.
3.2 Partial differential equations.
3.3 Special Features.

Chapter 4: Series — **2 weeks**
4.1 Numerical series.
4.2 Sequences and series of functions.
4.3 Integer series, Fourrier series.

Chapter 5: Fourier transformation 5.1 — **3 weeks**
Definition and properties.
5.2 Application to solving differential equations.

Chapter 6: Laplace transformation 6.1 — **2 weeks**
Definition and properties.
6.2 Application to solving differential equations.

Assessment mode :

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

Bibliographic references:

(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

Semester: 3

Teaching unit: UEF 2.1.1 Subject
2: Waves and Vibrations VHS:

45h00 (Course: 1h30, TD: 1h30)
Credits: 4

Coefficient: 2

Teaching objectives

Introduce the student to the phenomena of mechanical vibrations restricted to low amplitude oscillations for 1 or 2 degrees of freedom as well as the study of the propagation of mechanical waves

Prior knowledge recommended

Mathematics 2, Physics 1 and Physics 2

Material content :

Chapter 1: Introduction to Lagrange's equations 1.1 — 2 weeks
Lagrange's equations for a particle 1.1.1
Lagrange's equations 1.1.2
Case of conservative systems
1.1.3 Case of friction forces depending on velocity
1.1.4 Case of an external force depending du
temps 1.2 System with several degrees of freedom.

Chapter 2: Free oscillations of systems with one degree of freedom — 2 weeks
2.1 Undamped oscillations
2.2 Free oscillations of damped systems

Chapter 3: Forced oscillations of systems with one degree of freedom 1 week 3.1
Differential equation 3.2
Mass-spring-damper system 3.3
Solution of the differential equation
3.3.1 Harmonic excitation
3.3.2 Periodic excitation
3.4 Mechanical impedance

Chapter 4: Free oscillations of systems with two degrees of freedom 1 week 4.1
Introduction
4.2 Systems with two degrees of freedom

Chapter 5: Forced oscillations of systems with two degrees of freedom 2 weeks 5.1
Lagrange equations 5.2
System masses-springs-dampers 5.3
Impedance
5.4 Applications
5.5 Generalization to systems with n degrees of freedom

Chapter 6: One-dimensional propagation phenomena 6.1 — 2 weeks
Generalities and basic definitions
6.2 Propagation equation
6.3 Solution of the propagation equation
6.4 Sinusoidal traveling wave
6.5 Superposition of two sinusoidal traveling waves

Chapter 7: Vibrating Strings — 2 weeks

7.1 Wave equation 7.2
Harmonic traveling waves 7.3 Free
oscillations of a string of finite length 7.4
Reflection and transmission

Chapter 8: Acoustic waves in fluids 8.1 Wave equation 8.2 Speed of sound 8.3 Traveling sinusoidal wave 8.4 Reflection-Transmission	1 week
Chapter 9: Electromagnetic waves 9.1 Wave equation 9.2 Reflection-Transmission 9.3 Different types of electromagnetic waves	2 weeks

Assessment mode :

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

Bibliographic references:

(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

1. T. Becherrawy; Vibrations, waves and optics; Hermes science Lavoisier, 2007
2. T. Becherrawy; Vibrations, waves and optics; Hermes science Lavoisier, 2010
3. J. Brac; Propagation of acoustic and elastic waves; Hermes science publ. Lavoisier, 2003.
4. J. Bruneaux; Vibrations, waves; Ellipses, 2008.

Semester: 3

Teaching unit: UEF 2.1.2 Subject 1:

Fluid mechanics VHS: 45h00

(Course: 1h30, Tutorial: 1h30)

Credits: 4

Coefficient: 2

Teaching objective:

Introducing the student to the field of fluid mechanics, the statics of fluids will be detailed in the first part. Then in the second part the study of the movement of inviscid fluids will be considered Prior knowledge recommended: mathematics, integral calculus,

Chapter 1: General information on fluid mechanics. (02 weeks)

I.1 What is Fluid Mechanics ?; I.2 Description of the movement.; I.3 Streamlines and trajectories.; I.4 Flow patterns: velocity profiles; I.5 Reminders of vector analysis and elements of index calculation.

Chapter 2: .Physical properties of fluids. (02 weeks)

II.1 Density; II.2 Isothermal compressibility; II.3 Surface tension; II.4 Viscosity; II.5 Mathematical problem of fluid mechanics; II.6 Particle derivative; II.7 Boundary conditions; II.8 Dimensions, dimensional equations and units.

Chapter 3: Hydrostatics. (03 weeks)

III.1 Fundamental law of hydrostatics; III.2 Hydrostatic pressure in an incompressible fluid.
III.3Compressible fluid: perfect gas, III.4 Resultant of hydrostatic pressure forces.; III.5 Force exerted on a wall by a fluid; III.6 Archimedes thrust.

Chapter 4: Conservation of mass. (02 weeks)

IV.1 Leibniz's theorem; IV.2 Continuity Equation; IV.3 Flow conservation.

Chapter 5: Perfect fluid. (05 weeks)

V.1 Reminders of Mechanics ; V.2 Momentum theorem. V.3 Euler's equations; V.4 Bernoulli's theorem., V.5. Examples of application of Bernoulli's theorem: Pitot probe; Venturi nozzle; Unsteady emptying of a tank; V.6 Air escape from a pressure vessel: limit of compressibility.

Assessment mode: Continuous assessment: 40%; Final exam: 60%

Bibliographic references:

R. Comolet, 'Experimental fluid mechanics', Volume 1, 2 and 3, Ed. Masson et Cie.

R. Ouziaux, 'Applied fluid mechanics', Ed. Dunod, 1978 BR

Munson, DF Young, TH Okiishi, 'Fundamentals of fluid mechanics', Wiley & sons.

RV Gilles, 'Fluid Mechanics and Hydraulics: Courses and Problems', Schaum Series, Mc Graw Hill, 1975.

CT Crow, DF Elger, JA Roberson, ' Engineering fluid mechanics', Wiley & sons

RW Fox, AT Mc Donald, 'Introduction to fluid mechanics', fluid mechanics' VL Streeter, BE Wylie, 'Fluid mechanics', Mc Graw Hill FM White, ''Fluid mechanics', Mc Graw Hill S. Amiroudine, JL Battaglia, 'Fluid mechanics Course and corrected exercises', Ed. Dunod

-NOT. Midoux, Mechanics and rheology of fluids in chemical engineering, *Ed. Lavoisier, 1993.*

- M. Fourar, General equations, elastic solids, fluids, turbomachines, similarity, *Ed. Ellipses, 2nd Edition 2015.*

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Semester: 3

Course unit: UEF 2.1.2 Subject 1: Inorganic Chemistry

VHS: 45h00 (Class: 1h30, TD: 1h30)

Credits: 4

Coefficient: 2

Teaching objectives :

To give the basic notions of mineral chemistry

Learning of some methods such as crystallochemistry and synthesis.

Prior knowledge recommended

Basic notions of general chemistry

Content of the subject

Chapter 1: Reminders of some important definitions: 1 week

Mole, Molar Mass, Molar Volume, Molar Fraction, Mass Fraction, Volume Fraction; Density, density; Relationship between mass fraction and mole fraction; Mass balance: Concept of reagent and reagent in excess,

Concept of excess percentage, Concept of conversion percentage

Chapter 2: Crystal chemistry 3 weeks

Polyhedral description of structures, connectivity.

Chapter 3: Periodicity and in-depth study of the properties of the elements: 3 weeks

Halogens, chalcogens, nitrogen and phosphorus, boron.

Chapter 4: The major metallurgies 4 weeks

(Fe, Ti, Cu, Mg)

Chapter 5: Major mineral syntheses 4 weeks

(H_2SO_4, H_3PO_4, NH_3, HNO_3)

Assessment mode: Continuous assessment: 40%; Final exam: 60 %

Bibliographic references :

Ouahès, R, Devallez, B. General Chemistry. higher Exercises and Teaching Problems 1st cycle. Publishing Publisud.

Winnacker Karl 1903. Mineral Technology. Edition Eyrolles 1962, cop 1958. Treatise on applied chemistry: Inorganic chemistry, industrial chemistry, chemical industries, chemical engineering.

Semester: 3

Teaching unit: UEM2.1 Subject

1: Probabilities & Statistics VHS: 45h00

(Course: 1h30, TD: 1h30)

Credits: 4

Coefficient: 2

Objectives of the subject

This module allows students to see the essential notions of probability and statistics, namely: statistical series with one and two variables, probability over a finite universe and random variables.

Prior knowledge recommended

The basics of programming acquired in Math 1 and Math 2

Material content:

Part A: Statistics

Chapter 1: Basic definitions **1 week**

A.1.1 Notions of population, sample, variables, modalities

A.1.2 Different types of statistical variables: qualitative, quantitative, discrete, continuous.

Chapter 2: One-variable statistical series A.2.1 **3 weeks**

Number, Frequency, Percentage.

A.2.2 Cumulative number, Cumulative frequency.

A.2.3 Graphical representations: bar chart, pie chart, bar chart.

Polygon of frequencies (and frequencies). Histogram.
Cumulative curves.

A.2.4 Position characteristics

A.2.5 Dispersion characteristics: range, variance and standard deviation, coefficient of variation.

A.2.6 Shape characteristics.

Chapter 3: Statistical series with two variables **3 weeks**

A.3.1 Data tables (contingency table). A cloud of dots.

A.3.2 Marginal and conditional distributions. Covariance.

A.3.3 Linear correlation coefficient. Regression line and Mayer line.

A.3.4 Regression curves, regression corridor and correlation ratio.

A.3.5 Functional adjustment.

Part B: Probabilities

Chapter 1: Combinatorial analysis **1 week**

B.1.1 Arrangements
B.1.2 Combinations

B.1.3 Permutations.

Chapter 2: Introduction to probability B.2.1 **2 weeks**

Algebra of events B.2.2
Definitions

B.2.3 Probability spaces

B.2.4 General probability theorems

Chapter 3: Conditioning and independence **1 week**

B.3.1 Conditioning,

B.3.2 Independence,

B.3.3 Bayes formula.

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Chapter 4: Random variables **1 week**
B.4.1 Definitions and properties, B.4.2 Distribution function, B.4.3 Mathematical expectation, B.4.4 Covariance and moments.

Chapter 5: Usual discrete probability distributions **1 week**
Bernoulli, binomial, Poisson, ...

Chapter 6: Usual continuous probability laws **2 weeks**
Uniform, normal, exponential,...

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

Bibliographic references:
(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

[1] D. Dacunha-Castelle and M. Duflo. Probability and Statistics: Fixed Time Problems. Mason, 1982.

[2] J.-F. Delmas. Introduction to the calculus of probabilities and to statistics. ENSTA handout, 2008.
[3] W. Feller. An introduction to probability theory and its applications, volume 1. Wiley and Sons, Inc., 3rd edition, 1968.
[4] G. Grimmett and D. Stirzaker. Probability and random processes. Oxford University Press, 2nd edition, 1992.
[5] J. Jacod and P. Protter. Probability essentials. Springer, 2000.
[6] A. Montfort. Course in mathematical statistics. Economica, 1988.
[7] A. Montfort. Introduction to statistics. Polytechnic School, 1991

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Semester: 3

Teaching unit: UEM2.1 Subject

2: Computer Science 3 VHS:

22h30 (TP: 1h30)

Credits: 2

Coefficient: 1

Objectives of the subject

Teach the student programming using easily accessible software (mainly: Matlab, Scilab, Mapple, etc.). This subject will be a tool for the realization of practical work in numerical methods in S4.

Prior knowledge recommended

The basics of programming acquired in computer science 1 and 2

Material content :

TP 1: Presentation of a scientific programming environment (Matlab, Scilab, etc.) 1 week

Lab 2: Script Files and Types of Data and Variables 2 weeks

Exercise 3: Reading, displaying and saving data 2 weeks

Exercise 4: Vectors and matrices 2 weeks

TP 5: Control instructions (for and while loops, if and switch instructions)2 weeks

Exercise 6: Function files 2 weeks

TP 7: Graphics (Management of graphic windows, plot 2 weeks

Exercise 8: Using toolboxes 2 weeks

Evaluation mode :

Continuous control: 100%.

Bibliographic references:

(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

1. Getting started in algorithms with MATLAB and SCILAB / Jean-Pierre Grenier,- .Paris: Ellipses, 2007 .- 160 p.

2. Scilab from theory to practice / Laurent Berger, . - Paris: D. Booker, 2014.

3. Programming and simulation in Scilab / Bégyn Arnaud, Gras Hervé, Grenier Jean-Pierre, - Paris: Ellipses, 2014. - 160 p.

4. Computer science: programming and scientific computing in Python and Scilab scientific preparatory classes 1st and 2nd years / Thierry Audibert,; Amar Oussalah; Maurice Nivat, .- Paris: Ellipses, 2010 . - 520p

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Semester: 3

Teaching unit: UEM2.1 Subject 3:

Technical drawing VHS: 22h30 (TP:

1h30)

Credits: 2

Coefficient: 1

Course objectives This course will

allow students to acquire the principles of representation of parts in industrial design. Even more, this material will allow the student to represent and read the plans.

Recommended prior knowledge (brief description of the knowledge required to be able to follow this course – Maximum 2 lines).

In order to be able to follow this course, basic knowledge of the general principles of drawing is required.

Content of the subject

Chapter 1: General. 2 weeks

1.1 Usefulness of technical drawings and different types of drawings.

1.2 Drawing materials.

1.3 Normalization (Types of lines, Writing, Scale, Drawing format and folding, Title block, etc.).

Chapter 2: Elements of descriptive geometry 2.1 6 weeks

Notions of descriptive geometry.

2.2 Orthogonal projections of a point - Sketch of a point - Orthogonal projections of a straight line (any and particular) - Sketch of a straight line - Traces of a straight line - Projections of a plane (Unspecified and particular positions) - Traces of a plan.

2.3 Views: Choice and arrangement of views - Dimensioning - Slope and conicity - Determination of the 3rd view from two given views.

2.4 Method of execution of a drawing (layout, straight 45°, etc.)

Application exercises and evaluation (TP)

Chapter 3: Perspectives 2 weeks

Different types of perspectives (definition and purpose).

Application exercises and evaluation (TP).

Chapter 4: Sections and sections 2 weeks

4.1 Sections, standard representation rules (hatching).

4.2 Projections and section of simple solids (Projections and sections of a cylinder, a prism, a pyramid, a cone, a sphere, etc...).

4.3 Half Cuts, Partial Cuts, Broken Cuts, Sections, etc.

4.4 Technical vocabulary (terminology of machined shapes, profiles, piping, etc.

Application exercises and evaluation (TP).

Chapter 5: Rating 5.1 2 weeks

General principles.

5.2 Rating, Tolerance and Fit.

Application exercises and evaluation (TP).

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Chapter 6: Notions on definition and assembly drawings and bills of materials.
1 week

Application exercises and evaluation (TP).

Evaluation mode :
Continuous control: 100%.

Bibliographic references:
(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

1. Chevalier A industrial designer's guide. Hachette Technique Edition; 2. The technical drawing 1st part descriptive geometry Felliachi d. and Bensaada s. Edition OPU Algiers; 3. The technical drawing 2nd part the industrial drawing Felliachi d. and bensaada s. Edition OPU Algiers; 4. First notions of technical drawing Andre Ricordeau Edition Andre Casteilla;
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Recommendation: A large part of the TP should be in the form of personal work at home.

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Semester: 3

Teaching unit: UEM2.1 Subject 4:
Practical work Waves and Vibrations

VHS: 15h00 (practical work: 1h00)
Credits: 1

Coefficient: 1

Teaching objectives The

objectives assigned by this program relate to the initiation of the students to put into practice the knowledge received on the phenomena of mechanical vibrations restricted to the oscillations of low amplitude for one or two dof; as well as the propagation of mechanical waves.

Recommended prior knowledge Vibrations and
waves, Mathematics 2, Physics 1, Physics 2.

Material content:

TP.1 Mass – spring

TP.2 Simple pendulum

TP.3 Torsion pendulum

TP.4 Study of electrical oscillations

TP.5 Oscillating electric circuit in free and forced mode

TP.6 Coupled pendulums

TP.7 Vibrating rope

TP.8 Grooved pulley according to Hoffmann

TP.9 The loudspeaker

TP.10 Pohl's pendulum

Note: It is recommended to choose at least 5 TP among the 10 offered.

Evaluation mode: Continuous control: 100%.

Bibliographic references:
(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

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Semester: 3

Teaching unit: UED2.1 Subject
1: HSE Industrial installations VHS: 22h30

(course: 1h30)
Credits: 1

Coefficient: 1

Teaching objectives

- **Identify and assess the risk ;**
- **Implement appropriate prevention methods ;**
- **Check the reality and effectiveness of the systems put in place.**

Prior knowledge recommended

Content of the subject

Chapter 1: Introduction to Risk Assessment and Control, Accident Analysis 7 weeks

1.1 Understand the basic notions (hazard, risk) and identify the prevention actors; 1.2 Control the indicators relating to accidents at work (frequency rate, severity rate, etc.) and occupational diseases; 1.3 Observe and analyze the risks associated with a work situation; 1.4 Develop a tree of causes ;

Chapter 2: Introduction to Occupational Health and Environmental Protection 8 weeks

2.1 Identify the main hygiene and public health aspects; 2.2 Know the notions of home hygiene; 2.3 Know the main areas of environmental protection; 2.4 Understand the issue of sustainable development; 2.5 identify the role and mission of the various organizations in occupational health and safety and public health.

Assessment method: Final exam: 100%.

Bibliographic references:
(Depending on the availability of documentation at the level of the establishment, Internet sites...etc.)

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Semester: 3

Teaching unit: UED2.1 Subject 2: VHS

regulations and standards: 22h30 (course:

1h30)

Credits: 1

Coefficient: 1

Teaching Objectives The purpose

of this course is to introduce students to regulations and standardization and to instil in them the importance of both in the industrial field. Students will thus be prepared to respect the regulations and to use the standards.

Prior knowledge recommended

Content of the subject

Chapter 1: Introduction 1.1 — **3 weeks**

Regulations and regulatory texts.

1.2 Economic development and standardization.

Chapter 2: Standardization 2.1 — **4 weeks**

Purpose and development. Association and standardization bodies.

2.2 International Standardization. Standardization in Algeria: INAPI.

Chapter 3: Standardization of production 3.1 Normative — **4 weeks**

parameters. Interchangeability of products. Tolerances and adjustments.

3.2 Compliance control methods, certification.

Chapter 4: Classification — **4 weeks**

Classification of products. Classification of standards and their codification.

Assessment method: Final exam: 100%.

Bibliographic references: (Depending

on the availability of documentation at the level of the establishment, Internet sites...etc.)

Machine Translated by Google

Semester: 3

Teaching unit: UET2.1 Subject 1:

Technical English VHS: 22h30

(Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives

This course must allow the student to have a language level where he can use a scientific document and talk about his specialty and sector in English at least with ease and clarity.

Prior knowledge recommended

English 1 and English 2

Content of the subject

- Oral comprehension and expression, acquisition of vocabulary, grammar...etc. -
nouns and adjectives, comparatives, following and giving instructions, identifying things.
- Use of numbers, symbols, equations.
- Measurements: Length, surface, volume, power ...etc.
- Describe scientific experiments.
- Characteristics of scientific texts.

Assessment method :

Final exam: 100%.

Bibliographic references: (Depending

on the availability of documentation at the level of the establishment, Internet sites...etc.)

Semester: 4

Course unit: UEF 2.2.1 Subject 1:
Chemistry of solutions

VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4

Coefficient: 2

Teaching objective: This is
to give the student the basic notions relating to the chemistry of solutions.
It is a teaching which essentially aims to familiarize the student with the reasoning of chemistry in solution in order to be able to subsequently predict chemical reactions for analytical purposes. It is mainly about: -
Understanding the concept of electrolyte and conductivity of a solution, - Knowing how to calculate the pH of an aqueous solution, - Understanding the concept of oxidant and reducer and predicting oxidation-reduction reactions .

Recommended prior knowledge: Basic notions of general chemistry.

Content of the subject :

Chapter 1: Solutions **3 weeks**
Definitions: Concentrations: molarity, normality, molality, title, molar and mass fraction, activity etc…
. Conductimetry: mobility of ions, electrolytes (strong, weak), conductivity (specific and molar), conductimetric cell, Kohlrausch's law, conductimetric assay

Chapter 2: Acids-Bases - **3 weeks**
Acid-base balances in aqueous solution: acidity scale, acidity constant (Ka, pKa), dilution law (Oswald), pH calculation (simple solutions, mixtures, salines, buffer solutions , ampholyte solutions), reaction predictions, acid-base assays (polyacids and polybases).
- Colored indicators

Chapter 3: Redox **3 weeks**
Definition, Oxidant, reducer, Redox reactions, Oxidation state and number, Balancing of redox reactions, Electrochemical cells, Thermodynamic aspect, Electrodes

Chapter 4: Solubility **3 weeks**
Definition, Graphic representation, Effect of common ions, Influence of pH on solubility (case of hydroxides), Influence of potential on solubility, Influence of complexation on solubility

Chapter 5: Complexes 3 weeks
Definition, Nomenclature of complexes, Formation of complexes, Stability of complexes, Effect of pH on complexes, Effect of potential on complexes, Some fields of application of complexes

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

1- John Hill , Ralph Petrucci, Terry McCreary Scott Perry, Chemistry of Solutions, 2nd Ed, , Edition ERPI; 2014.
2- John C. Kotz, Chemistry of Solutions, Edition de Boeck 2006.

Semester: 4

Teaching unit: UEF 2.2.1 Subject 1:

Organic Chemistry VHS:

45h00 (Course: 1h30, TD: 1h30)

Credits: 4

Coefficient: 2

Teaching objectives: -

Introduce the basic notions of organic chemistry and present the main functional derivatives in order to understand the processes of industrial chemistry.

- Description of the mechanisms for obtaining different functions and the main reactions encountered in organic chemistry.

Recommended prior knowledge: Basic knowledge of carbon, notions of chemical bonding.

Material content:

Chapter 1: General **3 weeks**

Study of the carbon atom and its bonds

Functions and Nomenclature of Organic Compounds: IUPAC Ordinary, Trivial, Usual and Systematic Nomenclature

Chapter 2: Classification of organic functions **2 weeks**

Saturated aliphatic hydrocarbons (linear, branched), Alkenes (preparation, reactivity), Aromatic compounds (preparation, reactivity), Alcohols, thiols, aldehydes (preparation, reactivity), Ketones, carboxylic acids (preparation, reactivity) .

Chapter 3: Notions of stereo-isomerism **4 weeks**

Definition, plane isomerism (definition), function isomerism, position isomerism, tautomerism, geometric isomerism, stereochemistry: definition, representation of molecules in space, configuration isomerism.

Chapter 4: Electronic effects - **3 weeks**

Definition, Chemical bond: pure covalent, polarized covalent and ionic. Inductive effect: definition, Classification of inductive effects, Influence of the inductive effect on the acidity of a chemical compound, Influence of the inductive effect on the basicity of a chemical compound. Mesomeric effect: definition, conjugated systems and delocalization of electrons. Classification of mesomeric effects, Influence of the mesomeric effect on the acidity of a chemical compound, Influence of the mesomeric effect on the basicity of an organic com

Chapter 5: Major reactions in organic chemistry 3 weeks

Reagents and reaction intermediates; Classification of reactions: Addition; Substitution ;

Elimination; Rearrangement; Elementary rules: Markovnikov, Zeitsev ;

Assessment method:

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

Reference:

1- Paul Arnaud, Organic Chemistry,DUNOD; 2004.

2- Jean pierre Mercier, Pierre Gaudard Organic chemistry: an initiation; Presses polytechniques Romandes 2001.

3- Melania Kiel Organic Chemistry course and corrected exercises;; estem; 2004.

4- Jonathan Clayden, Nick , Stuart Warren , André Pousse, Organic Chemistry; Greeves deBoeck 2nd edition; 2013.

5-John McMurry, Eric Simanek, Organic chemistry the main principles; DUNOD 2nd edition; 2007.

Semester:4

Teaching unit: UEF 2.2.2 Subject
1: Chemical thermodynamics VHS: 45h00
(Course: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives : -
mastery of the 1st and 2nd and 3rd principles of thermodynamics.
- The application of thermodynamic principles
- The study of chemical equilibria, chemical potential, as well as real gases.

Recommended prior knowledge: Differential equations, Basic chemical thermodynamics (S2 of the ST common base).

Material content:

Chapter I: Reminders in thermodynamics I.1 **(2 weeks)**
Mathematical reminder on partial derivatives I.2
State variables and functions
I.3 Quantities and thermodynamic systems
I.4 The different principles of thermodynamics
I.5 Criterion for the evolution of a chemical system and potential

Chapter II: Thermodynamic properties of pure substances II.1 The ideal gas II.2 **(4 weeks)**
Intermolecular forces and real behavior of gases II.3
Equations of state of real gases
II.4 Corresponding states, residual deviations and fugacity II.5 Thermodynamic properties of condensed states

Chapter III: Phase equilibria of a pure substance II.1 **(4 weeks)**
General equilibrium relations (Clapeyron and Clapeyron-Clausius)
II.2 Liquid-vapor, liquid-solid and solid-vapor equilibria II.3
Stable and unstable equilibria and phase transition II.4
Generalized diagrams

Chapter IV: Chemical Equilibria IV.1 **(5 weeks)**
The affinity of a chemical reaction
IV.2 Monotherm-monobaric and monochoric systems IV.3 Heat of a chemical reaction and the laws of Hess and Kirchoff IV.4 Law of mass action and shift in chemical equilibrium

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

References

Smith, EB, Basic Chemical Thermodynamics, second ed., Clarendon Press, Oxford, 1977.
Rossini, FD, Chemical Thermodynamics, Wiley, New York, 1950.
Florence, Stanley I. Sandler, Chemical and Engineering Thermodynamics, Wiley, New York, 1977.
Elliot, J, Lira CT, Introductory chemical engineering ThermodynamicPsr,entice-Hall (1999)
Lewis GN, Randal M., Thermodynamics, Mac Graw
Hill Hougen OA, Watson KM, Chemical process principles, Vol II: thermodynamics John Wiley and sounds

Semester:4

Course unit: UEF 2.2.2 Subject 1:

Digital methods VHS: 45h00 (Course:

1h30, Tutorial: 1h30)

Credits: 4

Coefficient: 2

Teaching objectives:

Familiarization with numerical methods and their applications in the field of mathematical calculations.

Recommended prior knowledge:

Mathematics 1, Mathematics 2, Computing 1 and Computing 2, fortran,

Material content:

Chapter 1: Solving nonlinear functions 3 weeks Introduction to calculation errors and approximations, Introduction to methods for solving nonlinear equations, Bisection method, Method of successive approximations (fixed point), Newton-Raphson method.

Chapter 2: Polynomial interpolation **2 weeks**

General introduction, Lagrange polynomial, Newton polynomials.

Chapter 3: Function approximation : **1 week**

Approximation methods and quadratic average, Orthogonal or pseudo-Orthogonal systems, orthogonal polynomials, Trigonometric approximation. Fit and correlation (linear, parabolic, polynomial and arbitrary)

Chapter 4: Numerical integration **2 weeks**

General introduction, Trapezium method, Simpson's method, Quadrature formulas.

Chapter 5: Method for direct resolution of systems of linear equations 3 weeks

Introduction and definitions, Gaussian method and pivoting, LU factorization method, Choeleski MMt factorization method, Thomas algorithm (TDMA) for tri-diagonal systems.

Chapter 6: Method for iterative resolution of systems of linear equations 2 weeks Introduction and definitions, Jacobi method, Gauss-Seidel method, Use of relaxation.

Assessment mode:

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

Reference:

1- C. Brezinski, Introduction to the practice of numerical calculation, Dunod, Paris 1988.
2- G. Allaire and SM Kaber, Numerical Linear Algebra, Ellipses, 2002.
3- G. Allaire and SM Kaber, Introduction to Scilab. Corrected practical exercises in linear algebra, Ellipses, 2002.
4- G. Christol, A. Cot and C.-M. Marle, Differential calculus, Ellipses, 1996.
5- M. Crouzeix and A.-L. Mignot, Numerical analysis of differential equations, Masson, 1983.
6-S. Delabrière and M. Postel, Approximation methods. Differential equations. Scilab Applications, Ellipses, 2004.
7- J.-P. Demailly, Numerical analysis and differential equations. Grenoble University Press, 1996.
8- E. Hairer, SP Norsett and G. Wanner, Solving Ordinary Differential Equations, Springer, 1993.
9- PG Ciarlet, Introduction to matrix numerical analysis and optimization, Masson, Paris, 1982.
10. Boumahrat, Gourdin, H.Veysseyre, applied numerical methods

Semester:4

Teaching unit: UEF 2.2.3 Subject 1:

Chemical kinetics VHS: 22h30

(Course: 1h30)

Credits: 2

Coefficient: 1

Objectives of the subject:

To provide the student with the essential bases for any kinetic study of a chemical process and affects both the elementary notions of formal kinetics and the mathematical bases concerning the notion of the rate of a chemical reaction and its evolution over time, the parameters influencing the rate of a reaction, the determination of the order of a reaction by physico-chemical methods, the rate constant and the activation energy.

Recommended prior knowledge: Mathematics (derivative, integral), knowing how to express the concentration of a solution, mastering unit systems, knowing how to draw and use graphs.

Content of the subject:

Chapter I. Homogeneous chemical reactions (1 week)

I. Rate of reaction (Absolute rate, specific rate)

II. Experimental kinetic study of a reaction (Chemical and physical methods III. Experimental factors influencing the rate

Chapter II. Influence of concentrations and temperature on the rate I. (2 weeks)

Influence of concentration (Order of a reaction, Molecularity and Stoichiometry of a reaction, VANT'HOFF rule II.

Influence of temperature

Chapter III. Formal kinetics, simple reaction (6 weeks)

I. Determination of the rate constant of a reaction of given order (Order 0,1,2,3 and n)

II. Determination of reaction orders

- Methods for determining order by Integration (variation of concentrations as a function of time, methods of partial reaction times), example of calculation - Differential method, example of calculation - Methods based on the degeneracy of order, example of calculation - Method using dimensionless parameters, example of calculation Chapter IV. (6 weeks)

Compound reactions 1. Opposite or balanced reactions - General - Examples of opposite reactions (the two opposite reactions are of order 1, of reactions of order 2 opposed to reaction of order1, reactions of order 1 opposed to reaction of order2)

-Balance and speed of reactions

-Principle of microreversibility

2. Parallel reactions : general information, twin reactions, concurrent reactions, example, 3. Successive reactions : determination of rate constants, radioactive equilibrium, example of calculation.

Assessment method: Final exam: 100%.

References:

1- Claude Moreau, Jean-Paul Payen, Chemical kinetics, Edition Belin 1999

2-Michel Destriau, Gérard Dorthe, Roger Ben-Aïm, Kinetics and chemical dynamics Edition Technip1981.

3- P. Morlaes, Chemical kinetics: Structure of matter 1978 4- B. Frémaux, Elements of kinetics and catalysis, Tec Editor and 1998 5. M. Robson Wright, An Introduction to Chemical Kinetics, John Wiley & Sons Ltd Editions , Chichester, 2004

6. P. William Atkins, Elements of Physical Chemistry, Editions DeBoek University, Brussels, 1997

7. E. James House, Principles of Chemical Kinetics, 2nd edition, Editions Elsevier Inc., London, 2007

8. A. Azzouz, Chemical Kinetics, Editions Berti, Tipaza, 1991

9. A. Derdour, Cours de Kinétique Chimique, Editions OPU, Algiers, 1988 10. G. Scacchi, M. Bouchy, JF Foucaut and O. Zahraa, Kinetics and Catalysis, Technical Editions & Documentation, Paris, 1996 11. Chemical Thermodynamics, MA OTiuran and M. Robert., University Presses of Grenoble, 1997, 245 pages.

12. General Chemistry, R Ouahès, B Devallez, PUBLISUD 4th Ed, 1997, 504 pages.

13. General Chemistry, SS ZUMDAHL., De Boeck University 2nd Ed, 1999, 514 pages.

14. Elements of physical chemistry, PW ATKINS., De Boeck University 2nd Ed, 1996, 512 pages.

15.. General Chemistry, Elisabeth Bardez, Dunod Paris, 2009, 258 pages.

16. Les cours de Paul Arnaud, Resolute exercises in physical chemistry., Dunod Paris 3 rd Ed, 2008, 386 pages.

17. General chemistry at the PCEM, volume 1, C. Bellec, G. Lhommet., Vuibert, 1996, 307 pages.

Semester: 4

Course unit: UEM 2.2 Subject 1:
Solution chemistry lab

VHS: 10:30 p.m. (PT: 1:30 a.m.)
Credits: 2

Coefficient: 1

Teaching objectives :
Understand and properly assimilate knowledge.

Recommended prior knowledge Notions of
general chemistry and thermodynamics. The student has already been familiarized with laboratory equipment and glassware.

Material content:

TPN°1. Determination of water hardness by complexometry.
TPN°2. Experimental verification of Nernst's law.
TPN°3. Conductometric dosage of vinegar.
TPN°4. Determination, followed by pH-metry, of the alkalinity of an aqueous solution by a hydrochloric acid solution. Gran's method.
TPN°5. Dosage, followed by pH-metry and conductimetry of a sodium hydroxide solution.

TPN°6. Search for cations of the first group.
TPN°7. Determination of the solubility product of a sparingly soluble salt.
TPN°8. Measurement of the formation constant of a complex.
TPN°9. Potential-pH diagram of Iron.

Evaluation mode :
Continuous control: 100%.

Reference:

1- G. Milazo. Electrochemistry. Dunod
1969 2-Brenet. Introduction to the electrochemistry of equilibrium and non-equilibrium. Mason 1980

Semester: 4

Course unit: UEM 2.2 Subject 1:

Organic chemistry lab VHS:

15h00 (TP: 1h00)

Credits: 1

Coefficient: 1

Teaching objectives:

Preparation and analysis of organic products presenting the main functions encountered in organic chemistry (alcohols, acids, aldehydes, ketones, etc.)

Recommended prior knowledge: organic chemistry

Material content:

TPN°1. Esterification (Synthesis of aspirin).

TPN°2.Purification by recrystalisation of Benzoic acid.

TPN°3. Extraction of an organic product.

TPN°4.Determination of the composition of a mixture by refractometry.

TPN°5. Sublimation of Naphthalene.

TPN°6. Study of the properties of phenol or an organic substance.

TPN°7. Preparation of a soap.

TPN°98 transformation of an alcohol into a halogenated derivative (synthesis of 2-chloro-2-methylpropane from 2-methylpropan-2-ol).

TP n°09: Purification by distillation at atmospheric pressure and steam distillation TP n°10: Purification by fractional distillation on a column

Evaluation mode :

Continuous control: 100%.

Semester: 4

Teaching unit: UEM 2.2 Subject 1:

Practical work on fluid mechanics

VHS: 22h30 (TP: 1h30)
Credits: 2

Coefficient: 1

Teaching objectives: The
student puts into practice the knowledge of fluid mechanics taught in S3.

Recommended prior knowledge: Subjects:
fluid mechanics and physics 1.
Material content:

- Practical work N° 1.

Viscosimeter - Practical work N° 2. Determination of linear and singular pressure drops - Practical

work N° 3. Flow rate measurement - Practical work N° 4. Water hammer and mass oscillations -

Practical work N° 5.
Verification Bernoulli's theorem - TP N°
6.Impact of the jet - TP N° 7.Flow through an orifice - TP N°

8.Visualization of flows around an obstacle - TP N° 9.Determination of the Reynolds number: Laminar

Evaluation mode :
Continuous control: 100%.

Semester: 4

Teaching unit: UEM 2.2 Subject 1:

Practical work on digital methods VHS:

22h30 (TP: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives: Programming

of the various numerical methods with a view to their applications in the field of mathematical calculations using a scientific programming language (matlab, scilab, etc.).

Recommended prior knowledge: Numerical

Method, Computer Science 2 and Computer Science 3.

Material content:

Chapter 1: Solving nonlinear equations 3 weeks 1.Bisection method. 2. Fixed point method, 3. Newton-Raphson method

Chapter 2: Interpolation and approximation 1. **3 weeks**

Newton's interpolation, 2. Chebyshev's approximation

Chapter 3: Numerical integrations 1. Method **3 weeks**

of Rectangle, 2. Method of Trapezes, 3. Method of Simpson

Chapter 4: Differential equations 1.Euler **2 weeks**

method, 2. Runge-Kutta methods

Chapter 5: Systems of linear equations 1. Gauss- **4 weeks**

Jordon method, 2. Crout decomposition and LU factorization, 3. Jacobi method, 4. Gauss-Seidel method

Assessment mode: Continuous monitoring: 100% .

References:

1. Algorithms and numerical computation: resolved practical work and programming with Scilab and Python software / José Ouin, . - Paris: Ellipses, 2013 . - 189 p.

2. Mathematics with Scilab: calculation guide programming graphical representations; conforms to the new MPSI / Bouchaib Radi program; Abdelkhalak El Hami. - Paris: Ellipses, 2015 .- 180 p.

3. Applied numerical methods: for scientists and engineers / Jean-Philippe Grivet, . - Paris: EDP sciences, 2009 .- 371 p.

Semester: 4

Teaching unit: UEM 2.2 Subject 1:

VHS **chemical kinetic practical**

work : 22h30 (practical work: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives :

-Measurement of the reaction rate from the relation “Concentration = f(t)”
-Determination of the order; Evaluation of the rate constant and the activation energy.
- Use linear regression to process curves

Recommended prior knowledge:

Material content :

- **Chemical method (monitoring by volumetric method):**
  - **Saponification of an ester (ethyl ethanoate with sodium hydroxide):**
    RCOOR' + NaOH = RCOOR' + R'OH

- Physical method
- **Polarimetry: kinetics of sucrose inversion.**
- **Spectrophotometry: Decomposition of a Mn3+** complex **-**
Conductimetric method: Saponification of an ester (ethyl ethanoate by sodium hydroxide)
- **Volume measurement: Decomposition of hydrogen peroxide (hydrogen peroxide)**

Evaluation mode :

Continuous control: 100%.

Semester: 4

Course unit: UED 2.2 Subject 1:

Introduction to refining and petrochemicals.

VHS: 10:30 p.m. (class: 1:30 a.m.)

Credits: 1

Coefficient: 1

Teaching objectives:

Explain the genesis of fossil fuels. Master the nomenclature and specifications of petroleum products. Know the main refining and petrochemical processes and their products.

Prior knowledge recommended

Organic chemistry

Material content:

Chapter 1: Formation and Exploitation of Oil and Natural Gas 4 weeks

Definition and origin of oil, Oil deposits and characteristics, Exploitation techniques

Chapter 2: Oil Refining Schematics 6 weeks

Nomenclature and characteristics of petroleum products, Main diagrams of manufacturing processes, Environmental constraints and evolution of refining

Chapter 3: Petrochemical Process Diagrams 5 weeks

Diversity of petrochemical industry products, Main petrochemical manufacturing routes, Examples of processes (PVC, Ammonia)

Assessment method :

Final exam: 100%.

Reference:

1- Petroleum refining in 5 volumes, Technip, 1998.
2- P. Wuithier, petroleum, refining and chemical engineering. VOLUME 1, technip, 1972.
3- A. Fahim, Taher A. Al-Sahhaf, A Elkilani, Fundamentals of Petroleum Refining, Elsevier, 2010.

Semester: 4

Teaching unit: UED 2.2 Subject 1:

Notions of **VHS transfer phenomena :** 22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Objectives of the subject:

- Demonstrate the balance equations for equilibrium and for the flow of fluids - Give the basic notions of heat transfer then introduce the students to calculations - Give the basic laws which describe the processes of material transfer.

Recommended prior knowledge:

Thermodynamics and notions of kinetics

Material content:

Chapter 1: Introduction to Transfer Modes — **3 weeks**

Chapter 2: Heat Transfer — **6 weeks**
Conduction, Convection, Radiation

Chapter 3: Momentum Transfer — **6 weeks**
Properties of fluids, Statics of fluids, General conservation equations

Assessment method: Final exam: 100%.

Reference :

1- Transport Phenomena; BIRD(RB). STEAWART(WE)., J. Wiley and Sons. Inc., 1960.
2- Mass Transfer Operations; TREYBAL(RE). McGraw-Hill book Cy, Inc, 1955.
3- Petroleum, Refining and Chemical Engineering; P. WUITHIER, 1965 Edition Technip. Paris.
4-Chemical Engineering; COULSON and RICHARDSON. Pergamon Press. Lim., London 1955.

Semester: 4

Teaching unit: UET 2.2 Subject

1: Techniques of Expression and Communication VHS:

22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives: This
teaching aims to develop the student's skills, on a personal or professional level, in the field of communication and expression techniques.

Recommended prior knowledge:
Languages (Arabic; French; English)

Material content:

Chapter 1: Research, analyze and organize information Identify **3 weeks**
and use places, tools and documentary resources, Understand and analyze documents, Compile and update documentation.

Chapter 2: Improving the capacity for expression **3 weeks**
Take into account the Communication situation, Produce a written message, Communicate orally, Produce a visual and audiovisual message.

Chapter 3: Improving communication skills in interactive situations
3 weeks

Analyze the process of Interpersonal communication, Improve face-to-face communication skills, Improve group communication skills.

Chapter 4: Developing autonomy, organizational and communication skills within the framework of a project approach Being **6 weeks**
part of a project and communication approach, Anticipating action, Implementing a project: Presentation of a report of a practical work (homework).

Assessment method: Final exam: 100%.

References:

1-Jean-Denis Commeignes 12 methods of written and oral communication – 4th edition, Michelle Fayet and Dunod 2013.
2- Denis Baril; Sirey, Techniques of written and oral expression; 2008.
3-Matthieu Dubost Improve his written and oral expression all the keys; Edition Ellipses 2014.

Semester 5

Subject: UEF 3.1.1 Subject 1: Heat
Transfer

VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4

Coefficient: 2

Teaching objectives: -Study

of the different modes of transfer: conduction, convection and radiation.
-Applications of the laws governing these different types of transfer.

Recommended prior knowledge:

Thermodynamics, Differential equations.

Material content:

Chapter 1 :

General introduction to the different modes of heat transfer, (1 weeks)

Chapter 2 : (6 weeks)

Heat transfer by conduction: Fourier's law Case: simple wall, composite walls, cylindrical layer, composite cylindrical layers (electrical analogy, overall resistance); Insulation of cylindrical layers (critical insulation thickness); Insulation of spherical layers. general conduction equation, fin problems,

Chapter 3 : (5 weeks)

Convection Heat Transfer: Definitions; Expression of heat flux (Newton's law); heat transfer coefficient by convection, dimensional analysis, empirical correlations (natural and forced convection), calculation of heat flux in natural convection; Calculation of heat flux in forced convection.

Chapter 4 : (3 weeks)

Heat transfer by radiation: Laws of radiation; Lambert's law; Kirchhoff's law; Black body radiation; Radiation from non-black bodies; Reciprocal radiation of several surfaces (exchange of heat by radiation between black and gray surfaces).

Assessment method:

Continuous control: 40%; Review: 60%.

Bibliographic references:

1. J. Krabol, “Heat transfer”, Masson, 1990.
2. Martin Becker, “Heat transfer: a modern approach”. Plenum, 1986.
3. JF Sacadura, "Initiation to thermal transfer", TEC-DOC, 1980.
4. Pierre Wuithier, “Petroleum, refining and chemical engineering”.
5. Y. Jannot, thermal transfer course, 2nd edition, school of mines Nancy.
6. Incorpera, Dewwitt, Bergmann, Lavine, “Fundamentals of heat and mass transfer” , 6th edition Ed. Wiley (2010)

Semester:5

Course Unit: UEF 3.1.1 Subject 2:
Subject Transfer

VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4

Coefficient: 2

Teaching objectives:

Understand the mechanisms and the formalism allowing to describe the transfer of matter; Know how to write a material balance sheet necessary for the calculation of equipment.

Recommended prior knowledge:

Thermodynamics; chemical kinetics; Differential equations.

Material content:

Chapter 1: Mass transfer mechanism Introduction; (3 weeks)
Definition of molecular diffusion; Nomenclature: mass and molar, total and individual concentrations, diffusion and transport flux density (convection + diffusion); Definition of average mass and molar velocities; Fick's law and Stefan Maxwell's law (multicomponent gas systems); Diffusion coefficients (gaseous phase, liquid phase, order of magnitude of diffusion coefficients in different media (gas, liquids, solids); Diffusion coefficients in porous solids; Concept of effective diffusion coefficients.

-Chapter 2: Stationary and quasi-stationary one-dimensional diffusion (3 weeks)
Material balance-Continuity equation (global and partial); Reminders on the gradient and divergence operators of a vector; Balances of the total mass and for a constituent i on an element of fixed volume; Boundary conditions and initial condition; Examples of univariate diffusion problems (case of a gas through a stagnant gas film, evaporation problem, equimolar diffusion, applications for different geometries (plane, cylinder, sphere)); Diffusive transfer with homogeneous and heterogeneous chemical reaction.

Chapter 3: Transient diffusive transfer: (5 weeks)
Transient diffusive transfer: Fick's 2nd law; **Instantaneous source problems (quantity of diffusing material limited); Continuous source problems (fixed boundary condition (Learn to pose a problem with its adapted equation and its initial and boundary conditions).**

-Chapter 4: Mass transfer at an interface (between phases) (4 weeks)
Reminders of the balances between two phases; Theory of 2 films, penetration, surface renewal; Individual and global mass transfer coefficients; Concept of dimensional analysis: ÿ-Buchingham theorem; Dimensionless numbers relating to mass transfer (Sherwood, Reynolds, Schmidt); Estimates of mass transfer coefficients (dimensionless correlations)

Assessment method:

Continuous control: 40%; Review: 60%.

Bibliographic references:

1. **Bird, Stewart, Lightfoot, "Transport phenomena", Second Edition, J Wiley, 2002.**
2. **Treybal, "Mass transfer operations", McGraw-Hill.**
3. **Incorpera, Dewwitt, Bergmann, Lavine, "Fundamentals of heat and mass transfer" , 6th edition Ed. Wiley (2010)**
4. **Welty, Wicks, Wilson, Rorer, "Fundamentals of momentum, heat and mass transfer" 5th edition, Ed; Wiley (2007)**

Semester 5

Course unit: UEF 3.1.1 Subject 3:

Motion Quantity Transfer VHS: 22h30 (Course: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives: Learn to

analyze the typical problems encountered in fluid mechanics (statement of the problem, formulation and analytical solution); Make momentum and mechanical energy balances for simple unidirectional systems; Obtain the velocity profile and deduce the other quantities of interest (flow rates, forces, pressure drops, etc.).

Recommended prior knowledge: Basics in

mathematics; Notions in MDF.

Material content:

Chapter 1: (02 weeks)

Reminders: A- Properties of fluids, Statics of fluids, Dynamics of perfect fluids.

Chapter 2: (03 weeks)

Mass, momentum and energy balances: 1. Mass conservation equation; 2. Conservation of momentum equation; 3. Energy conservation equation.

Chapter 3: (05 weeks)

Fluid dynamics: 1. Stresses and strains in continuous media; 2. Equation of motion of real fluids; 3. Flow regime Applications of the Navier and Stockes equations (poiseuille flow, quilt flow, free surface flow)

Chapter 4: (02 weeks)

Simple shear flow of non-Newtonian fluids, case of BINGHAM fluid, case of OSTWALD fluid

Chapter 5 : (03 weeks)

Pumps and pumping: Calculation of networks.

Assessment method :

Review: 100%.

Bibliographic references:

1. Laszlo, “The scientific bases of chemical engineering”, Dunod, 1972.
2. Robert E Treybal, “Mass transfer operation”. Mc Graw-Hill, 1981.
3. RB Bird, WE Stewart, and EN Lightfoot, “Transport Phenomena”, Wiley 1960.
4. Midoux Noel, Mechanics of fluids in chemical engineering, Coll. Process engineering from the school of Nancy.
5. R. Comolet, Mechanics of real fluids - Volume 2, *Ed. Dunod, 2006.*
6. M. Fourar, General equations, elastic solids, fluids, turbomachines, similitude, *Ed. Ellipses, 2nd Edition 2015.*

Semester :

***5* Course unit: UEF 3.1.2 Subject 1: Electrochemistry**

VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4

Coefficient: 2

Teaching objectives: To
acquire the basic notions of electrochemistry, thermodynamics and electrochemical kinetics necessary for the understanding of electrochemical phenomena.

Recommended prior knowledge: Chemistry
of solutions. Chemical thermodynamics and notions of kinetics.

Material content:

Chapter 1 : (1 week)
Reminders on electrolytic solutions: Conductivity, ion mobility, Oswald's dilution law, Kohlrausch's relationship).

Chapter 2 : (3 weeks)
Properties and physical quantities of electrolytes: Debye-Huckel theory: applications to calculations of activity coefficients; Solvation and hydration of ions; Faraday's laws (Spreads and returns).

Chapter 3 : (5 weeks)
Thermodynamics of electrochemical reactions: Definition and preliminary reminders; Notions of chemical potential; Electrode voltage and equilibrium potential; Notions of electrochemical double layer and Stern model; Nernst relation and its applications; Predictions of RedOx reactions; Different types of electrodes; Electrochemical cells and notions of junction voltage (Henderson's law).

Chapter 4 : (4 weeks)
Kinetics of electrochemical reactions: Definitions; Speed of an electrochemical reaction; Electrochemical assemblies, Butler-Vollmer law; Approximation of Tafel.

Chapter 5 : (2 weeks)
Electrochemical methods and techniques: Voltammetry; Chronopotentiometry, ...

Assessment method:
Continuous control: 40%; Review: 60%.

Bibliographic references:

1. Genévrière ML Dumas, Roger Benaîm, essential in electrochemistry, Breal, 2001.
2. G. Milazo, "Electrochemistry", Dunod, 1969.
3. Brenet, "Introduction to the electrochemistry of equilibrium and non-equilibrium", Masson, 1980.
4. Allen J. Bard, "Electrochemistry: principles, methods and applications", Masson, 1983.
5. Fabien Miomandre, SaïdSadki, PierreAudebert, "Electrochemistry from concepts to applications", Dunod, 2005.
6. F.Cœuret, A. Stock, "Elements of electrochemical engineering", Lavoisier Tech. &.Doc, 1993.

Semester *:5*

Teaching unit: UEF 3.1.2 Subject 2:

Instrumentation – VHS sensors: 22h30

(Course: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives: Acquire

the knowledge allowing the mastery and the exploitation of the physical effects brought into play in the instrumental devices for collecting information in the measurement medium: machines, environment, etc.

Recommended prior knowledge:

Thermodynamics; Fluid mechanics ; Transfer phenomena.

Material content:

Chapter 1 : (2 weeks)

Principles of a measurement: Function of a measuring or control device; Overall composition of a measuring device; Qualities of a measuring device (Zero, Scale, Linearity); Performance of a measurement chain.

Chapter 2 : (2 weeks)

Pressure measurements: Absolute and differential pressures; Empty ; Pressure measuring devices; Use and assembly.

Chapter 3 : (2 weeks)

Flow measurements: Differential pressure, variable orifice and variable area flows; Counters.

Chapter 4 : (2 weeks)

Level measurements: Optical device, spirit level; Level measurement by the pressure due to the height of the liquid.

Chapter 5 : (2 weeks)

Temperature measurements: Thermometers and thermocouples, thermistors.

Chapter 6 : (5 weeks)

Sensors: Physics of sensors: Simple sensors; Transduction functions; Energy and electrical aspects; Sensor devices with multiple transductions: test body, acting quantity and measured quantity; Conditioning circuits: Differential bridges Integrated conditio,ners, Offset and drift compensation; Applications to measurements with thermal, mechanical, electromagnetic effects and to the dosage of chemical species.

Assessment method:

Review: 100%.

Bibliographic references:

1. M. Cerr, JC. Engrand, F. Rossman, “Industrial Instrumentation”, Ed Paris Technique & documentation Lavoisier impr., 1990 Paris Impr. Jouve.
2. Michel Grout, Patrick Salaun, "Industrial Instrumentation", Collection: Technique and Engineering, Dunod - The New Factory.
3. Michel Capot, “The principles of measurement: pressures, flow rates, levels, temperature”, TECHNIP Editions.

Semester: *5*

Teaching unit: UEF 3.1.2 Subject 3:

Chemical kinetics and homogeneous catalysis VHS:

22h30 (Course: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives:

Consolidate the basic notions of chemical kinetics (kinetic law: order, activation energy, rate constant). Acquire notions of approach to treatment of reaction mechanisms.
To make known a branch of chemical kinetics important in different sectors: catalysis.

Recommended prior knowledge: The basics

of general chemistry (atomistics, chemical bonding, thermochemistry) and the fundamental notions of chemical kinetics.

Material content:

Chapter 1: (2 weeks)
Reminders: Simple laws of chemical reaction rates; Activation energy; Molecularity.

Chapter 2 : (4 weeks)
Reaction mechanisms: Approximation of the quasi-steady state; Staged mechanisms; Chain mechanisms.

Chapter 3 : (4 weeks)
Kinetic theories: Theory of molecular collisions; Activated complex theory; Pseudo-monomolecular reactions.

Chapter 4 : (5 weeks)
Homogeneous catalysis: General information on homogeneous catalysis; Mechanisms; Acid-base catalysis; Enzymatic catalysis.

Assessment method:

Review: 100%.

Bibliographic references:

1. B. Fremaux, “Elements of kinetics and catalysis”, technique and doc. Lavoisier.
2. G. Scacchi, M. Bouchy, JF Foucaut, O. Zahraa, R. Fournet, “Kinetics and catalysis”, Lavoisier, 2011.
3. P. Morlaes, JC Morlaes, “Chemical kinetics”, Vuibert 1981.
4. Michelle Soustelle; chemical kinetics, fundamental elements, Lavoisier, 2011

Semester: ***5***

Teaching unit: UEM 3.1 Subject 1:

VHS analysis techniques: 37h30

(Course: 1h30, Lab: 1h00)
Credits: 3

Coefficient: 2

Teaching objectives: To know
the main physical methods of analysis: principle, interest and field of application in the field of process engineering in particular. Acquire the basics of analysis and control of raw materials and formulated products.

Recommended prior knowledge: Basics of
wave-particle duality; chemical bonds; Electronic Transitions; Notions of analytical chemistry; Chemistry of solutions.

Material content:

Chapter 1 : **(8 weeks)**
Chromatographic methods: General information on chromatographic methods; General principle of chromatographic separation; liquid chromatography; Gas chromatography.

Chapter 2 : **(3 weeks)**
UV – Visible Molecular Spectroscopy: Principle; Theoretical notions; Apparatus; Interpretation of a UV-Visible absorption spectrum.

Chapter 3: **(4 weeks)**
Infrared (IR) Spectroscopy: Principle; Theoretical notions; Apparatus; Interpretation of an IR absorption spectrum.

Applications:

- Identifications and quantifications by HPLC and CPG
- Verification of the Beer-Lambert law
- Identification of organic functions by IR.

Evaluation mode:

Continuous control: 40%; Review: 60%.

Bibliographic references:

1. Francis Rouessac , Annick Rouessac , Daniel Cruché, “Chemical analysis: Methods and techniques instruments”, 7th Edition Dunod, 2009.
2. Gwenola Burgot, Jean-Louis Burgot, “Instrumental methods of chemical analysis and applications: chromatographic methods, electrophoresis, spectral methods and thermal methods”, 3rd Edition, Tech & Doc, 2011.
3. R.Rosset, “Chromatography in liquid phase”, Masson, 1995
4. M. Dalibart, L. Servant, “Spectroscopy in the infrared, Techniques of the Engineer, treaty Analysis and Characterization”, P2845, 2000.

Semester *:5*

Course unit: UEM 3.1 Subject 2:

Physical Chemistry Lab 1 VHS:

22h30 (TP: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives:

Observation of physical phenomena studied during lectures; Validate and correctly present the results obtained; Formulate and communicate conclusions.

Recommended prior knowledge: - Chemistry

of solutions, notions of kinetics, basics of thermodynamics.

- Be informed of the safety instructions in a laboratory and be willing to work in a group.

NB: ***List for information only, adapt according to means;***

Number of practical work to be carried out = Seven(7): 4 in electrochemistry; 3 in homogeneous catalysis.

Material content:

Practical work

Electrochemistry • Dissociation constant; Low electrolytes; Activity coefficient. • Production of an electrochemical cell. • Drawing intensity-potential curves. • Battery voltage versus temperature measurements and error calculations.

• Corrosion of a metal. • Electrolysis lab

Kinetics and homogeneous catalysis

practical work • Effect of the nature of the catalyst on the chemical reaction: disproportionation of H2O2 in the presence of: iron(III) chloride, platinum wire, enzyme (piece of turnip) (demonstrative practical work to observe the catalytic effect and distinguish between homogeneous, heterogeneous, and enzymatic catalysis). • Determination of the catalytic constant of the reaction of

the persulfate ion with the iodide ion in the presence of CuSO4. • Kinetic study of the iodination (bromination or a base.

Evaluation mode:

Continuous control: 100%.

Bibliographic references:

1. **Allen J. Bard, "Electrochemistry: principles, methods and applications", Masson, 1983.**
2. **Fabien Miomandre, Said Sadki, Pierre Audebert, "Electrochemistry from concepts to applications", Dunod, 2005.**
3. **B. Fremaux, "Elements of kinetics and catalysis, technique and documentation", Lavoisier.**
4. **G. Scacchi, M. Bouchy, JF Foucaut, O. Zahraa, R. Fournet, "Kinetics and catalysis", Lavoisier, 2011.**
5. **Genévrière ML Dumas, Roger Benaîm, essential in electrochemistry, Breal, 2001.**

Semester 5

Course unit: UEM 3.1 Subject 3:

Chemical engineering 1 VHS:

22h30 (TP: 1h30)

Credits: 2

Coefficient: 1

Teaching objectives:

Observation of physical phenomena studied during lectures; Understand an experimental technique; Validate and correctly present the results obtained; Formulate and communicate conclusions.

Recommended prior knowledge: - Basics of thermodynamics, notions of transfer phenomena.

- Be informed of the safety instructions in a laboratory and be willing to work in band.

NB: ***List for information only, adapt according to means; Number of labs to perform = Seven(7): 3 in Heat Transfer; 2 in Mass Transfer; 2 in TQM.***

Material content:

1- Measurement of transfer coefficient, KLa, in a mechanically stirred reactor.
2- Diffusion of liquids.
3- Study of heat transfer by axial and radial conduction.
4- Study of heat transfer by convection.
5- Study of heat transfer by radiation.
6- Measurement of linear head losses in pipes of different diameters.
7- Measurement of the coefficient of friction in smooth pipes.
8- Calibration of a measuring device
9- Study of the performance of a measuring sensor (class, fidelity, accuracy, speed, etc.)

Assessment method:

Continuous control: 100%.

Bibliographic references:

1. J. Krabol, “Heat transfer”, Masson, 1990
2. Bird, Stewart, Lightfoot, “Transport phenomena”, Second Edition, J. Wiley and Sons, 2002.
3. Laszlo, “The scientific bases of chemical engineering”, Dunod, 1972.
4. Robert E. Treybal, “Mass transfer operation”, McGraw-Hill, 1981.

Semester ***:5***

Teaching unit: UEM 3.1 Subject 4:
Process simulators VHS: 22h30 (TP:
1h30)
Credits: 2
Coefficient: 1

Teaching objectives: - Become familiar with the concepts of process modeling and simulation.
- Know the main process engineering simulation software.
- Learn the basics of designing equipment and processes using software.

Recommended prior knowledge: Mathematics. Physical chemistry. Notions of transfer phenomena.

Material content:

Chapter 1 : (2 weeks)
General: Definition of simulation; Mathematical modeling; Commercial simulators (HYSYS, Aspen, Prosim, etc.); Components of a process simulator; presentation of the chosen software.

Chapter 2 : (3 weeks)
Getting started with the chosen Software: Creating a simulation; Selection from the list of compounds; Selection of the thermodynamic model; Become familiar with the simulation sheet; Installation and specification of material streams.

Chapter 3 : (3 weeks)
Thermodynamic models of the chosen software: Equations of state; Prediction of the physical properties of pure substances and mixtures; Calculation of liquid-vapor equilibria.

Chapter 4 : (3 weeks)
Simulation of some equipment: Simulation of pumps; Compressors; Regulators; Flash separator; Heat exchanger ; Furnaces and reactors.

Chapter 5 : (4 weeks)
Examples of process simulation

Assessment method:
Continuous control: 100%.

Bibliographic references:

1. **Michael E. Hanyark Jr., “Chemical Process Simulation and the Aspen HYSYS Software”, CreateSpace Independent Publishing Platform, 2012.**
2. **Hossein Ghanadzadeh Gilani, Katia Ghanadzadeh Samper, Reza Khodaparast Haghi, “Advanced Process Control and Simulation for Chemical Engineers”, CRC Press, 2012.**
3. **Alexandre Dimian, “Integrated Design and Simulation of Chemical Processes”, Elsevier, 2003.**
4. **Amiya K. Jana, “Chemical Process Modeling & Computer Simulation”, PHI Learning Pvt. Ltd., 2008.**

Semester *:5*

Teaching unit: UED 3.1 Subject 1:

Pharmaceutical processes VHS: 22h30

(Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives:

Descriptively introduce the basic notions on the processes of synthesis, treatment and purification of therapeutic molecules, their shaping in galenic formulations including the processes implemented, namely : The processes and technologies related to the formulation and industrial production of drugs.

Recommended prior knowledge: Basics of Chemistry; Notions of chemical engineering.

Material content:

Chapter 1: Medication (5 weeks) • Introduction
• Definitions •
Stages of drug development • Different drug classifications • Active ingredients • Excipients
• Packaging

• Drug activity and toxicity • Becoming active principles in the body

Chapter 2: synthetic operations (3 weeks) • Sources of active principles • Methods for obtaining natural substances • Synthetic methods
• Biotechnological methods

Chapter 3: Preformulation (3 weeks) • Routes of administration
• Choice of galenic forms •
Biopharmaceutical classification (solubility, permeability) •
Dissociation coefficient, partition coefficient

Chapter 4: Manufacturing Environment (3 weeks)
• Pharmaceutical company •
Manufacture of pharmaceutical water • Air treatment
• Concept of quality in the pharmaceutical industry

Assessment method: Exam: 100%.

Bibliographical references:

1. K. Peter C. Vollhardt, Neil E. Schore, "Treatise on organic chemistry", 5th edition, De boeck, 2009.
2. Graham L. Patrick, "Pharmaceutical Chemistry", De Boeck, 2002.
3. WEHRLE P. – PharmacieGalénique, Formulation et technologiepharmacieque, January 2008. *MALOINE*
4. LE HIR A. – PharmacieGalénique, Good practices for the manufacture of medicinal products, 8th edition, April 2001. Abbreviated by MASSON

Semester 5

Teaching unit: UED 3.1 Subject

2: Agro-food processes VHS: 22h30

(Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives: To

introduce an important specialty of process engineering by presenting the notions of process engineering specific to this branch of economic activity. ; Briefly list the processes applied to the food industry.

Recommended prior knowledge: Notions on

separation techniques and transfer phenomena.

Material content:

Chapter 1 : (2 weeks)

Processing and preservation processes: Optimization of thermal processes: Pasteurization; Canning; Cooking ; Aseptic processes; Optimization of refrigeration processes, Refrigeration; Freezing; Refrigerated transport; Dehydration and combined processes: Drying; Smoking; Dehydration-impregnation by immersion (DII).

Chapter 2 : (3 weeks)

General information on separation processes: Phase separation: Pressing; Settling, Filtration; centrifuging; Molecular scale separation: Extraction; Distillation, Evaporation, Entrainment...; Membrane processes.

Chapter 3 : (4 weeks)

Engineering of the reaction: Engineering of the physico-chemical reaction: Coagulation, Gelling, Formation of mixed networks, Heat-induced reactions; Biological reaction engineering: Biomass production, Metabolites production, Fermentation, Bioconversion.

Chapter 4 : (3 weeks)

Structuring operation; Emulsification; Cooking-extrusion; Expansion.

Chapter 5 : (3 weeks)

Mechanical and manufacturing operations: Grinding; Sieving; Flow (especially of powders); Transfer ; Cutting ; Assembly and formatting; Packing and packaging.

Assessment method:

Exam: 100%.

Bibliographic references:

1. Laurent Bazinet, François Castaigne, "Food engineering concepts: Associated processes and applications to food preservation", Tec & Doc, 2011.
2. Jean-Jacques Bimbenet, Albert Duquenoy, Gilles Trystram, "Food process engineering: From basics to applications", Dunod, 2007.

Semester ***:5***

Teaching unit: UET 3.1 Subject 1:

Air, Water and Soil Pollution VHS:

22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives: To

discover the problems of pollution and management of our environment (causes, consequences, remedies, influences of the management of our environment); The "soil pollution" part is constructed in such a way as to be accessible without prior knowledge of soil sciences.

Recommended prior knowledge: Basic
knowledge of chemistry.

Material content:

Chapter 1 : (5 weeks)

Water Pollution: Water Cycle; Measurement of water quality; Sources, mechanisms and symptoms of pollution of running waters and lakes; Influence of pollution on living beings; Oxygenation and deoxygenation; Eutrophication; Notions on the treatment and purification of wastewater; Prevention of water pollution.

Chapter 2 : (5 weeks)

Soil Pollution: Basics in Soil Science; Causes and consequences of soil degradation/pollution; Behavior of trace elements in soil; Behavior of organic pollutants in the soil; Risk analysis and legislation; Decontamination techniques and case studies.

Chapter 3 : (5 weeks)

Air Pollution: Scenario: Environment-Pollution-Sustainable Development-Energy Primary energy consumption and CO_2 emissions ; Report ; Basic notions of the atmosphere and meteorological parameters; Evolution of air quality and effect on organisms; Chemical constituents of atmospheric air; chemical pollutants; NO_2 pollution ; Formation of pollutants; Some consequences of air pollution: Greenhouse effect; Photochemical smog; Ozone hole.

Assessment method:

Review: 100%.

Bibliographic references:

1. Olivier Atteia, “Chemistry and groundwater pollution”, Ed. Lavoisier & Doc, 2015.
2. Emilian Koller, “Treatment of industrial pollution: Water, air, waste, soil, sludge”. Ed. Dunod, 2009.
3. Françoise Nési, “Soil Pollution: Soil Pollution”, 2010.
4. Louise Schriver-Mazzuoli, "Indoor Air Pollution: Sources, Health Effects, Ventilation", Ed. Dunod, 2009.

Semester ***:6***

Course unit: UEF 3.2.1 Subject 1:

VHS unit operations: 67h30

(Course: 3h00, Tutorial: 1h30)
Credits: 6

Rating: 3

Teaching objectives: Know

the main unit operations and understand the process diagrams of the different process engineering industries (chemical, electrochemical, food-processing, pharmaceutical, etc.); Write and control the material balances of these processes.

Recommended prior knowledge:

Thermodynamics; Differential equations ; Transfer phenomena.

Material content:

Chapter 1: (1 week)

General information on unit operations: Absorption; extract; adsorption; Distillation, etc.

Chapter 2 : (3 weeks)

Absorption: Liquid-gas equilibrium; Isothermal absorption, Mass balances; Theoretical stage concept; Method of Mac Cabe and Thièle, notions of contactors (packed columns and trays), hydrodynamics of flows

Chapter 3 : (4 weeks)

Liquid-to-Liquid Extraction: Introduction; definition (solvent, solute, diluent), Equilibrium diagram; Single stage extraction; multistage extraction: graphical method of Mac Cabe and Thièle, number of theoretical trays

Chapter 4 : (3 weeks)

Liquid-solid extraction (Leaching): Solid-liquid equilibrium; Janeck diagram: Determination of the number of theoretical stages, case of counter-current and cross-current extraction.

Chapter 5 : (4 weeks)

Distillation: Distillation of a binary mixture; Distillation in discontinuous, continuous mode; Calculation of the efficiency of a rectification column (Graphical methods of Mac Cabe and Thièle and of Ponchon and Savarit).

Assessment method:

Continuing control: 40%, Review: 60%.

References: **1. Robert E. Treybal, "Mass transfer operations", MC Graw Hill.**

2. MC Cabe and Smith, "Chemical engineering operations", MC Graw Hill.

3. COULSON JM, JF RICHARDSON, JR BACKHURST and JH HARKER, "Chemical Engineering", vol. two, Fifth edition, 2002.

Semester *:6*

Teaching unit: UEF 3.2.1 Subject 2:

Thermodynamics of equilibria VHS: 45h00

(Course: 1h30, TD: 1h30)

Credits: 4

Coefficient: 2

Teaching objectives: Master

the application of the three principles of thermodynamics; Distinguish the different states of a gas; Predict the direction of a chemical reaction.

Recommended prior knowledge: Chemical

thermodynamics; Differential equations.

Material content:

Chapter 1: Thermodynamics of solutions I.1 **(2 weeks)**
Behavior of a constituent in a mixture; I.2 Partial molar quantities; I.3 Excess quantities and activity; I.4 Models of non-electrolytic liquid solutions; I.5 Real gas mixtures and pseudo-critical properties

Chapter 2: Liquid-vapor equilibrium (5 weeks)
II.1 Equilibrium of an ideal binary mixture; II.2 Equilibrium of any solutions with miscible and immiscible constituent; II.3 Liquid-vapor diagram at constant pressure and temperature; II.4 Application to fractional distillation and steam entrainment; II.5 Extension to the ternary system

Chapter 3: Thermodynamics of Liquid-Liquid and Liquid-Solid Equilibria (5 weeks)
III.1 Binary liquid-liquid mixture; III.2 Application to liquid-liquid extraction; III.3 Liquid-solid mixture; III.4 Diagram of activities and solubilities; III.5 Application to ternary mixtures; III.6 Surfaces and Interfaces

Chapter 4: Thermodynamics of chemical equilibria (3 weeks)
IV.1 Equilibrium of a system in chemical reaction; IV.2 Homogeneous and heterogeneous chemical reactions; IV.3 Phase equilibria associated with a chemical reaction

Assessment method:

Continuing control: 40%, Review: 60%.

References: 1. Smith, EB, Basic,

Chemical Thermodynamics, 2nd ed., Clarendon Press, Oxford, 1977.

2. Stanley I. Sandler, Chemical and Engineering Thermodynamics, Wiley, New York, 1977.

3. Lewis GN, Randal M., Thermodynamics, Mac Graw Hill 4.

Hougen OA, Watson KM, Chemical process principles, Vol II: Thermodynamics, John Wiley and sounds

5. Brodyanski V., Sorin M., Le Goff P. The efficiency of industrial processes, exergy analysis and optimization, Amsterdam, Elsevier, (1994).

6. Wuithier, P, Petroleum, Refining and Chemical Engineering, Technip

Edition 1972 7. Abbott M; Theory and applications of thermodynamics, Schum series,

Paris 1978 8. Kireev, V. Cours de chimie physique, Edition Mir, Moscow 1975

Semester *:6*

Course unit: UEF 3.2.2 Subject 1:

Homogeneous reactors VHS: 45h00

(Course: 1h30, Tutorial: 1h30)
Credits: 4

Coefficient: 2

Teaching objectives: Highlight

the influence of the choice of chemical reactors and their operating conditions on the reaction products obtained. Dimensioning of ideal reactors.

Recommended prior knowledge:

Thermodynamics, basics of mathematics; transfer phenomena.

Contents: Chapter 1 :

(1 week)

Stoichiometry: Concept of conversion rate; Concept of advancement; Case of a single reaction; Case of several reactions.

Chapter 2: Classification of chemical reactors (1 week)

Classification of chemical reactors: Perfectly stirred batch reactor (RDPA); Perfectly stirred stationary continuous reactor (RCPA); Tubular stationary plug-flow (RCP) continuous reactor.

Chapter 3: Material balances in ideal reactors Single (2 weeks)

reaction: Perfectly agitated closed reactor; Perfectly stirred reactor continuously in steady state; Piston reactor in steady state.

Chapter 4: Study of isothermal homogeneous chemical reactors with one reaction: (4 weeks)

1-RDPA; ACPR; CPR; 2- Association of chemical reactors: Association of stationary continuous reactors in plug flow (series / parallel); Association of perfectly stirred stationary continuous reactors (series/parallel); 3- Comparative performances of ideal reactors.

Chapter 5: Study of isothermal homogeneous chemical reactors with several reactions

(4 weeks)

Consecutive irreversible reactions; Competitive reactions. Selectivity and yield ;

Chapter 6: Non-isothermal ideal reactors Notions (3 weeks)

of heat balances in non-isothermal ideal reactors.

Assessment method:

Continuing control: 40%, Review: 60%.

Bibliographical references: 1.

O. Levespiel, “Chemical reaction engineering”, Wiley, 1972.

2. G.Antonini, Benaim, “Engineering of reactors and reactions”. Nancy 1991.
3. Trambouze, “Chemical reactors, Design”.
4. J. Villermaux, “Chemical reaction engineering, Design and operation of reactors”, Edition Technical and Documentation. 1982.
5. Froment GF Chemical reactor analysis and design 2nd edition (1990) J. Wiley 6. Schweich D. Chemical reaction engineering. Tec&Doc Lavoisier, (2001) Paris

Semester ***:6***

Course unit: UEF 3.2.2 Subject 2:

Surface phenomena and heterogeneous catalysis VHS: 45h00

(Course: 1h30, TD: 1h30)

Credits: 4

Coefficient: 2

Teaching objectives: To make

known the existence of surface tension as an essential parameter intervening in interfacial interactions. Description of the phenomenon of adsorption of gases on the surface of solids through the laws of thermodynamics. Application to the determination of the surface and the porous volume of solids.
Give the basics of heterogeneous catalysis and the different techniques for developing catalysts. Briefly show the complexity of the catalytic act and the importance of modeling the kinetics.

Recommended prior knowledge: Mathematics;

chemical kinetics; basics of thermodynamics.

Material content:

Chapter 1 : (3 weeks)
Liquid-gas interface, Surface tension: Notion of surface tension; Thermodynamic functions; Effect of temperature; Effect of concentration; Gibbs relationship; Measurement of molecular area; Physico-chemical study of surfactant: Adhesion and cohesion; Wetting and contact angle.

Chapter 2: (5 weeks)
Adsorption of gases at the solid-gas interface: Types of adsorption; Thermodynamic study; Heat of adsorption; Physisorption equilibrium: adsorption in monolayer (modelling), in multilayers (modelling); Application to the determination of the surface of a solid. Hysteresis phenomena: Porosity; Kelvin's law; Porous volume.

Chapter 3: (2 weeks)
Gas chemisorption equilibria: chemisorption isotherms. Langmuir, Temkin, and Freundlich models.

Chapter 4: (2 weeks)
Introduction and general information on catalysts: Preparation methods; Characterization ; Classification.

Chapter 5 : (3 weeks)
Kinetics of reactions in heterogeneous catalysis: Mechanisms and models

Assessment method:

Continuous assessment: 40%, Examination: 60%.

Bibliographical references: 1.

CE Chitour, "Physico-chemistry of surfaces", OPU. Volumes 1 and 2.
2. JM Coulson, JF Richardson, Backhurst, Harker, "Chemical engineering", Pergamon Press. 3.
J. Fripiat, J. Chaussidon, A. Jelli, "Chemistry-physics of surface phenomena", Masson.
4. M. Boudart, "Kinetics of reactions in heterogeneous catalysis", Masson.

5. Fauvelle. JL (1989). Physico-chemistry; its role in natural, astronomical, geological, and biological. Edition: *Reinwald,* 512 p.
6. Friedli, C. (2005). General Chemistry for Engineers, Edition: *Polytechnic and University Presses Romandes.* 750p.
7. Fripiat, J. Chaussidon J, Jelli A. (1971) Chemistry-physics of surface phenomena, Edition: *Masson,* 387 p.
8. Landolt, D. (1993) Corrosion and surface chemistry of metals. Edition: *PPUR polytechnic presses.* 552 p.
9. Lalauze, R. (2006). Physico-chemistry of solid-gas interfaces 1: concepts and methodology for the study of solid-gas interactions (Coll. Sensors and instrumentation). *Hermes Science* edition , 240 p.
10. Somorjai, GA, Marie-Paule Delplancke, MP (1995). Surface chemistry and catalysis Edition: *Ediscience International.* 713 p.
11. Peter William Atkins, Julio De Paula, Physical Chemistry, Publisher: De Boeck, 4th Edition , 2013
12. Sidney FA Kettle, Inorganic Physical Chemistry, Publisher: De Boeck, 4th Edition 2013
13. Moore WJPhysical Chemistry, 2nd Edition (1965)

Semester *:6*

Course unit: UEM 3.2 Subject 1:

VHS End of Cycle Project: 45h00

(TP: 3h00)

Credits: 4

Coefficient: 2

Teaching objectives:

Assimilate in a global and complementary way the knowledge of the different subjects. Concretely put into practice the concepts inculcated during the training. Encourage the sense of autonomy and the spirit of initiative in the student. Teach him to work in a collaborative setting by arousing intellectual curiosity in him.

Recommended prior knowledge: The entire License program.

Material content:

The theme of the End of Cycle Project must come from a concerted choice between the tutor and a student (or a group of students: pair or even trinomial). The content of the subject must be consistent with the objectives of the training and the real aptitudes of the student (Bachelor's level). It is also preferable that this theme take into account the social and economic environment of the establishment. When the nature of the project requires it, it can be subdivided into several parts.

Note :

During the weeks during which the students are in the process of soaking up the purpose of their project and its feasibility (bibliographic research, research of software or materials necessary for the conduct of the project, revision and consolidation of teaching having a direct link with the subject, etc.), the person in charge of the subject must take advantage of this face-to-face time to remind students of the essential content of the two subjects "Writing methodology" and "Presentation methodology " addressed during the first two semesters of the common base.

At the end of this study, the student must submit a written report in which he must explain as explicitly as possible:

- **Detailed presentation of the subject of study, emphasizing its interest in its environment socioeconomic.**
- **Means implemented: methodological tools, bibliographical references, contacts with professionals, etc**
- **Analysis of the results obtained and their comparison with the initial objectives.**
- **Critique of the discrepancies noted and possible presentation of other additional details.**
- **Identification of the difficulties encountered by highlighting the limits of the work carried out and the follow-up to be given to the work carried out.**

The student or group of students finally present their work (in the form of a brief oral presentation or on a poster) in front of their tutor and a teacher examiner who can ask questions and thus evaluate the work accomplished on the technique and that of the presentation.

Assessment method:

Continuous control: 100%

Semester *:6*

Teaching unit: UEM 3.2 Subject 2:

VHS macroscopic assessments:

37h30 (Course: 1h30, Tutorial: 1h00)
Credits: 3

Coefficient: 2

Teaching objectives: The

various operations of Process Engineering require the writing of material and energy balance sheets to control the operation and sizing of equipment. The objectives of this subject are to provide all the fundamental concepts for carrying out the material and energy balances of a process in order to model the processes.

Recommended prior knowledge: Physical

chemistry, transfer phenomena, basics in math and computer science.

Material content:

- **Fundamental concepts – black box analysis**
- **Processes with or without chemical reaction**
- **Determination of the degrees of freedom**
- **Diagram with recycling**
- **Diagram with recycling and purging**
- **Examples of illustration (Continuous reactor; Separation column; Heat exchanger; Cooling tower; Boiler, etc.)**

Assessment method:

Continuous assessment: 40%, Examination: 60%.

Bibliographic references:

1. **PC Wankat, "Separation Process Engineering Includes Mass Transfer Analysis", Third edition, Prentice Hall publisher, 2011.**
2. **RK Sinnott, Coulson & Richardson's Chemical Engineering, Vol 6, Fourth edition, Elsevier publisher, 2005.**
3. **D. Ronze, "Introduction to process engineering", Editions Tec & Doc Lavoisier, 2008.**
4. **Joseph Lieto, "Chemical engineering for use by chemists", Tec & Doc (Editions), 2004.**

Semester *:6*

Teaching unit: UEM 3.2 Subject 3:

Physical Chemistry 2 and Chemical Engineering 2 VHS: 22h30

(TP: 1h50)

Credits: 2

Coefficient: 1

Teaching objectives: Observation

of physical phenomena studied during lectures; Validate and correctly present the results obtained; Formulate and communicate conclusions.

Recommended prior knowledge: Notions of kinetics,

basics of thermodynamics, Being informed of safety instructions in a laboratory and being willing to work in a group.

NB: ***List for information only, adapt according to means.***

Number of practical work to be carried out = eight (8): 2 in Thermodynamics; 2 in surface chemistry; 4 in Chemical Engineering.

Material content:

TP1. Thermodynamics

-Determination of the heat of dissolution.

- Thermodynamic functions of an acid-base equilibrium.

-Heat of vaporization of a pure liquid (Determination of the latent heat of vaporization of acetone.)

-Diagrams of thermodynamic phases: Liquid-vapor equilibrium. Liquid-liquid balances.

-Heat of ionic reaction.

-Determination of partial molar volumes of a binary solution.

-Diagram of a ternary mixture.

TP2. Surface phenomena

-Adsorption of a dye (methylene blue) on an adsorbent material (CA).

-Adsorption of an organic compound (acetic acid/phenol) on activated carbon

-Measurement of surface tension.

TP3. chemical engineering

-Discontinuous distillation.

-Continuous distillation of the Ethanol/Water mixture.

- Simple distillation

- Solvent extraction -

Partition coefficient

Assessment method:

Continuous control: 100%.

Semester ***:6***

Teaching unit: UED 3.2 Subject 1:

Cryogenic processes VHS: 22h30

(Course: 1h30)
Credits: 1

Coefficient: 1

Teaching objectives: To
present the different processes in the field of refrigeration and cryogenics; Some applications in the field of low temperatures.

Recommended prior knowledge: Heat transfer
phenomena; Thermodynamics and mathematical tools (differential equations and integral calculus).

Material content:

General introduction: Cryogenics and its fields of application (1 week)

Chapter 1: (2 weeks)

Vacuum technology: Importance of vacuum in cryogenics; Vacuum production systems.

Chapter 2 : (4 weeks)
Separation and purification processes for cryogenic fluids: Separation process: ideal system; Separation processes – Rectification; Role and description of the Joule Thomson valve; Air separation processes.

Chapter 3 : (5 weeks)
Permanent gas liquefaction processes: Linde-Hampson liquefaction process; Linde-Hampson double compression liquefaction process; Claude liquefaction process.

Chapter 4 : (3 weeks)
Cryogenic applications: Discovery of superconductivity; Application in the food industry.

Assessment method:

Review: 100%.

Bibliographic references:

1. RF BARRON, "Cryogenic Systems", 2nd Edition, Oxford University Press, NY, 1985.
2. PETIT, "Oxygen, Nitrogen, Rare Gases In The Air", Engineering Techniques, Treatise on Engineering and Processes Chemicals, J 6020,1973.
3. F.Ayela, P. Decool, JLDuchateau, P.Gandit, F.Kircher, A.Sulpice, L.Zani, "Cryogenic and Fluid Temperatures", Engineering Techniques, R2811, 2004.
4. A. Rojey, B. Durand, C. Jaffret, S. Jullian and M. Valais, "Natural gas", Ed. Technip, 1994.
5. P. Wuittier, Volume II, "Refining and chemical engineering", Technical Edition, France 1972.
6. Engineering Data Book, "Physical properties", Section 23, Edition 1994.
7. RC Reid, JM Prausnitz, TK Sherwood, "The Properties of gases and liquids", Third Edition Mc. Graw Hill 1977.
8. KD Timmerhaus, TM Flynn "cryogenic process engineering" Springer Science + business media, LLC 1989.

Semester *:6*

Course unit: UED 3.2 Subject 2: Corrosion

VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1

Coefficient: 1

Objectives of the lesson: To
make known the phenomenon of corrosion: To give the theoretical bases, and to present the various techniques of protection against corrosion.

Recommended prior knowledge: Basics of
electrochemistry, surface phenomena.

Material content:

Chapter 1: (6 weeks)
Different types of corrosion: Electrochemical corrosion: Generalized corrosion (uniform and galvanic); Localized corrosion; Stress corrosion; Intergranular corrosion, …, etc. ; Chemical corrosion; Bacterial corrosion.

Chapter 2 : (3 weeks)
Phase diagrams: Potential-pH diagram, Applications

Chapter 3: (6 weeks)
Different means of protection: Coatings; Inhibitors; Cathodic protection.

Assessment method:
Review: 100%.

Bibliographical references:

1. Dieter Landolt, "Corrosion and chemistry of metal surfaces" polytechnic and university, Romandes, 1997. , Treatise on Materials, process
2. C.Rochaix, "Thermodynamic-kinetic electrochemistry", Edition Nathan, 1996.
3. B.Baroux, "The corrosion of metals; passivity and localized corrosion", Dunod, 2014.
4. G.Béranger, H.Mazille, "Corrosion of metals and alloys: mechanisms and phenomena"; MIM Treated, Series Metallic alloys, Lavoisier, 2002.
5. F.Ropital, "Corrosion and degradation of metallic materials", Ed. Technip, 2009.

Semester: 6

Teaching unit: UET 3.2 Subject

1: Professional project and business management VHS:

22h30 (Course: 1h30)

Credits: 1

Coefficient: 1

Teaching objectives: To

prepare for professional integration at the end of studies through a process of maturation that is both individual and collective. Implement a post-licence project (continuation of studies or job search). Master the methodological tools needed to define a post-licence project. Prepare for the job search. Become aware of entrepreneurship through the presentation of an overview of management knowledge useful for the creation of activities.

Recommended prior knowledge: Basic

knowledge + Languages.

Skills targeted: Ability

to analyze, synthesize, work in a team, communicate well orally and in writing, be autonomous, plan and meet deadlines, be reactive and proactive.

Material content:

Chapter 1. Cover Letter Writing, Resume Writing (3 weeks)

Chapter 2. Documentary research on trades in the sector (3 weeks)

Chapter 3. Conducting interviews with trade professionals (3 weeks)

Chapter 4. Simulation of job interviews (2 weeks)

Chapter 5. Individual and/or group presentation and discussion (2 weeks)

Chapter 6. Projecting an idea, a collective research to give meaning to the individual journey (2 weeks)

Sequence 1. Plenary session
Presentation of the objectives of the module, Inventory of the sources of information available on professions and studies, Delivery of an individual sheet to be completed on the sector and the chosen professi

Sequence 2. Preparation of group work Creation
of working groups (4 students/group), Delivery of instructions for documentary research, Establishment of an action plan for carrying out interviews with professionals, Presentation of a questionnaire- kind.

Sequence 3. Documentary research and interviews in the field Free
time. Each student must provide a certificate signed by a professional which he will include in his final report.

Sequence 4. Sharing in groups Individual
presentation and exchange of results in groups, Preparation of a group summary which will be appended to each student's final report.

Sequence 5. Preparation for job search Writing a CV and cover letters, Examples of recruitment tests (interviews, tests).

Sequence 6. Focus on the creation of activities
Presentation of the management elements linked to entrepreneurship.

Alternative - plan two sessions on the subject: Creating your business: from design to implementation (Content: the job of entrepreneur, project definition, market and competition analysis, tools for develop a draft business plan, the administrative procedures for installation, an overview of the main management principles, etc.).

Sequence 7. Development of the individual post-licence project
Presentation of the outline of the individual final report, Preparation supervised by the supervisors.

Assessment method:

Review: 100%.

Bibliographic references:

1. Patrick Koenblit, Carole Nicolas, Hélène Lehongre, "Building your professional project", ESF Publisher, 2011.
2. Lucie Beauchesne, Anne Riberolles, "Building your professional project", L'Etudiant, 2002.

IV- Agreements / Agreements

STANDARD LETTER OF INTENT

(In case of license co-sponsored by another academic institution)

(Official paper on the letterhead of the university concerned)

Subject: Approval of the co-sponsorship of the license titled:

Hereby, the university (or the university center) license declare to co-sponsor the above mentioned during all the period of authorization of the license.

To this end, the university (or university centre) will assist this project by:

- Giving their point of view in the development and updating of teaching programs, - Participating in seminars
organized for this purpose, - By participating in
defense juries, - By working to pool human
resources and materials.

SIGNATURE of the legally authorized person:

FUNCTION :

date :

STANDARD LETTER OF INTENT

(In case of license in collaboration with a company of the user sector)

(Official letterhead of the company)

SUBJECT: Approval of the project to launch a Bachelor's degree course entitled:

Dispensed at:

The company hereby declares its desire to manifest its supports this training as a potential user of the product.

To this end, we confirm our support for this project and our role will be to :

- **Give our point of view in the development and updating of programs teaching,**
- **Participate in seminars organized for this purpose,**
- **Participate in defense juries,**
- **Facilitate as much as possible the reception of trainees either within the framework of memories of end of studies, or within the framework of tutored projects.**

The means necessary for the execution of the tasks incumbent on us for the achievement of these objectives will be implemented on the material and human level.

Mr (or Mrs)*… ....is designated as external coordinator of this project.

SIGNATURE of the legally authorized person :

FUNCTION :

Date :

OFFICIAL STAMP or COMPANY SEAL

V-Notices and Visas of the Administrative and Consultative Bodies

Title of the License: Process Engineering

Head of Department + Area Team Leader	
Date and stamp:	**Date and visa:**

Faculty Dean (or Institute Director)
Date and stamp:

Head of university establishment
Date and stamp:

VI – Opinion and Visa of the Regional Conference

VII – Opinion and Visa of the National Domain Educational Committee

People s Democratic Republic of Algeria'

وزارة التعليم العالي والبحث العلمي

Ministry of Higher Education and Scientific Research

اللجنة البيداغوجية الوطنية لميدان العلوم و التكنولوجيا

National Pedagogical Committee for Science and Technology

HARMONIZATION

TRAINING OFFER

ACADEMIC MASTERS

2016 - 2017

Domain	Sector	Speciality
Science And Technology	***Process Engineering***	***Polymer Engineering***

People s Democratic Republic of Algeria'

وزارة التعليم العالي والبحث العلمي

Ministry of Higher Education and Scientific Research

اللجنة البيداغوجية الوطنية لميدان العلوم و التكنولوجيا

National Pedagogical Committee for Science and Technology

مواءمة

عرض تكوين
ماستر أكاديمي

2017-2016

الميدان	الفرع	التخصص
علوم و تكنولوجيا	الطرائق هندسة	هندسة المبلمرات

I – Identity card of the Master

Access conditions

Sector	Harmonized master	Access Licenses at the masters	Classification according to license compatibility	Coefficient assigned to the license
Process Engineering	Polymer Engineering	Process Engineering	**1**	**1.00**
		Materials Engineering	**1**	**1.00**
		Materials Chemistry (Domain SM)	**2**	**0.80**
		Physics of materials (Domain SM)	**3**	**0.70**
		Organic Chemistry (Domain SM)	**4**	**0.65**
		Other ST domain licenses	**5**	**0.60**

II – Half-yearly lesson organization sheets specialty

Semester 1

Teaching unit	Materials / Entitled	Credits	Coefficient	Weekly hourly volume: Course	TD	TP	Semester Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Assessment method: Continuous monitoring	Review
Fundamental EU Code: UEF 1.1.1 Credits: 8 Coefficients: 4	Deep heat and mass transfer	4	2	1h30	1h30		45:00	55:00	40%	60%
	Thermodynamics and equilibrium diagrams	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental EU Code: UEF 1.1.2 Credits:10 Coefficients: 5	Macromolecular chemistry	4	2	1h30	1h30		45:00	55:00	40%	60%
	Physico-chemistry of macromolecules	4	2	1h30	1h30		45:00	55:00	40%	60%
	Surfaces and interfaces	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
Methodological Unit Code: EMU 1.1 Credits: 9 Coefficients: 5	Synthesis and formulation of polymers	6	3	1h30	1h30	1h30	67:30	82:30	40%	60%
	Polymer rheology	3	2	1h30		1h00	37:30	37:30	40%	60%
Discovery Teaching Unit Code: UED 1.1 Credits: 2 Coefficients: 2	Classes of materials and polymers	1	1	1h30			10:30 p.m.	02:30		100%
	Electrochemistry	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 1.1 Credits: 1 Coefficients: 1	Technical English and Terminology	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 1		**30**	**17**	**3:00 p.m.**	**7:30 a.m.**	**2h30**	**375h00**	**375h00**		

Semester 2

Teaching unit	Materials	Credits	Coefficient	Weekly hourly volume			Semester Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Assessment method	
	Entitled			**Course**	**TD**	**TP**			**Continuous monitoring**	**Review**
Fundamental EU Code: UEF 1.2.1 Credits: 10 Coefficients: 5	Implementation of polymers	6	3	3:00	1h30		67:30	82:30	40%	60%
	Blending polymers	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental EU Code: UEF 1.2.2 Credits: 8 Coefficients: 4	Conductive polymers	4	2	1h30	1h30		45:00	55:00	40%	60%
	Polymer membranes	4	2	1h30	1h30		45:00	55:00	40%	60%
Methodological Unit Code: EMU 1.2 Credits: 9 Coefficients: 5	Characterization of polymers	6	3	1h30	1h30	1h30	67:30	82:30	40%	60%
	Applied software	3	2	1h30		1h00	37:30	37:30	40%	60%
Discovery Teaching Unit Code: UED 1.2 Credits: 2 Coefficients: 2	**Subject of choice 1**	1	1	1h30			10:30 p.m.	02:30		100%
	Subject of choice 2	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 1.2 Credits: 1 Coefficients: 1	Ethics, deontology and intellectual property	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 2		**30**	**17**	**3:00 p.m.**	**7:30 a.m.**	**2h30**	**375h00**	**375h00**		

Semester 3

Teaching unit	Materials Entitled	Credits	Coefficient	Weekly hourly volume			Semester Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Assessment method	
				Course	**TD**	**TP**			**Continuous monitoring**	**Review**
Fundamental EU Code: UEF 2.1.1 Credits: 10 Coefficients: 5	Properties of polymers	4	2	1h30	1h30		45:00	55:00	40%	60%
	Polymer mechanics	4	2	1h30	1h30		45:00	55:00	40%	60%
	Bio-polymers	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental EU Code: UEF 2.1.2 Credits: 8 Coefficients: 4	Industrial applications	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
	Aging and degradation of polymers	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
	Recycling and recovery of polymers	2	1	1h30			10:30 p.m.	11:30 p.m.		100%
Methodological Unit Code: EMU 2.1 Credits: 9 Coefficients: 5	Physical analysis methods	6	3	1h30	1h30	1h30	67:30	82:30	40%	60%
	Process modeling	3	2	1h30		1h00	10:30 p.m.	11:30 p.m.	40%	60%
Discovery Teaching Unit Code: UED 2.1 Credits: 2 Coefficients: 2	Innovative composite materials	1	1	1h30			10:30 p.m.	02:30		100%
	Polymers and the environment	1	1	1h30			10:30 p.m.	02:30		100%
Transversal UE Code: UET 2.1 Credits: 1 Coefficients: 1	Documentary research and dissertation design	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 3		**30**	**17**	**4:30 p.m.**	**6:00 a.m.**	**2h30**	**375h00**	**375h00**		

Semester 4

Internship in a company sanctioned by a dissertation and a defence.

	VHS	coefficient	Credits
Personal work	550	09	18
Company internship	100	04	06
Seminars	50	02	03
Other (Framing)	50	02	03
Total Semester 4	750	17	30

This table is given for information only.

Evaluation of the End of Master Cycle Project

- Scientific value (Jury assessment) /6
- Dissertation writing (Jury assessment) /4
- Presentation and answer to questions (Jury assessment) /4
- Appreciation of the supervisor /3
- Presentation of the internship report (Jury assessment) /3

General guidelines on the choice of discovery materials:

1- Industrial Security
2- Glasses and Ceramics
3- Application on Numerical Codes
4- Servicing and regulation
5- Communication technique
6- Materials for Optics, Electronics and Optoelectronics
7- Nanotechnology and Nanomaterials
8- Computer Aided Design
9- Biocompatible Materials
10- Management of Technological Resources
11- Welding and NDT
12- Surface Treatments
13- Environment, Protection, Control
14- Business Strategy and Management
15- Recovery and Recycling of Materials
16- Management and Economy
17- Health & Safety
18- Safety and Environment
19- Industrial Equipment Vibration Study
20- Industrial Security
21- Electron Microscopy and Spectroscopy

III - Detailed program by subject of semester S1

Semester: 1
Course Unit: UEF 1.1.1
Material: Deep heat and mass transfer
VHS: 45h (class: 01h30, tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
Master the basic notions of the three modes of heat transfer
Know how to write a balance sheet and build an elementary model

Recommended prior knowledge:
Education in mathematics and physics or mechanics
Knowledge of applied thermodynamics

Material content:

Chapter 1: Conduction (4 weeks)

- Fourier's law and generalized Fourier's law, tensor of thermal conductivities, thermal conductivities, thermal diffusivities and effusivities.
- Conduction equation (EC), linear boundary conditions and examples of nonlinear conditions.
- One-dimensional transient solutions: Use Fourier analysis and Laplace transformation.
- The longitudinal and transverse fins, show the establishment of the equations in both cases.
- Suggest some solutions
- Job opportunity and optimization.
- The most common profiles (rectangular, trapezoidal).

Chapter 2: Radiant Heat Transfer (5 weeks)

- Laws and definitions in radiative transfer. Planck's law, Kirchhoff's law, Bouguer's formula.
- The radiative properties of surfaces. Exchanges between surfaces separated by a transparent medium.
- Beer's law. Radiative properties of gases (MST). Radiative properties of particles. Establishment of the radiative transfer equation (ETR).
- Some approximate solutions of the simplified RTE.

Chapter 3: Convection (3 weeks)

- Reminders of dimensional analysis, usefulness of dimensionless numbers.
- Mechanical and thermal boundary layers, integral methods.
- Convection equations, modeling of a convection problem.
- Solutions to some convection problems. Forced convection in a cylinder. Natural convection on a flat vertical plate and in a rectangular cavity .

Chapter 4: Heat transfers during phase changes (2 weeks)

- Condensation on a vertical flat plate and on a horizontal cylinder, Nusselt film theory. Practical use of correlations.
- Boiling of pure substances, main parameters involved in boiling. Evaluation of transfer rates in this mode and inherent errors.

Chapter 5: Mass Transfer (1 week)

- Diffusion equation, Fick's law
- Simultaneous heat and mass transfer
- Mass diffusion mechanism
- convective diffusion

Assessment method:
Continuous Control: 40%, Review: 60% .
Bibliographic references :

1. *H. _ S. Carslaw, Introduction to the mathematical theory of the conduction of heat in solids, Mc Millan and Co ed., 1921, , 2nd edition.*
2. *HS Carslaw and JC Jaeger, Conduction of heat in solids, 2nd edition, Clarendon press ed., 1959*
3. *Latif Jiji, Heat Conduction, Jaico Publishing House, 2003.*
4. *Ozisik, MN, 1980, Conduction Heat Transfer, John Wiley and Sons, New York.*
5. *Gebhart, Heat transfer, McGraw Hill editor, 1971*

A. *B. De Vriendt, The transmission of heat, Volume 2, Introduction to thermal radiation, Gaetan Morin, 1983*

6. *Bejan, AD Kraus, Heat transfer handbook, John Wiley Editor, 2003*
7. *Vedat S. Arpaci, Conduction Heat transfer, 1966 by Addison-Wesley publishing.*
8. *R. Ghez, A Primer of Diffusion, John Wiley and Sons Editor, 1988, 2nd edition*
9. *Chandrasekhar, radiative transfer, Dover publication, 1960*
10. *MF Modest, Radiative heat transfer, Academic Press, 3rd edition, 2012*
11. *M. Quinn Brewster, Thermal radiative transfer and properties, Wiley Inter-science Publication, 1992*
12. *Hottel, H. C, and AF Sarofim, Radiative Transfer, McGraw-Hill, New York, 1967*
13. *R. Siegel and JR Howell, Thermal Radiation Heat Transfer, 5th Edition, Ed. Taylor and Francis, 2010.*
14. *M. Necati Osizik, Radiative transfer and interactions with conduction and convection, Ed. J. Wiley and Sons*
15. *RB Bird, WE Stewart, EN Lightfoot, Transport phenomena, Wiley editor, 1960*
16. *Rjucsh K. Kundu, IM Cohen, Fluid Mechanics, 2nd Edition, Academic Press, 2002*
17. *DP Kesseler and RA Greenkorn, Momentum, Heat, and Mass transfer: Fundamentals, M. Dekker, 1999.*
18. *Kreith, F.; Boehm, RF et al., Heat and Mass Transfer, Mechanical Engineering Handbook Ed. Frank Kreith, CRC Press LLC, 1999.*
19. *HD Baehr and K. Stephan, Heat and Mass transfer, 2nd revised edition, Springer Verlag editor, 2006.*

Semester : 1
Course Unit: UEF 1.1.1
Subject: Thermodynamics and equilibrium diagrams
VHS: 45 h (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The student must be able to use thermodynamic tools in order to carry out the concrete study of physico-chemical systems in equilibrium or in the process of evolution.
The tool and concepts developed in this course will be directly applied to the reading course using phase diagrams

Recommended prior knowledge:

Structure of matter, probability and statistics, crystallography, thermodynamics

Material content:

Thermodynamics: (4 weeks)

1- reminders of basic definitions: system, phase, constituent, variables and state functions, expressions of compositions, first and second principle,
2- fundamental reminders of equilibrium conditions: chemical potential and Gibbs relations, true and apparent equilibrium, stability, metastability,
3- multi-constituted systems: partial quantities, models of ideal, regular and interstitial solutions **.**

Balance diagrams:

1- Balance **(1 week)**
2- One component system
3- Binary solutions **(1 week)**
4- Balances in heterogeneous systems **(1 week)**
5- Binary phase diagrams **(3 weeks)**
6- Ternary phase diagrams **(3 weeks)**
7- Case studies: reading and using equilibrium diagrams between phases (polymers, metals, ceramics, oxides, etc.) **(2 weeks)**

Evaluation mode: Continuous control 40%; Review 60%.

Bibliographic references:

1. *P. Perez, Thermodynamics: Foundation and applications, Masson et Cie, 1997 .*
2. *M. Karapetianz, Chemical Thermodynamics, Ed. Mir, Moscow, 1975 .*
3. *L. Sewing; C. Chahine; R. Zitoun, Thermodynamics: lessons and exercises and solved problems, Dunod, Paris, 1989*

Course unit: UEF 1.1.2
Subject: Macromolecular Chemistry
VHS: 45h00 (Class: 1h30 , TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The purpose of this course is to present in detail the architecture of macromolecular chains as well as the possibilities of development of these chains. Assimilate the degree of polymerization of polymers (chain length)…etc.

Recommended prior knowledge:

Basics of chemical kinetics and organic chemistry as well as notions of the structure of matter

Material content:

Introduction :

1. Positioning of macromolecular synthesis as an essential tool for controlling the final properties of the material
2. Understanding the differences between chain polymerization techniques and step polymerizations
3. Description of the different structures and morphology accessible during macromolecular synthesis
4. Limitations of macromolecular synthesis

A/ Radical polymerization:

1. Kinetic Reminders
2. Priming
3. Spread
4. Termination
5. Transfer
6. Control of molecular weights
7. Statistical copolymerization

B/ Polycondensation:

1. General introduction

1.1. Reminders of basic definitions

1.2. Average molar masses

2. General information on the synthesis of polymers

2. 1. Polycondensation – polyaddition versus chain polymerization (reminders)

2. 2. Examples of polycondensations and polyadditions

3. Degree of polymerization and molar masses

3.1. Number-average degree of polymerization. Carothers approach

3.2. Distribution of molar masses. Flory's statistical theory

4. Polymerization kinetics

5. Cross-linked polycondensates. Frost point prediction

5.1. Carothers theory.

5.2. Flory–Stockmayer theory
6. Examples of industrial syntheses of polycondensates
6.1. Polyamides
6.2. Polycarbonates
6.3. Polyurethanes (intervention of an industrialist)
C/ Anionic and cationic polymerization:
1. Anionic polymerization: principle, reaction mechanisms, kinetics of reactions, examples
2. Cationic polymerization: principle, reaction mechanisms, kinetics of reactions, examples

Evaluation mode: Continuous control: 40%; Review: 60%.

Bibliographic references :

- *Chemistry of GFP Polymers Vol 3*
- *Introduction to polymers RJ Young, PA Lovell Chapman & Hall*
- *Principles of polymerization, G. Odian Wiley*
- *Comprehensive polymer science; Anionic polymerization (Schwarz)*
- *Exercises and problems of macromolecular chemistry M. Bartholin, T. Hamaide Lavoisier.*

Semester: 1
Course unit: UEF 1.1.2
Subject: Physico-chemical macromolecules
VHS: 45h (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
Understand the basic notions of the statistical behavior of polymers and see how these notions are involved in the behavior of polymer systems.

Recommended prior knowledge:
Matrix calculation, numerical methods, resistance of materials.

Material content:

- Chain statistics, radius of gyration, Gaussian chain, introduction to excluded volume
- physical origin of the elasticity of chains, elasticity of a rubber material
- application of linear response theory to rubber elastic
- Measurement of single chain elasticity, measurement of force on a single chain, physical significance of a ligand/receptor force measured by AFM
- radial distribution function of colloids, light scattering and relationship with the radial distribution function, application to the case of polymers, Zimm plott
- Flory theory, phase separation, osmotic pressure
- LCST polymers

Evaluation mode: Continuous control 40%; Review 60%.

Bibliographic references:

- *Introduction to the science of GFP polymers Volumes 2, 8, 10 and 17*
- *Treatise on materials Polytechnic and university press Volumes 1 and 14*
- *From macromolecule to polymer material J. L Halary & F. Lauprêtre Belin*
- *Physics of polymers volume I P. Combette & I. Ernoult Hermann*
- *Introduction to Physical Polymer Science LH Sperling Wiley*

Semester: 1
Course unit: UEF1.1.2
Material: Surfaces and interfaces
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:
Acquire basic knowledge on the fundamental notions of surface phenomena and interfacial tension. At the end of this teaching, the student must be able to assimilate the phenomena of superficial retention and to link them to the surface energy of matter.

Recommended prior knowledge:
Basic notions of chemistry, states of matter, surface activity, adsorption.

Material content:

This course covers the following topics:
Surface phenomena
Interfaces, films and membranes
Molecular systems organized at interfaces ,
Capillarity and wetting
Langmuir films at the water-air interface
Physico-chemistry of surfactant activity, detergency.

Assessment method: Examination: 100 % .
Bibliographic references :

K. Oura, Lifshits VG, Surface science, Springer, New York, 2003
Chems Eddine Chitour, Physico – surface chemistry , 2nd expanded edition, university publications office, Algiers, 2004
Dervichian, Surfactant, emulsifiers, wetting agents (engineering technique), Paris France
Fripiat, Physical chemistry of surface phenomena, Ed Masson, Paris 1971
Boudart, Kinetics of reactions - heterogeneous catalysis, Ed. Masson, Paris, 1982
www.techniquedelingenieur.com

Semester: 1
Course unit: UEM1.1
Subject: Synthesis and formulation of polymers
VHS: 62h30 (Class: 1h30, TD: 1h30, TP: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

Acquire the basic techniques for the preparation of polymers, assimilate the ingredient formulation systems. After understanding the different types of polymer synthesis, the objective will be to understand the modes of action of stabilizers and additives used in a formulation.

Recommended prior knowledge:

Basic notions of organic chemistry, chemical reaction, chemical bonding, macromolecular chemistry

Material content:

Synthesis:
1- Definitions, classification, nomenclature, importance of the discipline.
2- Polycondensations: definitions, kinetic study, three-dimensional structures, molecular distributions.3- Polyadditions: definitions, kinetic study, three-dimensional structures, molecular distributions.4- Radical copolymerizations.5- Polymerizations in the dispersed state

Formulation:
1- Study of systems formulated from emulsions (normal and inverse):
- study of surfactants (structure, classification, choice of surfactant suitable for the application, interface properties, organization in solution). - nature, stability and characterization of emulsions, 2- study of encapsulation (micro, nano) from the three main families of processes (physical, physico-chemical, chemical).

Practical work: According to the capacities of the establishments

Assessment method: Continuous Assessment: 40%, Examination: 60% .

Bibliographic references:

- *Mark & Herman, Plastics, Time Inc., USA, 1973*
- *Ehrenstein, Gottfried W., Polymer materials: structure, properties and applications Nouv. ed. Hermes science publications, Paris, 2000.*
- *Polymers: from polymerization to properties first Franco-Mexican conference, Grenoble, 1995, Polytechnica, Paris, 1996*

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Semester: 1
Course unit: UEM1.1
Material: Polymer Rheology
VHS: 37h30 (Class: 1h30, Lab: 1h00)
Credits: 3
Coefficient: 2

Teaching objectives:
Allow the student to know the main types of rheological behavior of fluids and particularly polymers in the liquid state and in the melting state and their applications to shaping.

Recommended prior knowledge:
Basic knowledge in chemistry and physics.

Material content:

Liquid rheology

- Principles of operation of the different rheometers.
- Newtonian fluids
- Non-Newtonian fluids
  • Non-Newtonian fluid with behavior independent of time (Fluid without critical stress, (pseudoplastic or shear-thinning, dilating), Fluid with critical stress (Bingham, Casson, etc.)
  • Time-dependent viscous fluid (thixotropic fluid, rheopexe fluid
- Purely elastic linear solids
- Viscoelasticity of molten polymers
  • Viscoelastic behavior (highlighting, the Weissenberg effect, etc.).

Rheology of solid polymers

- Reminders on tensors and index notations
- Reminders on the stress/strain relations in linear elasticity
- Different viscoelastic behaviors of polymers
- Behavior under static loads (creep, relaxation)
  • Boltzman's principle of superposition
  • Models: Models of Maxwell, Kelvin-Voigt, …
  • Creep and relaxation experiments
  • Notion of relaxation time
- Viscoelastic behavior of polymers under dynamic loads (Complex module)
- Solid State Testing (Creep and Relaxation, Tensile, Torsion, Shock, Fatigue, Rupture, Dynamic Mechanical Analysis)

TP: (Depending on the capacity of the establishment)

- Practical work Viscometry: determination of the viscosity and rheological behavior of different fluids (Newtonian and non-Newtonian)
- Practical work in rheometry (rheology of complex properties, measuring the viscosity of dilute polymer solutions, measuring the viscoelasticity of polymers, etc.)

Assessment method: Continuous Control: 40%, Review: 60% .

Bibliographic references:

RI TANNER "Engineering rheology" Oxford Science Publications, 1992.
CL ROHN "Analytical polymer Rheology" Hanser, New York, 1995. JM PIAU and JF AGASSANT "Rheology for polymer melt processing", Elsevier, 1996. DEALY / SAUCIER "Rheology in plastics quality", SPE – Hanser, 2000
CW MACOSKO, Rheology: principles, measurements and applications, ed. VHC, 1994.
IM WARD "Mechanical properties of solid polymers" John Wiley and sons, London 1971
*JD FERRY "Viscoelastic properties of polymers" John Wiley Eds. New-York, 1980 AD JENKINS "Polymer science" Vol 1 and 2, North Holland Pub, Amsterdam, 1972 M.DOÎ and SF EDWARDS "The phenomenological theory of linear viscoelastic behavior" Springer**

Semester: 1
Course unit: UED 1.1
Material 1: Classes of materials and polymers
VHS: 45h00 (Class: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

The knowledge and characterization of solids with perfectly controlled shapes, sizes and structures has become essential, due to their wide use in industry: catalysts for cracking or hydrocarbon synthesis, fillers introduced into elastomers or paints, pigments , adsorbents used for purification or chemical analysis (molecular sieves, adsorbents for chromatography), hydraulic binders (concretes), powders intended for the preparation of emulsions (emulsions of products for agricultural treatments)...

The objective of the course is to provide the student with a clear vision of the major classes of materials, their physico-chemical characteristics in order to be able to give their limit of use.

Recommended prior knowledge:

General chemistry, organic chemistry, thermodynamics

Material content:

Chapter 1. Inorganic Materials (5 Weeks)

I- Introduction: cohesion in crystalline solids, physical properties of materials.
II- Metals and alloys
III- Ceramics and glasses
IV- Damage to materials over time

Chapter 2. Organic materials (5 weeks)

I- Presence of polymers in the environment
II- Classification of synthetic and natural polymers
III- Place of polymeric materials compared to ceramic metals

Chapter 3. Classification of polymers by their properties (5 Weeks)

I- Thermal properties
II- Mechanical properties
III- Electrical properties
IV-Optical properties

Assessment method: Exam: 100%.

Bibliographic references :

1- Microstructure and properties of materials.
Press Collective of the National School of Bridges and Roads (ENPC)
Presses of the National School of Bridges and Roads (ENPC)

2- Properties of natural materials
3- Materials (box of 4 volumes) - AMC, special issue
Steel - Wood - Terracotta - Glass, Collectif Groupe Moniteur

Semester: 1
Course unit: UED 1.1
Subject 1: Electrochemistry
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

Teaching objectives: The student must be able to apply the knowledge acquired in electrochemistry and more particularly in electrochemical kinetics, to materials. This EU also allows him to discover the importance of electrochemical phenomena that occur in the materials industries.

Recommended prior knowledge:

Basic notions of chemistry.

Material content:

A- Fundamental electrochemistry:
1- brief reminders of electrochemical systems at equilibrium
2- electrochemical kinetics,
3- introduction to cyclic voltammetry and impedance spectrometry

B- Electrochemistry applied to materials:
1- application of electrochemical kinetics to corrosion: mechanisms, protection against corrosion,
2- electrochemical surface treatments: electrolytic polishing, electrolytic deposits, electropolymerization,
3- Impedance spectrometry

Assessment method: Exam: 100%.

Bibliographic references :

- *Pannietier –Souchay, General chemistry – Chemical kinetics Ed. Masson -1974*
- *Rochaix, Electrochemistry, Nathan, Paris, 1996*
- *G. Charlot, Electrochemical and absorptiometric methods, Masson et Cie, Paris, 1971*
- *C. Antropov, Theoretical Electrochemistry, Ed. Mir, Moscow, 1975*

Semester: 1
Course unit: UET 1.1
Subject 1: Technical English and Terminology
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

To introduce the student to technical vocabulary. Strengthen your knowledge of the language. Help him understand and synthesize a technical document. Enable him to understand a conversation in English held in a scientific setting.

Recommended prior knowledge:

Vocabulary and basic grammar in English

Material content:

- Written comprehension: Reading and analysis of texts relating to the specialty.

- Oral comprehension: Based on authentic popular science video documents, note taking, summary and presentation of the document.

- Oral expression: Presentation of a scientific or technical subject, elaboration and exchange of oral messages (ideas and data), Telephone communication, Gestural expression.

- Written expression: Extraction of ideas from a scientific document, Writing of a scientific message, Exchange of information in writing, writing of CVs, letters of application for internships or jobs.

Recommendation: It is strongly recommended that the person in charge of the subject present and explain at the end of each session (at most) about ten technical words of the specialty in the three languages (if possible): English, French and Arabic.

Assessment method:

Review: 100%.

Bibliographic references:

1. *PT Danison, Practical guide to writing in English: customs and rules, practical advice, Editions d'Organisation 2007*
2. *A. Chamberlain, R. Steele, Practical Guide to Communication: English, Didier 1992*
3. *R. Ernst, Dictionary of techniques and applied sciences: French-English, Dunod 2002.*
4. *J. Comfort, S. Hick, and A. Savage, Basic Technical English, Oxford University Press, 1980*

III - Detailed program by subject of semester S2

Semester: 2
Course Unit: UEF 1.2.1
Matter : Implementation of polymers
VHS: 67h30 (class: 3h00, tutorial: 1h30)
Credits: 6
Rating: 3

Teaching objectives:

The aim of this module is to learn about the techniques for transforming polymers and plastics. It is a question of assimilating the different states of transformation of the polymer and of designing and predicting the rheology.

Recommended prior knowledge:

Basic notions of macromolecular chemistry and the physico-chemistry of polymers.

Material content:

I- Introduction: Influence of the structure of polymers on their transformation

II- Storage and pre-treatment of polymers: Storage of materials to be transformed, Pre-treatment (pre-drying, pre-forming and pre-heating).

III- Implementation of liquid systems: molding processes by dipping, coating, casting, injection-reaction (RIM).

IV- Transformation of polymers in the plastic state: extrusion and molding processes: extrusion of tubes and profiles, plates, sheets, films, fibers and filaments, blow molding of sheaths. Injection molding, transfer, compression, calendering, coatings.

V- Transformation of polymers in the viscoelastic state: Thermoforming, extrusion-blow molding of hollow bodies, injection-blowing of hollow bodies.

VI- Application of rheology to design: Extrusion dies, injection moulds, compression moulds, calenders.

VII- Regeneration of polymer waste: Industrial waste, non-industrial waste.

Assessment method :

Continuous control: 40%; Review: 60%.

Bibliographic references :

CG Gogos and Z. Tadmor: Principles of Polymer Processing, John Wiley, New York (1978)
J. Bost: Plastics - Technology and Plastics, Lavoisier, Paris (1982)
P. Dubois: Modern Plastics, Lavoisier, Paris (1963)
L. Mascia: Thermoplastics - materials Engineering, Elsevier publishing Co. Inc, New York (1989)
JF Agassant, P. Avenas and J. Ph. Sergent: Shaping of Plastic Materials, Lavoisier, Paris (1986)

Semester: 2
Course Unit: UEF 1.2.1
Material: Polymer blend
VHS: 45 h (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The objective of the Polymer Blending course is to provide the most comprehensive information on all aspects of polymer blending science and plastics technology. Accordingly, this module can be considered to have two parts: Fundamentals and Technology.

Recommended prior knowledge:

Basic notions of organic chemistry, macromolecular chemistry and polymer physics

Material content:

1. Introduction to polymer blends: Resins and their blends, Specialty polymers and their blends, biodegradable blends, blending and recycling.
2. Thermodynamics of polymer blends: liquid polymer blends. Phase separation. Measurement methods.
3. Crystallization, morphological structure and melting of polymer blends: miscible blends, immiscible blends.
4. Compatibilization of polymer blends: Types of polymer blends. Compatibilization by addition of a compatibilizing agent: formation of graft copolymers, formation of block copolymer, covalent crosslinking.
5. Morphology of polymer blends: microscopic methods
6. Preparation of polymer blends: Fundamentals of blending, mixing methods and equipment, reactive treatment (compatibilization).
7. Properties and performance of polymer blends
8. Application of polymer blends

Assessment method:

Continuous control: 40%; Review: 60%.

Bibliographic references :

LA Utracki, Polymers blends Handbook, vol.1, Kluwer Academic Publishers, (2002), Dordrecht, The Netherlands.
LA Utracki, Polymer Alloys and Blends, Hanser Publishers, (1989), Munich, Germany.
MM Coleman, JF Graf and PC Painter, Specific Interactions and the Miscibility of Polymer Blends, Technomics Publishing, (1991), Lancaster, UK
Datta, S., and Lohse, DJ, Polymeric Compatibilizers: Uses and Benefits in Polymer Blends, Hanser Pub., (1996), Munich, Germany.
O. Olabishi, LM Robeson and MY Shaw, Polymer-Polymer Miscibility, Academic Press, (1979), New York.

Semester: 2

Course Unit: UEF 1.2.2
Material: Conductive Polymers
VHS: 45h00 (Class: 1h30 , TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The objective of the Conducting Polymers course is to provide students with the most comprehensive information on this new aspect of polymer science, through the presentation of a class of organic compounds which are given electrically conductive properties by different chemical treatments (doping) or by structuring the material.

Recommended prior knowledge:

Basic notions in electrochemistry, electricity and macromolecular chemistry.

Material content:

1. Introduction: Theory of conjugated polymers, Electronic delocalization, Doping methods, Synergy of optical and electronic properties, Evolution of the electrical conductivity of polymers

2. Classification of electrochemically active polymers: Redox polymers, polymers derived from aromatic amines, conductive composites.

3. Chemical and electrochemical syntheses of conductive polymers: helical polyacetylene, poly(arylene vinylenes), polyaniline, polypyrrole, polythiophenes.

4. Redox transformations and transport processes: transport of electrons, ions, coupling, relaxation and hysteresis phenomena.

5. Application of conductive polymers: Deposition by thin film and microstructuring (antistatic coatings, microwave absorption, Microelectronics), electroluminescent and electrochromic devices, corrosion protection, sensors, gas detectors, Electroanalysis and biosensors, Materials for energy technologies.

Assessment method :

Continuous control: 40%; Review: 60%.

Bibliographic references :

G.Inzelt, Conducting Polymers. A New Era in Electrochemistry, Springer, (2012), Dordrecht, The Netherlands
TA Skotheim and JR Reynolds, Handbook of Conducting Polymers. Conjugated Polymers, Theory, Synthesis, Properties and Characterization, CRC Press Taylor & Francis, (2007), Boca Raton, FL, USA.
F. Monfort-Windels, Making Polymers Conductive: State of the Art, Lavoisier, (1999), France.
P. Chandrasekhar, Conducting Polymers, Fundamentals and Applications: A Practical Approach, Springer Science+Business Media, (1999), New York, USA.
L. Rupprecht, Conductive Polymers and Plastics In Industrial Applications, Plastics design Library, (1999), Norwich, USA.

Semester: 2
Course Unit: UEF 1.2.2

Material: Polymer membranes
VHS: 45h (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Membranes have gained an important place in chemical technology and are increasingly being used in a wide range of biomedical applications. The objective of this course is to present one of the most important industrial uses of polymers.

Recommended prior knowledge:

Basic notions of surface chemistry, solution chemistry and physical chemistry of polymers.

Material content:

1. Introduction, types of membranes: symmetric porous membranes, dense membranes, charged membranes, asymmetric membranes, ion exchange membranes.
2. Microfiltration: manufacture and structure of the membrane, determination of pore size, retention characteristics, applications (sterilization, filtration of particles, heavy metals, etc.)
3. Ultrafiltration: manufacture and structure of the membrane, determination of pore size, retention characteristics, applications (pharmaceutical industries, water-oil separation, decontamination, treatment of industrial effluents, etc.)
4. Reverse Osmosis: manufacture of reverse osmosis membranes (flat, spiral, tubular, hollow fiber), applications: Industrial reverse osmosis in refineries, reverse osmosis and pollution control, reverse osmosis and desalination of water from sea, …
5. Electrodialysis: typical membranes (homogeneous, heterogeneous), retention characteristics, applications: bipolar membranes, electrodes and power cells, etc.
6. Gas separation membranes: gas transport, manufacture and structure of membranes, applications: carbon dioxide separation, oxygen/nitrogen separation, dehydration, etc.

Assessment method :

Continuous control 40%; Review 60%.

Bibliographic references:

MC Porter, Handbook of Industrial Membrane Technology, Noyes Publications, (1990), Westwood, USA.
D. Bouyer, C. Faur, C. Pochat, Processes for producing membranes by phase separation, Engineering Techniques, Article / Ref: J2799 V1, (2011).
L. Auvray, F. Devreux, B. Duplantier, Physics of membranes and biological polymers, Ed. École polytechnique, (2003), Paris, France.
M. Mulder, Basic Principles of Membrane Technology, Kluwer Academic Publishers, (1991), Dordrecht, The Netherlands.
RW Baker, Membrane Technology and Applications, McGraw-Hill, (2000), New York, USA.

Semester: 2
Course unit: UEM1.2
Matter : Characterization of polymers
VHS: 67h30 (Class: 1h30, TD: 1h30, TP: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

The aim of this module is to know the techniques for characterizing polymeric materials and to assimilate the basic notions in the synthesis and behavior of macromolecules.

Recommended prior knowledge:

Basic notions of organic and macromolecular chemistry as well as the physico-chemistry of polymers.

Material content:

1. Concept of molecular mass, Concept of average: Definitions of Mn, Mw, Mz and Mv.
2. Polymolecularity, Molecular mass distribution of a polymer.
3. Fractionation, gel permeation chromatography. Osmometry.
4. Hydrodynamic measurements: viscometry, ultracentrifugation.
5. Spectrometric characterization techniques: Infrared and Raman spectroscopy, NMR and mass spectrometry,
6. Microscopic techniques for characterizing materials: optical microscopy, scanning and transmission electron microscopy,
7. X-ray diffraction techniques,
8. Thermal analysis methods: differential thermal analysis, Thermogravimetry.
9. Mechanical methods and rheometry: static and dynamic tests.

TP : (Depending on the capacity of the establishment)
- Practical work Viscometry: determination of the molecular weight of a polymer by viscometry (Relation of Mark–Houwink) or by gel permeation chromatography (GPC).
- Practical work in infrared spectroscopy: synthesis of a polymer and analysis of its structure by FTIR spectroscopy.
- Thermal analysis practical work: Study of the thermal stability of a polymer by thermogravimetric analysis or Study of the phase transitions of a plastic by differential thermal analysis (DTA).
- Practical work in mechanical analysis: Study of the behavior in traction (in compression) of a polymer, breaking load, deformation, modulus of elasticity. Study of the flow of a polymer solution by rheometry.

Assessment method:

Continuous Control: 40%, Review: 60% .

Bibliographic references:

J. Prud'homme, RE Prud'homme: Synthesis and characterization of macromolecules. The presses of the University of Montreal, 1981, Canada.
PJ Flory: Principles of polymer chemistry, Cornell. University Press, 1953, Ithaca New York
IM Ward, Mechanical properties of solid polymers. Wiley-Interscience, 1971, London
JR BILLEYER, Text book of polymer science. John Wiley, 1971, New York
F. Rouessac, A. Rouessac, Chemical analysis: modern instrumental methods and techniques, Ed. Dunod, 2004, Paris

Semester: 2
Course unit: UEM1.2
Subject: Applied Software
VHS: 37h30 (Class: 1h30, Lab: 1h00)
Credits: 3
Coefficient: 2

Teaching objectives:

- Course on numerical methods (finite element method and finite volume methods).
- Become familiar with simulation software for the implementation of polymers and the flows of these non-Newtonian materials.

Recommended prior knowledge:

Material content:

According to the capacities of the establishment

Course: Discretization methods used in digital simulation software (Finite element method, finite volume method)

Practical work: Simulation using computer codes used by mold makers and plastics makers (simulation of simple filling: Visualization of material flow, maps of temperatures, speeds, pressures, shear stresses, etc.)
Practical work: Numerical simulation of non-Newtonian fluids (in particular viscoelastic and viscoplastic fluids)

Assessment method: Continuous Assessment: 40%, Examination: 60% .

Bibliographic references:

Semester: 2
Course unit: UED 1.2
Subject 1: Subject of choice 1 (Example: Industrial safety)
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

This course allows you to assimilate the technical aspects of the safety of chemical processes. He must make students aware of preventive measures to reduce major risks linked to explosive atmospheres in the company.

Recommended prior knowledge:

Basic notions in chemistry in general and in industrial chemistry, in particular. Students in chemistry or physico-chemistry holding a license in technical sciences in process engineering will be able to follow.

Material content:

1. The main chemical risks in the workplace: Risks linked to reactions and risks linked to stocks. The risks associated with gases and gaseous media. Dust explosions. Corrosive and toxic gases.

2. Analysis and management of technological risks: Definition and characteristics of major technological risks. The sources of risk, evaluation of the probabilities and consequences of a risk. Acceptable risk. Risk interdependencies. Technological risks in business strategies. Legislation concerning technological risks. Disaster management.

3. Risk reduction measures: Preventive measures, corrective measures, post-incident intervention measures, major crisis management. Technical, regulatory and human aspects. The residual risk.

4. Ergonomics and safety: Reliability, human error and prevention. Designing systems to withstand human error. Human reliability assessment issues. Representation of accidents and risks by logical trees.

Assessment method:

Review: 100%.

Bibliographic references :

- Safety recommendations: laboratories, Ed.Technip, Paris, 1976.
- Y. Dacosta, Food bio-protection: microbial antagonism in the service of microbiological safety and quality, Ed. Dacosta, Paris, 2000.
- J. Boisselier, Hygiene and safety, who is responsible? Ed. Organization, Paris, 1982.
- JL. Pomian, T. Pradère, I. Gaillard, Engineering and ergonomics: elements of ergonomics for use in industrial projects, Ed. Cépaduès, Toulouse, 1997.
- G. Gautret de la Moricière, The chemical risk, Ed. Dunod, Paris, 2008
- N. Margossian, Reminder of the chemical risk 2nd edition, Ed. Lavoisier, Paris, 2007.

Semester: 2
Course unit: UED 1.2
Subject 2: Subject of your choice 2

VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

Recommended prior knowledge:

.

Material content:

Assessment method:

Review: 100%.

Bibliographic references :

Semester: 2
Course unit: UET 1.2
Subject 1: Ethics, deontology and intellectual property
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

Develop student awareness of ethical principles . Introduce them to the rules that govern life at the university (their rights and obligations vis-à-vis the university community) and in the world of work. Make them aware of the respect and valuation of intellectual property. Explain to them the risks of moral evils such as corruption and how to combat them.

Recommended prior knowledge:

None

Material content:

A- Ethics and deontology

I. Notions of Ethics and Deontology (3 weeks)

1. Introduction
   1. Definitions: Morality, ethics, deontology
   2. Distinction between ethics and deontology
2. Charter of ethics and professional conduct of the MESRS: Integrity and honesty. Academic freedom. Mutual respect. Requirement of scientific truth, objectivity and critical thinking. Equity. Rights and obligations of the student, teacher, administrative and technical staff.
3. Ethics and deontology in the world of work
   Legal confidentiality in business. Loyalty to the company. Responsibility within the company, Conflicts of interest. Integrity (corruption in work, its forms, its consequences, methods of fighting and sanctions against corruption)

II. Integral and responsible research (3 weeks)

1. Respect for the principles of ethics in teaching and research
2. Responsibilities in teamwork: Professional equality of treatment. Conduct against discrimination. The search for the general interest. Inappropriate conduct in the context of collective work
3. Adopting responsible conduct and combating excesses: Adopting responsible conduct in research. Scientific fraud. Conduct against fraud. Plagiarism (definition of plagiarism, different forms of plagiarism, procedures to avoid unintentional plagiarism, detection of plagiarism, sanctions against plagiarists, etc.). Falsification and fabrication of data.

B- Intellectual property

I- Fundamentals of intellectual property (1 week)

1. Industrial property . Literary and artistic property.
2. Rules for citing references (books, scientific articles, communications in a congress, theses, dissertations, ...)

II- Copyright (5 weeks)

1. Copyright in the digital environment

Introduction. Database copyright , software copyright . Specific case of free software.

2. Copyright in the internet and e-commerce

Domain name rights. Intellectual property on the internet. Law of the e-commerce site. Intellectual property and social networks.

3. Patent

Definition. Rights in a patent. Usefulness of a patent. Patentability . Patent application in Algeria and worldwide .

4. Trademarks, designs and models

Definition. Trademark Law. Designs and models law . Denomination of origin. The secret. Counterfeit .

5. Geographical Indications Law

Definitions. Protection of Geographical Indications in Algeria. International Treaties on Geographical Indications **.**

III- Protection and enhancement of intellectual property (3 weeks)

How to protect intellectual property. Violation of rights and legal tool. Valuation of intellectual property. Protection of intellectual property in Algeria.

Assessment method:
Review: 100%

Bibliographic references :

1. Charter of ethics and university deontology, https://www.mesrs.dz/documents/12221/26200/Charte+fran__ais+d__f.pdf/50d6de61-aabd-4829-84b3-8302b790bdce
2. Orders No. 933 of July 28, 2016 setting the rules relating to the prevention and fight against plagiarism
3. The ABCs of Copyright, United Nations Educational, Scientific and Cultural Organization (UNESCO)
4. E. Prairat, On teacher ethics. Paris, PUF, 2009.
5. Racine L., Legault GA, Bégin, L., Ethics and Engineering, Montreal, McGraw Hill, 1991.
6. Siroux, D., Deontology: Dictionary of Ethics and Moral Philosophy, Paris, Quadrige, 2004, p. 474-477.
7. Medina Y., Ethics, what will change in the company, editions of Organization, 2003.
8. Didier Ch., Thinking the ethics of engineers, Presses Universitaires de France, 2008.

9. Gavarini L. and Ottavi D., Editorial. of professional ethics in training and research, Research and training, 52 | 2006, 5-11.
10. Caré C., Morality, ethics, deontology. Administration and education, 2nd quarter 2002, n°94.
11. Jacquet-Francillon, Francois. Concept: professional ethics. Le Télémaque, May 2000, n° 17
12. Carr, D. Professionalism and Ethics in Teaching. New York, NY Routledge. 2000.
13. Galloux, JC, Industrial Property Law. Dalloz 2003.
14. Wagret F. and JM., Patents, trademarks and industrial property. PUF 2001
15. Dekermadec, Y., Innovating through patents: a revolution with the internet. 1999
16. AEUTBM. The engineer at the heart of innovation. Belfort-Montbeliard University of Technology
17. Fanny Rinck And léda Mansour, literacy in the digital age: copying and pasting among students, University of Grenoble 3 and University of Paris-Ouest Nanterre la Défense Nanterre, France
18. Didier DUGUEST IEMN, Citing your sources, IAE Nantes 2008
19. Similarity detection software: a solution to electronic plagiarism? Report of the Working Group on electronic plagiarism presented to the CREPUQ Sub-Committee on Pedagogy and ICT
20. Emanuela Chiriac, Monique Filiatrault and André Régimbald, Student Guide: Intellectual Integrity Plagiarism, Cheating and Fraud… Avoiding Them and, Above All, How to Cite Sources Properly, 2014.
21. Publication of the University of Montreal, Plagiarism prevention strategies, Integrity, fraud and plagiarism, 2010.
22. Pierrick Malissard, Intellectual property: origin and evolution, 2010.
23. The website of the World Intellectual Property Organization www.wipo.int
24. http://www.app.asso.fr/

الجمهورية الجزائرية الديمقراطية الشعبية

People's Democratic Republic of Algeria

وزارة التعليم العالي والبحث العلمي

Ministry of Higher Education and Scientific Research

جامعة 20 أوت 1955- سكيكدة

University 20 août 1955-Skikda

Academic Licence Degree

Civil Engineering

Institution	*Faculty*	*Department*
University 20 août 1955-Skikda	**Faculty of Technology**	***Civil Engineering***
Domain	*Branch*	*Speciality*
Science and Technology	***Civil Engineering***	***Civil Engineering***

Objective

The Licence degree in "specialty civil engineering" aims to provide students with high-level scientific and technical training in the fields of civil engineering.
This training consists of training students capable of managing multi-faceted superstructure and infrastructure projects (Buildings, Roads, structures, VRD, hydraulics, etc.). The licensee is able to participate as a qualified employee in the design and execution tasks.

License's program Content

Branch
Civil Engineering

Specialty
Civil Engineering

Semester 5

Teaching Unit	Program content – Title	Credits	Coefficient	Weekly hourly volume – Course	Tutorial	Practical work	Semester hourly volume (15 weeks)	Complementary work consulting (15 weeks)	Evaluation method – Progressive assessment	Exam
Fundamental Teaching Unit Code : FTU 3.1.1 Credits : 12 Coefficients : 6	Strength of materials	4	2	1h30	1h30		45h00	45h00	40%	60%
	Reinforced concrete 1	4	2	1h30	1h30		45h00	45h00	40%	60%
	Metal frame	4	2	1h30	1h30		45h00	45h00	40%	60%
Fundamental Teaching Unit Code : FTU 3.1.2 Credits : 6 Coefficients : 3	Soil mechanics 2	4	2	1h30	1h30		45h00	45h00	40%	60%
	Building materials	2	1	1h30			22h30	27h30		100%
Methodology Teaching Unit Code: MTU 13 Credits : 9 Coefficients: 5	Topography	4	1			1h30	22h30	27h30	100%	
	Soil mechanics 2	2	1			1h30	22h30	27h30	100%	
	Building materials 2	2	1			1h30	22h30	27h30	100%	
	Drawing of buildings and public works	3	2			2h30	37h30	37h30	100%	
Discovery Teaching Unit Code : DTU 3.1 Credits: 2 Coefficients : 2	Topography 2	1	1	1h30			22h30	02h30		100%
	Hydraulics	1	1	1h30			22h30	02h30		100%
Transversal Teaching Unit Code: TTU 3.1 Credits : 1 Coefficients : 1	Technics and construction rules	1	1	1h30			22h30	02h30		100%
Total semester 5		**30**	**17**	**12h00**	**6h00**	**7h00**	**375h00**	**375h00**		

Semester 6

Teaching Unit	Program content	Credits	Coefficient	Weekly hourly volume			Semester hourly volume (15 weeks)	Complementary work consulting (15 weeks)	Evaluation method	
	Title			Course	Tutorial	Practical work			Progressive assessment	Exam
Fundamental Teaching Unit *Code : FTU 3.2.1* *Credits : 8* *Coefficients : 4*	*Calculation of structures*	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
	Metal constructions	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
Fundamental Teaching Unit *Code : FTU 3.2.2* *Credits : 10* *Coefficients : 5*	*Reinforced concrete2*	6	*3*	*3h00*	*1h30*		*67h30*	*82h30*	*40%*	*60%*
	Foundations and geotechnical works	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
Methodology Teaching Unit *Code : MTU 3.2* *Credits : 9* *Coefficients : 5*	*Project 's of end study*	*4*	*2*			*3h00*	*45h00*	*55h00*	*100%*	
	Computer aided calculation	*3*	*2*			*2h30*	*37h30*	*37h30*	*100%*	
	Metering and price estimation	*2*	*1*	1h30			*22h30*	*27h30*		*100%*
Discovery Teaching Unit *Code : DTU 3.2* *Credits : 2* *Coefficients : 2*	*Cariageway and roads*	*1*	*1*	*1h30*			*22h30*	*2h30*		*100%*
	Site organisation	*1*	*1*	*1h30*			*22h30*	*2h30*		*100%*
Transversal Teaching Unit *Code : TTU 3.2* *Credits : 1* *Coefficients : 1*	*Professional project and enterpreise management*	*1*	*1*	*1h30*			*22h30*	*02h30*		*100%*
Total semester 6		**30**	**17**	*15h00*	*6h00*	**5h30**	**375h00**	**375h00**		

	الجمهورية الجزائرية الديمقراطية الشعبية *People's Democratic Republic of Algeria* وزارة التعليم العالي والبحث العلمي *Ministry of Higher Education and Scientific Research*	جامعة 20 أوت 1955- سكيكدة *University 20 août 1955-Skikda*

Academic Master Degree

Materials in Civil Engineering

Institution	*Faculty*	*Department*
University 20 août 1955-Skikda	**Faculty of Technology**	***Civil Engineering***

Domain	*Branch*	*Speciality*
Science and Technology	***Civil Engineering***	***Materials in Civil Engineering***

Objective

The master's degree in "specialty materials in civil engineering" aims to provide students with high-level scientific and technical training in the fields of building materials.

Master's program Content

Branch
Civil Engineering

Specialty
Materials Civil Engineering

Semester 1

Teaching Unit	Program content Title	Credits	Coefficient	Weekly hourly volume Course	 Tutorial	 Practical work	Semester hourly volume (15 weeks)	Complementary work consulting (15 weeks)	Evaluation method Progressive assessment	 Exam
Fundamental Teaching Unit Code : FTU 1.1.1 Credits : 8 Coefficients : 4	Elasticity	4	2	1h30	1h30		45h00	55h00	40%	60%
	Building materials 1	4	2	1h30	1h30		45h00	55h00	40%	60%
Fundamental Teaching Unit Code : FTU 1.1.2 Credits : 10 Coefficients : 5	Concrete technology	4	2	1h30	1h30		45h00	55h00	40%	60%
	Reinforced concrete structures	6	3	3h00	1h30		67h30	82h30	40%	60%
Methodology Teaching Unit Code: MTU 1.1 Credits : 9 Coefficients: 5	Physics of materials	4	2			3h00	45h00	55h00	100%	
	Binder	3	2			2h30	37h30	37h30	100%	
	Concrete technology	2	1			1h30	22h30	27h30	100%	
Discovery Teaching Unit Code : DTU 1.1 Credits : 2 Coefficients : 2	Building thermal	2	2	1h30	1h30		45h00	05h00	40%	60%
Transversal Teaching Unit Code:TTU 1.1 Credits : 1 Coefficients : 1	Technical english and terminology	1	1	1h30			22h30	02h30		100%
Total semester 1		**30**	**17**	**10h30**	**7h30**	**7h00**	**375h00**	**375h00**		

Semester 2

Teaching Unit	Program content: Title	Credits	Coefficient	Weekly hourly volume: Course	Weekly hourly volume: Tutorial	Weekly hourly volume: Practical work	Semester hourly volume (15 weeks)	Complementary work consulting (15 weeks)	Evaluation method: Progressive assessment	Evaluation method: Exam
Fundamental Teaching Unit *Code : FTU 1.2.1* *Credits : 10* *Coefficients : 5*	*Plasticity and damage*	*6*	*3*	*3h00*	*1h30*		*67h30*	*82h30*	*40%*	*60%*
	Building materials 2	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
Fundamental Teaching Unit *Code : FTU 1.2.2* *Credits : 8* *Coefficients : 4*	*Innovative concretes 1*	*4*	*2*	*3h00*			*45h00*	*55h00*		*100%*
	Matal structures	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
Methodology Teaching Unit *Code : MTU 1.2* *Credits : 9* *Coefficients : 5*	*Mechanics of materials*	*2*	*1*			*1h30*	*22h30*	*27h30*	*100%*	
	Applied computing	*3*	*2*			*2h30*	*37h30*	*37h30*	*100%*	
	Experimental methods	*4*	*2*	1h30		*1h30*	*45h00*	*55h00*	*40%*	*60%*
Discovery Teaching Unit *Code : DTU 1.2* *Credits : 2* *Coefficients : 2*	*Pathology of constructions* *Enterprise organisation and management*	*1* *1*	*1* *1*	*1h30* *1h30*	*1h30* *1h30*		*22h30* *22h30*	*2h30* *2h30*		*100%* *100%*
Transversal Teaching Unit *Code : TTU 1.2* *Credits : 1* *Coefficients : 1*	*Ethics, deontology and intellectual property*	*1*	*1*	*1h30*			*22h30*	*02h30*		*100%*
Total semester 2		**30**	**17**	*13h30*	*6h00*	**5h30**	**375h00**	**375h00**		

Semester 3

Teaching Unit	Course content – Title	Credits	Coefficient	Weekly hourly volume – Course	Tutorial	Practical work	Semester hourly volume (15 weeks)	Complementary work consulting (15 weeks)	Evaluation method – Progressive assessment	Exam
Fundamental Teaching Unit *Code : FTU 2.1.1* *Credits : 12* *Coefficients : 6*	*Composite materials*	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
	Recycled materials	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
	Prestressed concrete	*4*	*2*	*1h30*	*1h30*		*45h00*	*55h00*	*40%*	*60%*
Fundamental Teaching Unit *Code : FTU 2.1.2* *Credits : 6* *Coefficients : 3*	*Durability of materials*	*4*	*2*	*3h00*			*45h00*	*55h00*		*100%*
	Innovatrive concrete 2	*2*	*1*	*1h30*			*22h30*	*27h30*		*100%*
Methodology Teaching Unit *Code : MTU 2.1* *Credits : 9* *Coefficients : 5*	*Finite elements*	*4*	*2*	*1h30*		*1h30*	*45h00*	*55h00*	*40%*	*60%*
	Durability of materials	*3*	*2*			*2h30*	*37h30*	*37h30*	*100%*	
	Innovative concrete	*2*	*1*		*1h30*		*22h30*	*27h30*		*100%*
Discovery Teaching Unit *Code : DTU 2.1* *Credits : 2* *Coefficients : 2*	*Material rheology*	*1*	*1*	*1h30*			*22h30*	*02h30*		*100%*
	Site organisation and mangement	*1*	*1*	*1h30*			*22h30*	*02h30*		*100%*
Transversal Teaching Unit *Code : TTU 2.1* *Credits : 1* *Coefficients : 1*	*Documentary research and dissertation conception*	*1*	*1*	*1h30*			*22h30*	*02h30*		*100%*
Total semester 3		**30**	**17**	*15h00*	*6h00*	*4h00*	**375h00**	**375h00**		

Semester 4

	Semester Hourly Volume (SHV)	*Coeff*	*Credits*
Personnel work	*550*	*09*	*18*
Enterprise internship	*100*	*04*	*06*
Seminars	*50*	*02*	*03*
Other (Supervision)	*50*	*02*	*03*
Total Semester 4	*750*	*17*	*30*

People's Democratic Republic of Algeria
Ministry Of Higher Education and Scientific Research

Institution	Faculty	Department
University of Skikda	Economics, Commerce and Management Sciences	Commerce Sciences

Academic Master Training Offer

Field: Economics, Management and Commerce Sciences

Branch: Commerce Sciences

Specialty: Finance and International Trade

Academic year: 2016- 2017

Master's Title: Finance and International Trade

Training framework and objectives

Access conditions

This speciality is open to bachelor of:

- International Trade and Supply;
- International Trade, Marketing;
- Services Marketing;
- Tourism and Hotel Marketing;
- Hotel Marketing;
- Tourism Marketing;
- Business management.

In addition to obtaining the rank that enables them to join the master's degree, and the conditions of the formation staff, including the biography and behaviour.

Objectives

- Ensuring the qualification of students to obtain a master's degree in Finance and International Trade by providing them with knowledge and qualifications in the fields of international trade, international economic, international finance.
- Enabling students to control the fields related to the various applications of international supply and international marketing.
- Enabling students to practice professions related to international trade and international finance and various public and private institutions through deepen their commercial, administrative, financial and legal knowledge.

Target qualifications and abilities

At the end of the training, the program aims to achieve the following objectives:

- Obtaining the necessary knowledge in the field of international trade;
- Obtaining the necessary knowledge in the field of international finance.
- Obtaining the necessary knowledge in the field of supply and its operations.
- Obtaining the necessary knowledge in tax legislation.

- Obtaining the necessary knowledge in customs legislation.
- Obtaining the necessary knowledge in the field of export and import techniques.
- Controlling the techniques of international marketing.
- Controlling the mechanisms applied within the methods and strategies of international trade.
- Teaching students how to use techniques relevant to the speciality.
- Keeping abreast of developments in the field of finance and international trade.
- Qualify aspiring students to complete their course of study in this speciality or other related disciplines, in addition to active and fruitful participation in advancing human and economic development in the country.
- Contribute to the promotion of scientific research and contribute to the sustainable development of society.

Transitions towards other disciplines

This speciality allows studying other disciplines, such as marketing, management, industrial marketing, and international marketing.

Summary of the training offer

Teaching units	Basic teaching unit	Methodical teaching unit	Exploratory teaching unit	Horizontal teaching unit	Sum
Course	202.5 h	135 h	67.5 h	-	405 h
Oriented works	202.5 h	90 h	-	67.5 h	360 h
Practical works	-	-	-	-	-
Personal work	675 h	337.5 h	67.5 h	45 h	1125 h
Other work (dissertation)	600 h	-	-	-	600 h
Sum	1680 h	562.5 h	135 h	112.5 h	2490 h
Credits	72	36	8	4	120
%credits for each unit	60%	30%	6.67%	3.33%	100%

كليـــة
العلوم الإقتصادية
و التجارية و علوم التسيير

Master’s Title: Finance and International Trade

كليـة
العلوم الإقتصادية
و التجارية و علوم التسيير

Semester: One

Teaching Unit	Hours volume	Weekly hours volume				Coefficient	Credits	Valuation types	
	14-16 weeks	Course	Oriented works	Practical works	Other works			Continuous	Final exam
Basic Teaching Unit									
International business management	120 h	1.5 h	1.5 h		5 h	2	6	×	×
International finance	120 h	1.5 h	1.5 h		5 h	2	6	×	×
E-commerce	120 h	1.5 h	1.5 h		5 h	2	6	×	×
Methodical Teaching Unit									
International insurance	105 h	1.5 h	1.5 h		4 h	2	5	×	×
Communication and administrative editing	90 h	1.5 h			4.5 h	1	4		×
Exploratory Teaching Unit									
Consumer protection law	45 h	1.5 h			1.5 h	1	2		×
Horizontal Teaching Unit									
Foreign language	25 h		1.5 h		1 h	1	1		×
Semester one	**625 h**	**9 h**	**7.5 h**		**26 h**	**11**	**30**		

Master's Title: Finance and International Trade

Semester: One

Unit Title: Basic Teaching Unit

Module 1: International business management
Credit: 6
Coefficient: 2

Teaching goals:

Enabling students to master the various concepts related to international business management and foreign investment.

Required background:

Background about international marketing and foreign investment.

Subject matter content:

- Introduction to international business management.
- International business environment.
- Management and strategic planning of human resources in international business.
- Electronic management within international business.
- Foreign investment Forms.
- Multinational companies (forms, conglomerates, alliances).

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's Title: Finance and International Trade

Semester: One

Unit Title: Basic Teaching Unit

Module 2: International finance

Credit: 6

Coefficient: 2

Teaching goals:

- Knowing the basic concepts of international finance.
- Controlling the principles and rules of international finance in general.
- Acquiring knowledge in the field of international financial systems.

Required background:

For a deep understanding of the subject matter, it is recommended that students acquire, in advance, the most important rules and principles of finance, and laws regulating them, in addition to the elements related to the balance of payments and foreign exchange systems.

Subject matter content:

- Introduction to international finance (concept, dimensions, benefits and importance).
- Foreign exchange markets and systems.
- Foreign exchange risk management.
- Balance of payments (equilibrium theories).
- The international financial system (past, currently).
- The institutional structure of international trade and finance (IMF, World Bank, esc).
- International macroeconomic environment (theories and practices).

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's Title: Finance and International Trade

Semester: One

Unit Title: Basic teaching Unit

Module 3: E-commerce

Credit: 6

Coefficient: 2

Teaching goals:

- Reviewing the concept of e-commerce, its types and areas.
- Controlling the principles and rules of e-commerce.
- Focusing on the most important areas and sectors that can benefit from e-commerce application.

Required background:

In order to understand the subject matter well, it is recommended that students acquire, in advance, the most important rules and principles of trade and laws regulating it, in addition to the elements related to its applied areas.

Subject matter content:

- Basic concepts about e-commerce.
- Electronic commerce, its financing mechanisms, and its legal and tax dimensions.
- The role of e-commerce in the international trade.
- Basics of applying the e-commerce system.

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's Title: Finance and International Trade

Semester: One

Unit Title: Methodical Teaching Unit

Module 4: International insurance

Credit: 5

Coefficient: 2

Teaching goals:

- Having an overview about legislation and regulations related to the subject matter.
- Controlling the principles and rules of insurance.
- Acquiring knowledge and qualifications in the field of international insurance.

Background required:

In order to understand the subject matter well, it is recommended that students have acquired the most important rules and principles of insurance, and laws regulating it, in addition to the elements related to risk management.

Subject matter content:

- Concept definition of insurance and risk.
- Insurances types.
- Risks types.
- Insurance actors.
- Insurance of exports and imports.
- Insured risks and pricing-compensation mechanisms.
- Transport insurances (ground, naval, air and travelling abroad for people and cars).
- International insurance markets.

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's Title: Finance and International Trade

Semester: One

Unit Title: Methodical teaching Unit

Module 5: Communication and administrative editing

Credit: 4

Coefficient: 1

Teaching goals:

Considering that communication is important for the organization, it is necessary to provide students with the principles of communication and administrative editing.

Required background:

Having a basic knowledge of management concepts in general.

Subject matter content:

- Nature of communication.
- Communication elements and functions.
- Models and forms of communication.
- Constituents and obstacles of communication.
- Communication techniques and its development steps.
- Communication obstacles.
- Administrative editing as communicative techniques (its definition, conditions and formulas).
- Administrative editing principles and rules.
- Administrative letter and other administrative documents.
- Models of formal letters, models of personal informal letters, other models.

Valuation method:

- Final exam: 100%

Semester: One

Unit Title: Exploratory Teaching Unit

Module 6: Consumer protection law

Credit: 1

Coefficient: 2

Teaching goals:

Providing students with knowledge about consumer protection law, developing their legal abilities and skills in law, in addition to keep them updated on developments of the Algerian legal system in order to reach a high academic level in a rapidly developing world.

Background required:

Students should have a theoretical background about law in general.

Subject matter content:

Explanation and clarification of Ordinance No. 03-03 containing the Competition Law.

Valuation method:

- Final exam: 100%

Master's Title: Finance and International Trade

كلية
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و التجارية و علوم التسيير

Semester: One
Unit Title: Horizontal Teaching Unit

Module 7: Foreign language
Credit: 1
Coefficient: 1

Teaching goals:

Providing students with knowledge related to English language, improving their abilities to think objectively, and developing their skills in English, in addition to keeping them updated on developments related to research, relying on foreign languages in order to ensure a high academic level in a rapidly developing world.

Required background:

Students should have a theoretical background in English and some terms related to their specialty.

Subject matter content:

The key features of course are core reading texts to explain the basic content, systematic vocabulary development, translations into English, a grammar work schedule and grammar practice test, progress tests or mock examinations.

Valuation method:

- Final exam: 100%

Master's Title: Finance and International Trade

Semester: Two

Teaching Unit	Hours volume	Weekly hours volume						Valuation types	
	14-16 weeks	Course	Oriented works	Practical works	Other works	Coefficient	Credits	Continuous	Final exam
Basic Teaching Unit									
International marketing	120 h	1.5 h	1.5 h		5 h	2	6	×	×
Exchange risk management and policies	120 h	1.5 h	1.5 h		5 h	2	6	×	×
International trade financing techniques	120 h	1.5 h	1.5 h		5 h	2	6	×	×
Methodical Teaching Unit									
Economic geography	105 h	1.5 h	1.5 h		4 h	2	5	×	×
Entrepreneurship	82.5 h	1.5 h	1.5 h		2.5 h	2	4	×	×
Exploratory Teaching Unit									
International commercial arbitration	45 h	1.5 h			1.5 h	1	2		×
Horizontal Teaching Unit									
Foreign language	25 h		1.5 h		1 h	1	1		×
Semester two	**617.5 h**	**9 h**	**9 h**		**24 h**	**12**	**30**		

Master's Title: Finance and International Trade

Semester: Two

Unit Title: Basic Teaching Unit

Module 8: International marketing

Credit: 6

Coefficient: 2

Teaching goals:

International marketing is an important theme in the field of international trade since it is related to marketing patterns represented in the international marketing mix and how it helps in international institutions development.

Required background:

In order to understand the subject matter well, it is recommended that students have acquired information about principles and rules of marketing.

Subject matter content:

- Introduction to international marketing (historical development, field of practice, concept, esc).
- Importance and objectives of international marketing.
- International marketing environment.
- Strategies for entering international markets (adaptation strategy, standardization strategy or consolidation).
- International marketing mix policies: product, price, distribution, promotion.

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's Title: Finance and International Trade

Semester: Two
Unit Title: Basic Teaching Unit

Module 9: Exchange risk management and policies
Credit: 6
Coefficient: 2

Teaching goals:

Providing students with knowledge about exchange market, exchange policy and various techniques for exchange risks management.

Required background:

In order to understand the subject matter well, it is recommended that the students have acquired the important rules and principles of finance, and laws regulating it, in addition to the elements related to the balance of payments and foreign exchange systems.

Subject matter content:

- Exchange market: description and practical mechanism of exchange market, participants, motives, market segments, organization and mechanism of the current exchange market, market characteristics, determinants of the current exchange rate, management of currency treasury and exchange risk.
- Exchange policy: authorities and controlling exchange rate policy, exchange policy and economic balance.
- Nominal reduction and real reduction.
- Exchange risk and exchange rate prediction.
- Internal techniques for exchange risks management.
- Effect on deadlines: process deadlines management, granting discounts for prepayment, intercept accounts, LOCK BOX, self-coverage and NETTING.
- Other internal means and techniques: influencing the company trade flows, Billing in national currency or choosing a less volatile currency, external techniques for exchange risks management, forward exchange, currency SWAPS, advance in currency, Currency future contract, currency options
- Coverage techniques against exchange risks: covering exchange risk through foreign trade insurance companies.

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's Title: Finance and International Trade

Semester: Two

Unit Title: Basic Teaching Unit

Module 10: International trade financing techniques

Credit: 6

Coefficient: 2

Teaching goals:

- Having an overview about mechanisms related to international financing field.
- Acquiring knowledge about foreign trade financing techniques.
- Acquiring knowledge related to financing international trade risks.

Required background:

In order to understand the subject matter well, it is recommended that students have acquired the most important rules and principles of international finance, and laws regulating it, in addition to the elements related to payment methods in international trade.

Subject matter content:

- Short-term financing for foreign trade operations: documentary collection, invoice transfer, bill discounting, loans for debt mobilization arising from exports.
- Medium and long-term financing: supplier loan, buyer loan, risk financing, documentary credit.

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's title: Finance and International Trade

Semester: Two
Unit Title: Methodical Teaching Unit

Module 11: Economic geography
Credit: 5
Coefficient: 2

Teaching goals:

The module sheds light on the importance of economic geography, natural economic resources, energy and oil resources and their concentration areas, as well as cultural and human resources, which are considered influential in economic activity and international economic relations.

Required background:

Students should be familiar with the topics of international economics and resource economics.

Subject matter content:

- Defining economic geography and its importance.
- Fields of economic geography in relations to other sciences.
- The natural and human factors affecting economic activity.
- Investment ways in economic resources.

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's Title: Finance and International Trade

Semester: Two

Unit Title: Methodical teaching Unit

Module 12: Entrepreneurship

Credit: 4

Coefficient: 2

Teaching goals:

Providing students with information and knowledge about entrepreneurship and how to create and manage projects.

Required Background:

Background about the management, marketing and finance.

Subject matter content:

- Concept of entrepreneurship and the project: establishment stages, introducing the founder, the idea, and the work plan.
- Compatibility between the founder and the project.
- Project management.
- Enterprise financing.
- Studying the effectiveness of the project.

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's Title: Finance and International Trade

Semester: Two

Unit Title: Exploratory teaching Units

Module 13: International commercial arbitration

Credit: 1

Coefficient: 2

Teaching Objectives:

The module aims at providing the student with knowledge related to the set of international commercial arbitration rules and the organization of the international community and the procedures for implementing international commercial arbitration.

Required Background:

Students should have a theoretical background on law in general and laws related to international trade in particular.

Subject matter content:

- Nature and characteristics of international commercial arbitration.
- The emergence and development of international commercial arbitration.
- Sources of international commercial arbitration.
- Rules to conduct international commercial arbitration.
- Procedures for implementing international commercial arbitration.

Valuation method:

- Final exam: 100%

Master's Title: Finance and International Trade

Semester: Two

Unit Title: Horizontal Teaching Unit

Module 14: Foreign language

Credit: 1

Coefficient: 1

Teaching goals:

Providing students with concepts and terminology related to the field of finance and international trade in English language.

Required background:

Students should have a theoretical background about some terms related to his specialty in English.

Subject matter content:

First section: concepts related to the specialty:

- Concept of international marketing.
- International commercial and financial organizations: the International Monetary Fund, the World Bank, and the World Trade Organization.
- Inco terms in Arabic and English (considered as the basic terms for editing international commercial contracts -printed handout-).

Second section: editing letters, preparing reports, editing international commercial contracts:

- Administrative letter editing model: purchase orders, billing
- Forms for editing international commercial contracts: transport contracts, insurance, purchasing.

Valuation method:

- Final exam: 100%

Master's Title: Finance and International Trade

Semester: Three

Teaching Unit	Hours volume	Weekly hours volume						Valuation types	
	14-16 weeks	Course	Oriented works	Practical works	Other works	Coefficient	Credits	Continuous	Final exam
Basic Teaching Unit									
International economic relations	120 h	1.5 h	1.5 h		5 h	2	6	×	×
Export and import procedures	120 h	1.5 h	1.5 h		5 h	2	6	×	×
International transport and logistics	120 h	1.5 h	1.5 h		5 h	2	6	×	×
Methodical Teaching Unit									
Forecasting techniques	105 h	1.5 h	1.5 h		4 h	2	5	×	×
Scientific research methodology	85 h	1.5 h			3.5 h	1	4	×	×
Exploratory Teaching Unit									
Competition law	45 h	1.5 h			1.5 h	1	2		×
Horizontal Teaching Unit									
Foreign language	25 h		1.5 h		1 h	1	1		×
Semester three	**620 h**	**9 h**	**7.5 h**		**25 h**	**11**	**30**		

Master's Title: Finance and International Trade

Semester: Three

Unit Title: Basic Teaching Unit

Module 15: International economic relations
Credit: 6
Coefficient: 2

Teaching goals:

Providing students with knowledge related to economic relations, politics, international finance and the new system of international economic relations,

Required knowledge:

Students should be familiar with the principles of economics, international trade and international finance.

Subject matter content:

- Nature and aspects of international economic relations: the importance of international economic relations and aspects of international exchange, global economy features, theories explaining international exchange and movements of production factors.
- International monetary and financial relations: payments balance, external exchange theories, international payments.
- International trade policies: the historical development of international trade policies, international trade policy tools, types and effects of international trade policy.
- The New Order of International Economic Relations: Economic Integration and Economic Blocs, World Trade Organization.

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's Title: Finance and International Trade

Semester: Three

Unit Title: Basic Teaching Unit

Module 16: Export and import procedures

Credit: 6

Coefficient: 2

Teaching goals:

Export and import techniques are among the basic sections necessary for student formation in the field of international foreign trade.

Required knowledge:

In order to understand the subject matter well, it is recommended that students have acquired the most important rules of exchange rates and interest with customs administration.

Subject matter content:

- What is customs system, customs procedures (tariff and non-tariff restrictions), the role of customs systems in export and import operations.
- The impact of international agreements and organizations on customs systems in countries, World Customs Organization, customs development and modernization trends, customs in Algeria, customs restriction and liberalization.

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's Title: Finance and International Trade

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العلوم الإقتصادية
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Semester: Three

Unit Title: Basic Teaching Units

Module 17: International transport and logistics
Credit: 6
Coefficient: 2

Teaching goals:

Controlling international logistics and transport policies and techniques, and procedures of international transport and international insurance contracts.

Required background:

Concepts related to logistics and transport, in addition to customs law and international business law.

Subject matter content:

Export procedures, international contracts, terms of delivery, international means of transport, international insurances, export order processing, import supply.

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's Title: Finance and International Trade

Semester: Three

Unit Title: Methodical teaching Unit

Module 18: Forecasting techniques

Credit: 5

Coefficient: 2

Teaching goals:

Providing students with knowledge related to forecasting techniques using SPSS program, developing their abilities for objective thinking, as well as keeping them updated to developments related to practical studies that rely on SPSS to ensure a high academic level in a rapidly developing world.

Required knowledge:

Students should have a background in statistics obtained at the bachelor's level in descriptive statistics and inferential statistics modules, in addition to knowledge acquired in informatics.

Subject matter content:

Generalities about forecasting (importance and types), forecasting qualitative methods, linear regression (simple linear regression, multiple linear regression), time series, Holt-Winters exponential smoothing model or Jinking-box, Data analysis using SPSS1 (data coding, data entry, comparing averages using SPSS), data analysis using SPSS2 (variance analysis using SPSS, correlation and regression using SPSS, statistical tests using SPSS).

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Master's Title: Finance and International Trade

Semester: Three

Unit Title: Methodical Teaching Unit

Module 19: Scientific research methodology

Credit: 4

Coefficient: 1

Teaching goals:

Enabling students to discuss and interact in debates related to marketing of services latest topics.

Required background:

Having a background about marketing in general and marketing of services in particular.

Subject matter content:

Research outline, research elements (title, research problem, research hypotheses, literature review, theoretical framework, study determinants and variables, references, research appendices), research methodology, scientific research tools, samples, academic writing, and using sources and footnotes.

Valuation method:

- Final exam: 100%

Master's Title: Finance and International Trade

Semester: Three
Unit Title: Exploratory Teaching Unit

Module 20: Competition law
Credit: 2
Coefficient: 1

Teaching goals:

Providing students with knowledge related to competition law, developing his abilities for objective thinking, improving his skills in the field of laws that help him in his specialty, in addition to keeping them updated to developments related to Algerian competition law to ensure a high academic level.

Required background:

Basic background in law and competition in general.

Subject matter content:

Explaining the competition law content.

Valuation method:

- Final exam: 100%

Master's Title: Finance and International Trade

وزارة التعليم العالي و البحث العلمي
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العلوم الإقتصادية
و التجارية و علوم التسيير
جامعة 20 أوت 1955 - سكيكدة

Semester: Three

Unit Title: Horizontal Teaching Unit

Module 21: Foreign language
Credit: 1
Coefficient: 1

Teaching goals:

Providing students with knowledge related to modern concepts in the field of international trade, international finance and international marketing in English.

Required background:

Students should have a good background in English in addition to some terms and concepts related to his specialty.

Module content:

- International marketing.
- International trade.
- Export and import techniques.
- Stock exchange.
- Banking.
- E-commerce.

Valuation method:

- Final exam: 100%

Master's Title: Finance and International Trade

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Semester: Four

An internship in an institution that culminates in a publicly presented dissertation.

	Hours volume	Weekly hours volume	Coefficient	Credits
Dissertation	600 h	30 h	4	30
Semester four	600 h		4	30

People's Democratic Republic of Algeria
Ministry Of Higher Education and Scientific Research

Institution	Faculty	Department
University of Skikda	Economics, Commerce and Management Sciences	Commerce Sciences

Academic Bachelor Training Offer

Field: Economics, Management and Commerce Sciences

Branch: Commerce Sciences

Specialty: International Trade and Logistics

Academic year: 2017-2018

Bachelor's Title: International Trade and Logistics

كلية
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جامعة 20 أوت 1955 - سكيكدة

Training framework and objectives

Access conditions

This bachelor training is opened for all students of the common core (1^{st} year) in the field of Economics, Management and Commerce Sciences.

Objectives

Through the path of university training and qualification within the LMD system for the field of Economics, Management and Commerce Sciences, and in particular the academic bachelor's path, students of the first year are formed according to the common core program for the bachelor's degree. Then, students are oriented to one of the four branches of the field. If the student is oriented to the branch of Commerce Sciences, it is formed in the second year according to the education program for the second year of the bachelor's degree in the branch of Commercial Sciences. After passing this stage, the student can easily choose a bachelor's degree in International Trade and Logistics, which allows students to control the following competencies and knowledge:

a. Cognitive aspect:

Enabling students to acquisition:

- Concepts related to international trade;
- Theoretical foundations of international finance;
- Theoretical and technical foundations of logistics and supply;
- Various transport technologies, customs, international insurance and incoterms;
- Scientific vision in the field of international marketing.

b. Practical aspect:

Enabling students to:

- Analysing international trade;
- Controlling supply technologies and processes;
- Controlling international marketing policies and techniques;
- Preparing students to practice jobs and tasks related to customs, ports and airports, economic institutions in the field of export and import;

- In addition to the knowledge acquired within the common basic training, which is related to management, finance and economics.

Target qualifications and abilities

Enabling students to acquire the following qualifications and competencies:

- Necessary knowledge in the field of international trade;
- Necessary knowledge in the field of international finance;
- Necessary knowledge in the field of logistics and its operations;
- Necessary knowledge in tax legislation;
- Necessary knowledge in customs legislation;
- Necessary knowledge in the field of export and import techniques;
- Controlling the techniques of international marketing;
- Controlling the mechanisms applied within the methods and strategies of international trade.

Transitions towards other disciplines

This speciality allows studying other disciplines, such as marketing, management, industrial marketing, international marketing, International logistics and transportation, customs and transit techniques, finance and international trade.

Summary of the training offer

Teaching units	Basic teaching unit	Methodical teaching unit	Exploratory teaching unit	Horizontal teaching unit	Sum
Course	472.5 h	315 h	202.5 h	22.5h	1012.5 h
Oriented works	450 h	225 h	22.5 h	112.5 h	810
Practical works	00 h	00 h	45 h	00 h	45 h
Personal work	1237.5 h	707.5 h	302.5 h	90 h	2337.5 h
Other work	-	-	-	-	-
Sum	2160 h	1247.5 h	572.5 h	225 h	4205 h
Credits	103	55	16	6	180
%credits for each unit	57.22%	30.55%	8.90%	3.33%	100%

Bachelor's Title: International Trade and Logistics

Semester: One

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Teaching Unit	Hours volume	Weekly hours volume				Coefficient	Credits	Valuation types	
	14-16 weeks	Course	Oriented works	Practical works	Other works			Continuous	Final exam
Basic Teaching Unit									
Introduction to economics	45 h	1.5 h	1.5 h		45 h	2	5	×	×
Microeconomics 1	45 h	1.5 h	1.5 h		45 h	2	5	×	×
Financial accounting 1	45 h	1.5 h	1.5 h		45 h	2	4	×	×
History of economic events	45 h	1.5 h	1.5 h		45 h	2	4	×	×
Methodical Teaching Unit									
Statistics 1	45 h	1.5 h	1.5 h		40 h	2	4	×	×
Mathematics 1	45 h	1.5 h	1.5 h		40 h	2	4	×	×
Research Methodology 1	22.5 h	1.5 h			40 h	1	1		×
Exploratory Teaching Unit									
Introduction to law	22.5 h	1.5 h			40 h	1	1		×
Introduction to sociology	22.5 h	1.5 h			40 h	1	1		×
Horizontal Teaching Unit									
Foreign language 1	22.5 h		1.5 h		40 h	1	1	×	×
Semester one	**360 h**	**13.5 h**	**10.5 h**		**420 h**	**16**	**30**		

Bachelor's Title: International Trade and Logistics

Semester: One

Unit Title: Basic Teaching Unit

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Module 1: Introduction to economics
Credit: 5
Coefficient: 2

Teaching goals:

Enabling students to acquire basic knowledge about the principles of economics.

Required background:

General knowledge about economic concepts.

Subject matter content:

a. Cognitive introduction

- Subject of economics (wealth, prosperity, effective choices, social relations).
- Economic problem.
- Concept of need and commodity.
- Use and applications of economics.

b. Theoretical entrance:

- Production activity (concept, calculation, elements).
- Exchange activity (instruments, subjects of exchange, and space of exchange).
- Distribution activity (before production, after production).
- Consumption activity (spending).
- Saving activity.
- Investment activity.

c. The regular entrance:

- Concept of economic system.
- Philosophy and doctrine of economic system.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: One

Unit Title: Basic Teaching Unit

Module 2: Microeconomics 1
Credit: 5
Coefficient: 2

Teaching goals:

This course aims to build knowledge about theories that explain consumption behaviour and theories that explain production behaviour.

Required background:

General knowledge about consumption and production, in addition to knowledge about mathematical analysis.

Subject matter content:

a. Consumer behaviour theory

- Expected utility theory (numerical): hypotheses, types of utility.
- Ordinal utility theory (indifference curve analysis).
- Analysis of indifference curves, marginal rate of substitution, budget constraint, consumer equilibrium, substitution effect and income effect, change in consumer environment.
- Demand function (concept of demand function, mathematical representation of demand function, individual demand function, market demand function, elasticity).

b. Producer behaviour theory

- Definition and types of production functions
- Production function in the short run

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: One

Unit Title: Basic Teaching Unit

Module 3: Financial accounting 1

Credit: 4

Coefficient: 2

Teaching goals:

This course aims to build knowledge about management and organisation of all types of accounts in companies.

Required background:

Knowledge of types of financial accounts in the National Accounting Guide.

Subject matter content:

- Conceptual framework for financial accounting.
- Accounts functioning (studying class 1 equity accounts, studying class 2 fixed assets accounts, studying class 3 inventories accounts, studying class 4 third party accounts, studying class 5 financial accounts).
- Income accounts (class 6 expenses, class 7 revenues).
- Preparation and presentation of financial statements (balance sheet, income statement, cash flows statement, statement of variation in equity).

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Bachelor's Title: International Trade and Logistics

Semester: One

Unit Title: Basic Teaching Unit

Module 4: History of economic events
Credit: 4
Coefficient: 2

Teaching goals:

This course aims to study the most important economic events throughout history, from ancient centuries to contemporary economic events.

Required background:

General knowledge about economic systems that the world has known.

Subject matter content:

Introduction: concept of economic events and their importance.

a. Economic event in ancient centuries

- Greece.
- Romans.

b. Economic events in the Islamic world

c. Economic events in the western world

- Feudal system.
- Literal system.
- Capitalism (commercial capitalism, industrial capitalism, financial capitalism).
- Economic events between the two wars (peace treaties and the German problem, 1929 global economic crisis, socialism emergence).
- Contemporary economic events (BW system and the new economic system, emergence of Asian economies, socialism collapse, economic globalisation, 2008 financial crisis).

Valuation method:

- Continue valuation in oriented works: 40%
- Final exam: 60%

Bachelor's Title: Licence International Trade and Logistics

Semester: One
Unit Title: Methodical Teaching Unit

Module 5: Statistics 1
Credit: 4
Coefficient: 2

Teaching goals:

This course aims to study statistical methods by identifying the nature and sources of statistical data, as well as measures of dispersion.

Background required:

Categories, frequencies, and measures of central tendency such as the arithmetic mean, median, and mode.

Subject matter content:

a. General concepts
- Concept of statistics.
- Society, sample and individual.
- Statistical data sources.
- Nature of statistical data.

b. Display statistical data
- Tables and their types (category, frequencies, category centre...).

c. Graphic representation according to the type of variable

d. Measures of positional central tendency
- Mean, median, mode...

e. Dispersion measures
- Closed distribution: standard deviation.
- Open distribution: half of the quartile range.
- Two pointers.

f. Shapes
- Symmetrical shape.
- Skewness.
- Flattening and tapering.

Valuation method:
- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: One

Unit Title: Methodical Teaching Unit

Module 6: Mathematics 1

Credit: 4

Coefficient: 2

Teaching goals:

This module aims to provide students with mathematical tools that enable them to conduct analytical studies of economic phenomena.

Background required:

Basic knowledge of mathematics.

Subject matter content:

- Principles of groups' theory.
- General concepts about sequences and series.
- Continuous applications.
- Derivatives.
- Exponential and logarithmic functions.
- Original functions and calculation of integration.
- Functions with several variables.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: One

Unit Title: Methodical Teaching Unit

Module 7: Research Methodology 1

Credit: 1

Coefficient: 1

Teaching goals:

The course aims to study theoretical concepts of scientific research methodology and the methods used.

Background required:

Some simple knowledge about the methodology.

Subject matter content:

Introduction to the science of methodology (definition of methodology, methodological schools, methods).

Valuation method:

- Final exam: 100%.

Bachelor's Title: Licence International Trade and Logistics

Semester: One

Unit Title: Explanatory Teaching Unit

Module 8: Introduction to law

Credit: 1

Coefficient: 1

Teaching goals:

The course aims to provide students with knowledge related to law, its necessity, the characteristics of its rules, the distinction between it and other social rules, the scope of the law, its sections and branches, in addition to a set of abstract and general rules that strictly govern the behaviour of individuals in society and their relations with each other.

Background required:

Preliminary knowledge in itself.

Subject matter content:

- Introduction to the law.
- Abstract and general legal rules.

Valuation method:

- Final exam: 100%.

Bachelor's Title: Licence International Trade and Logistics

Semester: One

Unit Title: Explanatory Teaching Unit

Module 9: Introduction to sociology

Credit: 1

Coefficient: 1

Teaching goals:

General knowledge about sociology.

Background required:

General culture in sociology.

Subject matter content:

- Emergence and development of sociology.
- Basic concepts about sociology.
- Relationship of sociology with economic sciences.
- Relationship between sociology and management sciences.
- Most important theories explaining sociology.

Valuation method:

- Final exam: 100%.

Bachelor's Title: Licence International Trade and Logistics

Semester: One

Unit Title: Horizontal Teaching Unit

Module 10: Foreign language 1

Credit: 1

Coefficient: 1

Teaching goals:

This course aims to enable students to understand the terminology of the specialisation in the foreign language.

Background required:

Students must be proficient in the grammar of the foreign language that he will study.

Subject matter content:

The content is selected topics in the foreign language specialisation.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

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Bachelor's Title: International Trade and Logistics

Semester: Two

Teaching Unit	Hours volume 14-16 weeks	Weekly hours volume Course	Oriented works	Practical works	Other works	Coefficient	Credits	Valuation types Continuous	Final exam
Basic Teaching Unit									
Introduction to management	45 h	1.5 h	1.5 h		45 h	2	6	×	×
Microeconomics 2	45 h	1.5 h	1.5 h		45 h	2	6	×	×
Financial accounting 2	45 h	1.5 h	1.5 h		45 h	2	4	×	×
Methodical Teaching Unit									
Statistics 2	45 h	1.5 h	1.5 h		45 h	2	4	×	×
Mathematics 2	45 h	1.5 h	1.5 h		45 h	2	4	×	×
Informatics 1	45 h	1.5 h	1.5 h		45 h	2	3	×	×
Exploratory Teaching Unit									
Commercial law	22.5 h	1.5 h			45 h	1	1		×
Sociology of organisations	22.5 h	1.5 h			45 h	1	1		×
Horizontal Teaching Unit									
Foreign language 2	22.5 h		1.5 h		45 h	1	1	×	×
Semester two	**337.5 h**	**12 h**	**10.5 h**		**405 h**	**15**	**30**		

Bachelor's Title: Licence International Trade and Logistics

Semester: Two

Unit Title: Basic Teaching Unit

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Module 11: Introduction to management

Credit: 6

Coefficient: 2

Teaching goals:

This course aims to provide knowledge about concepts related to business administration and its functions.

Background required:

General knowledge about management functions.

Subject matter content:

- Management: concepts, approaches, importance and objectives.
- Stages of development of management thought.
- Management functions: plan, organisation, direction (lead, communicate, motivate, control).

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: Two

Unit Title: Basic Teaching Unit

Module 12: Microeconomics 2
Credit: 6
Coefficient: 2

Teaching goals:

This course aims to enable students to acquire knowledge related to production functions, cost theory, market equilibrium, perfect competition and monopoly.

Required background:

General concepts about production, and mathematical methods used in analysis.

Subject matter content:

- Production functions in the long period (production function when all factors of production are changed returns to scale or economies of scale).
- Production when two variable factors are available.
- Elasticity (elasticity of factors of production, flexibility of substitution).
- Supply functions (definition, individual supply function, market supply function).
- Theory of costs and revenues (functions of costs in the short period, functions of costs in the long period, revenues, profit).
- Market equilibrium (concept of equilibrium, interaction of supply and demand, consumer surplus and producer surplus).
- Perfect competition (definition, characteristics, analysis over periods).
- Perfect monopoly (definition, types and conditions, demand curve and marginal revenue, monopolist's equilibrium, regulation of monopoly…).

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: Two

Unit Title: Basic Teaching Unit

Module 13: Financial accounting 2

Credit: 4

Coefficient: 2

Teaching goals:

This course aims to enable students to apply accounting treatment techniques for financial transactions of companies.

Required background:

Knowledge of the accounting 1 program.

Subject matter content:

- Accounting treatments of the process of company creation.
- Accounting treatment of purchase and sale operations, commercial discounts and value-added tax.
- Accounting treatment of commercial papers.
- Packaging accounting.
- End of the period.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Two
Unit Title: Methodical Teaching Unit

Module 14: Statistics 2
Credit: 4
Coefficient: 2

Teaching goals:

Enabling students to understand mathematical statistics.

Background required:

Principles in descriptive statistics.

Subject matter content:

a. Introduction to probability
- Random experiment.
- Probability.
- Events (compatibility, incompatibility, independence, dependence).

b. Random variable
- Discrete and continuous random variables.
- Probability distribution.
- Probability distribution function.
- Expected value.
- Standard deviation.

c. Probability distributions

c.a. Probability distributions for discrete random variables
- Binomial distribution.
- Poisson distribution.
- Other distributions.

c.b. Probability distributions for continuous random variables
- Normal distribution.
- Transformation from Normal distribution to Binomial and Poisson distributions.

Valuation method:
- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Two

Unit Title: Methodical Teaching Unit

Module 15: Mathematics 2

Credit: 4

Coefficient: 2

Teaching goals:

Learn to use mathematics in economic analysis.

Background required:

Basic knowledge of mathematics.

Subject matter content:

- Radial space structure.
- Linear applications.
- General concepts of matrices.
- Basic operations on matrices.
- Matrix rank and inverse calculation.
- Solving systems of linear equations.
- Eigenvalues and eigenvectors.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Two

Unit Title: Methodical Teaching Unit

Module 16: Informatics 1

Credit: 3

Coefficient: 2

Teaching goals:

The ability to use informatics.

Background required:

General knowledge about informatics principles.

Subject matter content:

- Computer Definition.
- Hardware component of computer.
- Software component of computer.
- Operating systems.
- Auxiliary application programs.
- Internet and its applications.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Two

Unit Title: Exploratory Teaching Unit

Module 17: Commercial law
Credit: 1
Coefficient: 1

Teaching goals:

The objective of this course is to provide students with knowledge related to sources of commercial law, traders, and commercial establishments. This enables them to develop their abilities in objective thinking and enhance their skills in the field of law, while connecting it to the economy. Additionally, the course aims to keep students updated with the latest developments in this subject to ensure a high academic level.

Background required:

Student should be familiar with the topics of introduction to law in terms of application, scientific aspects, and practical aspects, as well as their understanding of general and specific rules.

Subject matter content:

- Origins, definition, and evolution of commercial law and its characteristics.
- Commercial activities and their importance.
- The merchant: definition, conditions for acquiring merchant status, merchant's obligations).
- Commercial establishment: nature, characteristics, and elements of a commercial establishment.
- Types of commercial companies.

Valuation method:

- Final exam: 100%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Two

Unit Title: Exploratory Teaching Unit

Module 18: Sociology of Organisations

Credit: 1

Coefficient: 1

Teaching goals:

Enable students to understand and analyse organisations.

Background required:

The student should have knowledge of sociology.

Subject matter content:

- Theoretical principles of organisational analysis.
- Economic theories of organisational analysis.
- Sociological theories of organisational analysis.
- Internal analysis of organisations.

Valuation method:

- Final exam: 100%.

Bachelor's Title: Licence International Trade and Logistics

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Semester: Two

Unit Title: Horizontal Teaching Unit

Module 19: Foreign language 2

Credit: 1

Coefficient: 1

Teaching goals:

The course aims to enable students to understand the terminology of the specialisation in the foreign language.

Required background:

Students should be proficient in the rules of the foreign language.

Subject matter content:

The content is selected topics in the foreign language specialisation.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: Three

Teaching Unit	Hours volume	Weekly hours volume						Valuation types	
	14-16 weeks	Course	Oriented works	Practical works	Other works	Coefficient	Credits	Continuous	Final exam
Basic Teaching Unit									
Enterprise management	45 h	1.5 h	1.5 h		75 h	2	6	×	×
Macroeconomics 1	45 h	1.5 h	1.5 h		75 h	2	6	×	×
Analytical accounting	45 h	1.5 h	1.5 h		55 h	2	5	×	×
Methodical Teaching Unit									
Statistics 3	45 h	1.5 h	1.5 h		30 h	2	3	×	×
Economic mathematics	45 h	1.5 h	1.5 h		30 h	2	3	×	×
Research Methodology 2	22.5 h	1.5 h			2.5 h	1	1		×
Exploratory Teaching Unit									
Monitory economy and capital markets	45 h	1.5 h	1.5 h		55 h	2	4	×	×
Informatics 2	22.5 h	1.5 h		1.5 h	2.5 h	2	1	×	×
Horizontal Teaching Unit									
Foreign language 3	22.5 h		1.5 h		2.5 h	1	1		×
Semester three	**337.5 h**	**12 h**	**10.5 h**	**1.5 h**	**327.5 h**	**16**	**30**		

Bachelor's Title: International Trade and Logistics

Semester: Three

Unit Title: Basic Teaching Unit

Module 20: Enterprise management

Credit: 6

Coefficient: 2

Teaching goals:

The purpose of this course is to identify the concepts of the enterprise through its types, functions and methods of decision-making.

Required background:

Background about companies' management.

Subject matter content:

- Formation and development of enterprises.
- Types of enterprises.
- Functions of enterprises.
- Decision theory (processes and models).

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: Three
Unit Title: Basic Teaching Unit

Module 21: Macroeconomics I
Credit: 6
Coefficient: 2

Teaching goals:

The aim of this course is to deepen the knowledge of students on the issues of modern macroeconomics theory, and studying indicators of the national economy and government spending through the rate of investment, consumption, and savings.

Required background:

A good mathematical background and some background in economics.

Subject matter content:

a. Concept of economic theory
- Building models, studying internal and external variables, dynamic and static analysis, basic macroeconomic characteristics, behavioral equations, equilibrium conditions.

b. Some concepts and aggregates related to macroeconomics
- Calculating national product and national income, gross domestic product, gross national product, net national product, national income, personal income.

c. Classical general equilibrium model
- Hypotheses of classical school, general equilibrium at the classics (equilibrium of the labor market, equilibrium of the goods and services market, equilibrium of the money market, evaluation of the general equilibrium theory at the classics).

d. Keynesian economics analysis
- Determining national income with two sectors (consumption function, saving function, investment function, and marginal sufficiency of capital, Keynesian analysis of the interest rate, multiplier and its types, accelerator).
- Determining the national income with the presence of a government sector (government spending, taxes, transfers, and the equilibrium of national income), the impact of investment and government spending (government spending, taxes, the transfer multiplier, the balanced budget multiplier, income-related taxes and the study of the multiplier).
- National income with the presence of foreign trade.

Valuation method:
- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: Three

Unit Title: Basic Teaching Unit

Module 22: Analytical Accounting
Credit: 5
Coefficient: 2

Teaching goals:

Analytical accounting is an integral part of accounting; it includes analytical skills to take managerial decisions in multidimensional aspects of the organization. The objective of this course is to familiarize students with cost accounting.

Required background:

A good background about financial accounting.

Subject matter content:

- Introduction to analytical accounting (definition of the analytical accounting system, comparison between financial accounting system and analytical accounting system).
- Introduction to the concept of costs.
- Inventory accounting methods.
- Cost Accounting and Activity Based Costing.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Three

Unit Title: Methodical Teaching Unit

Module 23: Statistics 3

Credit: 3

Coefficient: 2

Teaching goals:

This course provides a deep understanding of the theoretical and practical aspects in applied statistics for the purpose of scientific research.

Background required:

In order to understand the subject matter well, it is recommended that students have acquired knowledge in principles of statistics.

Subject matter content:

- Sampling distribution (concepts, sampling, point estimators evaluation).
- Confidence level (normal samples, confidence intervals, confidence interval of variance, abnormality, mean confidence interval, confidence interval between two means, confidence interval for the ratio between two variances).
- Statistical tests.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Three

Unit Title: Methodical Teaching Unit

Module 24: Economic mathematics

Credit: 3

Coefficient: 2

Teaching goals:

The aim of this course is to present a systematic overview of several mathematical tools that are commonly employed in companies, and enable students to control the methods used to solve problems and choose the optimal solutions.

Background required:

Students should know basic concepts of mathematical methods.

Subject matter content:

- Linear programming (linear programming problem, formulation of the problem, graphical solution, presentation of the solution using the Simplex method, the binary issue, sensitivity analysis).
- Transportation problems (formulation of the problem, representation of the transportation problem in network theory).
- Introduction to non-linear programming with or without restrictions.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Three

Unit Title: Methodical Teaching Unit

Module 25: Research Methodology 2

Credit: 1

Coefficient: 1

Teaching goals:

This course aims to provide students with methodological tools for the completion of scientific research.

Background required:

Familiarity with the knowledge of methodology.

Subject matter content:

- Methodology for preparing a thesis.
- Introduction to research.
- Research Plan.
- Editing the content of the research.
- Citations.
- Bibliography.
- Preparing and conduct the questionnaire.

Valuation method:

- Final exam: 100%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Three

Unit Title: Exploratory Teaching Unit

Module 26: Monetary economy and capital markets

Credit: 4

Coefficient: 2

Teaching goals:

Providing students with knowledge about various concepts related to money, banks, monetary systems, and financial markets.

Background required:

Students should have a theoretical background aboutmoney and banking.

Subject matter content:

- Evolution of exchange systems.
- Forms and functions of money.
- Classical monetary theories.
- Modern monetary theories.
- Types and functions of banks.
- Stock market and capital markets.
- Forms and characteristics of securities.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Semester: Three

Unit Title: Exploratory Teaching Unit

Module 27: Informatics 3

Credit: 1

Coefficient: 2

Teaching goals:

Providing students with knowledge to control the use of computer as well as to be able to create software.

Background required:

Students should control the use of computer and internet.

Subject matter content:

- Using a computer to solve problems.
- Programming structure.
- Algorithms.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Three
Unit Title: Horizontal Teaching Unit

Module 28: Foreign language 3
Credit: 1
Coefficient: 1

Teaching goals:

Providing students with knowledge related to English language, improving their abilities to think objectively, and developing their skills in English, in addition to keeping them updated on developments related to research, relying on foreign languages in order to ensure a high academic level in a rapidly developing world.

Required background:

Students should have a theoretical background in English and some terms related to their specialty.

Subject matter content:

a. Terminology:

- Globalisation.
- Market economy.
- International trade.

b. Key features of course are:

- Core reading texts to explain the basic content.
- Systematic vocabulary development.
- Translations into English.
- Grammar works schedule and grammar practice tests.
- Final test

Valuation method:

- Final exam: 100%.

Bachelor's Title: International Trade and Logistics

Semester: Four

Teaching Unit	Hours volume	Weekly hours volume						Valuation types	
	14-16 weeks	Course	Oriented works	Practical works	Other works	Coefficient	Credits	Continuous	Final exam
Basic Teaching Unit									
Enterprise economy	45 h	1.5 h	1.5 h		75 h	2	6	×	×
Macroeconomics 2	45 h	1.5 h	1.5 h		75 h	2	6	×	×
Public finance	22.5 h	1.5 h	1.5 h		57.5 h	1	4	×	×
Methodical Teaching Unit									
Marketing	45 h	1.5 h	1.5 h		55 h	2	5	×	×
Financial mathematics	45 h	1.5 h	1.5 h		80 h	2	5	×	×
Exploratory Teaching Unit									
Informatics 3	45 h	1.5 h		1.5 h	30 h	2	3	×	×
Horizontal Teaching Unit									
Corruption and work ethics	22.5 h	1.5 h			2.5 h	1	1		×
Semester four	**270 h**	**10.5 h**	**7.5 h**	**1.5 h**	**375 h**	**12**	**30**		

Bachelor's Title: International Trade and Logistics

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Semester: Four

Unit Title: Basic Teaching Unit

Module 29: Enterprise economy

Credit: 6

Coefficient: 2

Teaching goals:

Familiarity with concepts related to the organization, its functions, and its growth patterns.

Required background:

Students should have knowledge about the economic environment in which the enterprise operates and factors affecting it.

Subject matter content:

- Concept of the enterprise.
- The enterprise and the environment.
- Organization of the enterprise.
- Functions of the enterprise.
- Enterprise economic analysis tools.
- Enterprise growth patterns.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Semester: Four

Unit Title: Basic Teaching Unit

Module 30: Macroeconomics 2
Credit: 6
Coefficient: 2

Teaching goals:

The aim of this course is to provide students with knowledge related to the development of consumption theories, in addition to studying economic growth models and economic cycles, to develop students' abilities to think objectively and develop their skills in using the methods of macroeconomic analysis, in addition to making students keep abreast of developments related to the scale to ensure a high academic level.

Required background:

Students should be familiar with the subjects of macroeconomics 1 that he had acquired in the third semester, in addition to other subjects: principles of economics, money, banking, history of economic thought, economic mathematics and statistics.

Subject matter content:

- Modern consumption functions (Kuznets theory of consumption, permanent income theory, relative income theory, life cycle theory, effect of assets on consumption).
- Money demand functions.
- Hicks and Hans analysis of interest rate (general economic equilibrium curve).
- Economic growth models, Hard's model, Domar's model, Kaldor's model, John's model, Robinson's model, Solow's model.
- Economic cycles, definition of economic cycle, types of economic cycles.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: Four

Unit Title: Basic Teaching Unit

Module 31: Public finance

Credit: 4

Coefficient: 1

Teaching goals:

This course aims to give students an overview of public finance through public expenditures, how to prepare them, as well as public revenues and their sources.

Required background:

In order to understand the subject matter well, it is recommended that students have acquired knowledge about spending and revenue through macroeconomic analysis.

Subject matter content:

- Emergence and development of public finance and its relationship to other sciences.
- Public expenditures (concept of public and private expenditures, types of public expenditures, division of public expenditures, effects public economic and social expenditures).
- Public revenues (concept of public revenues, types of public revenues, sources of revenues).
- Government budget.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Four

Unit Title: Methodical Teaching Unit

Module 32: Marketing

Credit: 5

Coefficient: 2

Teaching goals:

This course aims to provide students with knowledge related to marketing and marketing activities, and to identify the basis for segmentation of market into sectors, purchasing behaviours of individuals and the factors influencing them, as well as the elements of the marketing mix.

Background required:

The environment in which the organization operates, as well as consumption and the factors affecting it, and the business activities of the organization.

Subject matter content:

- Nature and importance of marketing.
- Knowing the environment and the market.
- Market segmentation.
- Consumer behaviour.
- Marketing mix.
- Types of marketing.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Four

Unit Title: Methodical Teaching Unit

Module 33: Financial mathematics

Credit: 5

Coefficient: 2

Teaching goals:

The student should learn about the types of interest applied to loans and how to calculate them.

Background required:

Types of loans, conditions and procedures for obtaining them, and guarantees that cover the volume of loans.

Subject matter content:

- Simple interest and discount.
- Compound interest and payments.
- Equivalence of rates and capital.
- Investment selection criteria.
- Loans and their amortization.
- Valuation of bonds and stocks.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

Semester: Four

Unit Title: Exploratory Teaching Unit

Module 34: Informatics 3

Credit: 3

Coefficient: 2

Teaching goals:

Enabling students to control all office applications.

Background required:

Computer knowledge and how to use it, as well as controlling the creation of software.

Subject matter content:

- Office applications program word.
- Office applications program Excel.
- Office applications program Power Point.
- Office applications program Access.
- Office applications program Front Page.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: Licence International Trade and Logistics

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Semester: Four

Unit Title: Horizontal Teaching Unit

Module 35: Corruption and work ethics

Credit: 1

Coefficient: 1

Teaching goals:

The course aims to educate students and make them aware of the danger of corruption, and motivate them to contribute to fighting it.

Required background:

Students should have a background in administrative methods of management as well as money management.

Subject matter content:

- Concept of corruption
- Types of corruption: financial corruption, administrative corruption, moral corruption, political corruption.
- Manifestations of administrative and financial corruption.
- Reasons for administrative and financial corruption.
- Effects of administrative and financial corruption.
- Fight against corruption.

Valuation method:

- Final exam: 100%.

Bachelor's Title: International Trade and Logistics

Semester: Five

Teaching Unit	Hours volume 14-16 weeks	Weekly hours volume: Course	Oriented works	Practical works	Other works	Coefficient	Credits	Valuation types: Continuous	Final exam
Basic Teaching Unit									
International trade theories	120 h	1.5 h	1.5 h		5 h	2	5	×	×
International finance	120 h	1.5 h	1.5 h		5 h	2	5	×	×
International trade techniques	120 h	1.5 h	1.5 h		3.5 h	2	4	×	×
Merchandise markets	97.5 h	1.5 h	1.5 h		3.5 h	2	4	×	×
Methodical Teaching Unit									
Exchange systems and currency markets	97.5 h	1.5 h	1.5 h		5 h	2	5	×	×
Customs and transit operations	67.5 h	1.5 h			3 h	1	4		×
Exploratory Teaching Unit									
Customs Law	45 h	1.5 h			1.5 h	1	2		×
Horizontal Teaching Unit									
Foreign language	22.5 h		1.5 h			1	1	×	×
Semester five	**690 h**	**10.5 h**	**9 h**		**26.5 h**	**13**	**30**		

Bachelor's Title: International Trade and Logistics

Semester: five

Unit Title: Basic Teaching Unit

Module 1: International trade theories

Credit: 5

Coefficient: 2

Teaching goals:

- Examine the traditional theories related to international trade.
- Access to modern theories and models related to international trade.

Required background:

It is recommended that students should acquire, in advance, the concept and importance of foreign trade and its role in the economic, political and social fields.

Subject matter content:

- Classical and modern theories explaining international exchange.
- Evolution of international trade terms.
- Determinants of specialization and international commercial competition.
- Economic growth and international trade.
- Determinants of the movement of international factors of production.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: five

Unit Title: Basic Teaching Unit

Module 2: international Finance

Credit: 5

Coefficient: 2

Teaching goals:

- Familiarity with the basic concepts of international finance.
- Master the principles and rules of international finance in general.
- Acquiring knowledge in the field of international financial systems.

Required background:

It is recommended that students should acquire, in advance, the most important rules and principles of finance, and the laws regulating them, in addition to the elements related to the balance of payments and foreign exchange systems.

Subject matter content:

- Introduction to international finance (concept, dimensions, benefits and importance).
- Foreign exchange markets and systems.
- Foreign exchange risk management.
- Balance of payments (equilibrium theories).
- International financial system (past, present).
- International trade and finance institutions (IMF, World Bank, etc.).
- International macroeconomic environment (theories and practices).

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: five

Unit Title: Basic Teaching Unit

Module 3: International trade techniques

Credit: 4

Coefficient: 2

Teaching goals:

This course allows students to identify the conditions for preparing international trade contracts, in addition to insurance, transportation, negotiation and payment techniques within international trade.

Required background

Previous knowledge related to international insurance techniques, commercial law and contract terms from a legal point of view.

Subject matter content:

- International trade contracts and their components.
- Negotiation operations, transportation and insurance in international trade.
- Payment and financing techniques in international trade.
- Problems associated with the implementation of international trade contracts (international trade arbitration).

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: five

Unit Title: Basic Teaching Unit

Module 4: Merchandise markets
Credit: 4
Coefficient: 2

Teaching goals:

- Examining the legislation and regulations related to the module and grasp the principles and rules of finance in general.
- Acquiring legal and applied knowledge and qualifications in the field of tax administration.

Required background

It is recommended that students should acquire, in advance, the most important rules and principles of public finance, and the laws regulating them, in addition to the elements related to the management of public and private administrations and organisations.

Subject matter content

- Concept, tools and performance indicators of stock exchange.
- Procedures for dealing in stock exchange.
- What is the current stock market for merchandise ?
- Types of merchandise in the present stock exchange.
- Risk management in commodity markets.
- Futures and options applications.
- Commodity futures pricing.
- Speculation in commodity markets.
- Short selling in the futures markets.
- Clearing and settlement.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: five

Unit Title: Methodical Teaching Unit

Module 5: Exchange systems and currency markets

Credit: 5

Coefficient: 2

Teaching Objectives:

Being able to grasp the theoretical framework of exchange rates and the theories that explain it, as well as the advantages related to foreign exchange markets. Also, makes students able to manage and grasp foreign exchange rates in applied framework.

Required background:

It is recommended that students should acquire, in advance, the principles of macroeconomics, financial and monetary policy, in addition to banks processes and financial institutions.

Subject matter content

- Concepts related to exchange rate.
- Concept, types and characteristics of currency markets (foreign exchange markets).
- Theories explaining exchange rate.
- Exchange systems.
- Management of foreign exchange operations.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: five
Unit Title: Methodical Teaching Unit

Module 6: Customs and transit operations
Credit: 4
Coefficient: 1

Teaching objectives:

Acquiring theoretical knowledge related to customs systems, transit and techniques of customs functions and the customs declaration of various products within the framework of international transport.

Required background:

It is recommended that students should acquire, in advance, knowledge related to economic and commercial terminology, customs and commercial legislation, and international logistics and transportation.

Subject matter content:

- Functions of customs administration.
- Basic elements of customs legislation.
- Preliminary customs procedures: (bringing goods, temporary deposit, customs regulations, transit regulations, customs deposit).
- Customs procedures:
  Concepts of customs declaration (form, qualified persons, characteristics, effects).
  Conditions for issuing customs declaration.
  Detailed declaration examination (examination, objections).
- Liquidation, payment, recovery of rights and customs duties.
- The role of customs systems in international trade.

Valuation method:

- Final exam: 100%.

Bachelor's Title: Licence of International Trade and Logistics

Semester: five

Unit Title: Exploratory Teaching Unit

Module 7: Customs law

Credit: 2

Coefficient: 1

Teaching goals:

Providing students with a complete background on the most important elements that must be included in customs legislation in order to simplify customs procedures and insure against risks resulting from import cases.

Background required:

It is recommended that students should acquire, in advance, information about the principles of legislation and laws.

Subject matter content:

- Aspects of customs legislation (agreements, customs law, regulations of customs procedures).
- Explaining the content of the law.

Valuation method:

- Final exam: 100%.

Bachelor's Title: International Trade and Logistics

Semester: five

Unit Title: Horizontal Teaching Unit

Module 8: Foreign language

Credit: 1

Coefficient: 1

Teaching goals:

This module aims to train students in English language according to the basic training approach to speak the language through grammar and sentence construction, in addition to the specialized training approach in the foreign language for the field of international trade and logistics, and this is considered an essential key to the practice international business. In addition to the basic concepts of specialization and methods of drafting international commercial contracts.

Required background:

The prior knowledge lies in the basic terms acquired in the pre-learning semesters.

Subject matter content:

- Concept of international business.
- Concept of international logistics.
- Concept of the stock market.
- Concept of banking.
- Concept of negotiation.
- International trade techniques: export, import, insurance, transportation, customs procedures.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: Six

Teaching Unit	Hours volume 14-16 weeks	Weekly hours volume				Coefficient	Credits	Valuation types	
		Course	Oriented works	Practical works	Other works			Continuous	Final Exam
Basic Teaching Unit									
Logistics and international transportation	120 h	1.5 h	1.5 h		5 h	2	5	×	×
International trade financing	120 h	1.5 h	1.5 h		5 h	2	5	×	×
International marketing	97.5 h	1.5 h	1.5 h		3.5 h	2	4	×	×
International investment	97.5 h	1.5 h	1.5 h		3.5 h	2	4	×	×
Methodical Teaching Unit									
Internship report	90 h				6 h	1	4	×	×
International negotiation techniques	100 h	1.5 h			3 h	1	5		×
Exploratory Teaching Unit									
Law 04-08 related to conditions for conducting commercial activities	45 h	1.5 h			1.5 h	1	2		×
Horizontal Teaching Unit									
Foreign language	22.5 h		1.5 h			1	1	×	×
Semester six	**692.5 h**	**9 h**	**7.5 h**		**27.5 h**	**12**	**30**		

Bachelor's Title: International Trade and Logistics

Semester: Six

Unit Title: Basic Teaching Unit

Module 44: Logistics and international transportation

Credit: 5

Coefficient: 2

Teaching goals:

Controlling policies and techniques of international supply and international transportation and logistics, international transportation contract procedures, and international insurance.

Required background:

Concepts related to supply, transportation, customs law, and international business law.

Subject matter content:

- Introduction to international supply and transportation: concepts, definition, and importance.
- The role of Incoterms in international trade.
- Selecting the mode of transportation and the process of transportation in international trade.
- Transportation operations in international trade (maritime, land, air).
- International transportation contracts.
- Cargo transportation insurance.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: Six

Unit Title: Basic Teaching Unit

Module 45: International trade financing

Credit: 5

Coefficient: 2

Teaching goals:

- Knowing mechanisms related to international finance.
- Acquiring knowledge about techniques of international trade financing.
- Acquiring knowledge related to risks of international trade financing.

Required background:

To understand the subject matter in depth, it is advisable for students to acquire principles and rules of international finance, as well as the regulatory laws governing it, in addition to the elements related to payment methods in international trade.

Subject matter content:

- Introduction to international trade financing (concept and importance).
- Payment in international trade and its methods.
- International trade financing operations (short-term, medium-term, long-term financing, guarantees, and international warranties).
- International dimensions of long-term financing.
- Managing risks of international trade financing operations.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: Six

Unit Title: Basic Teaching Unit

Module 46: International marketing
Credit: 4
Coefficient: 2

Teaching goals:

International marketing is a vital aspect of international trade, as it deals with marketing patterns represented by the international marketing mix and how it is constructed for international institutions.

Required background:

To have a deeper understanding of the subject matter, it is advisable for students to acquire prior knowledge about the principles and rules of marketing.

Subject matter content:

- Introduction to international marketing (historical evolution, scope of practice, concept).
- Importance and objectives of international marketing.
- International marketing environment.
- International market entry strategies (adaptation strategy, standardization strategy, etc.).
- Policies of international marketing mix: product, price, distribution, promotion.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: Six

Unit Title: Basic Teaching Unit

Module 47: International investment

Credit: 4

Coefficient: 2

Teaching goals:

Enabling students to acquire knowledge about nature of direct and indirect foreign investments, while highlighting their positive and negative effects on economic growth, development, and environment.

Required background:

The prerequisite knowledge for students includes forms of international trade and international marketing.

Subject matter content:

- Concept and implications of foreign investment.
- Importance of foreign investment in international trade.
- Types of foreign investment.
- Theories of foreign investment.
- Factors influencing foreign investment (business environment).
- Strategies of multinational companies.
- Impacts of foreign investment.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.

Bachelor's Title: International Trade and Logistics

Semester: Six

Unit Title: Methodical Teaching Unit

Module 48: Internship report

Credit: 4

Coefficient: 1

Teaching goals:

Enabling students to master techniques of preparing an internship report.

Required background:

Research methodology.

Subject matter content:

An internship report in an economic institution, focusing on a marketing topic under the supervision of a specialized professor in the field.

Valuation method:

- Continue valuation: 100%.

Bachelor's Title: International Trade and Logistics

Semester: Six
Unit Title: Methodical Teaching Unit

Module 49: International negotiation techniques
Credit: 5
Coefficient: 1

Teaching goals:

Mastering communication and negotiation techniques in various fields is essential for organizational work, as communication and negotiation are highly important means of achieving positive interactive relationships. This is particularly crucial in the fields of international trade and logistical support, where the effectiveness of agreements is a key element for the success of international business operations.

Required background:

To have a deeper understanding of the subject matter, it is advisable for students to have prior knowledge by studying the course of Enterprise management, as it covers one of the administrative functions in the organization, namely the coordination function.

Subject matter content:

- Concept of negotiation and negotiation in international trade.
- Types of negotiations.
- Parties of negotiations.
- Components of the negotiation process.
- Steps of negotiation.
- Approaches and strategies of negotiation.
- Dialogue and persuasion techniques.
- Opening and closing maneuvers in negotiation.
- Power of negotiation.
- Characteristics and qualifications of negotiator.
- Post-negotiation strategy.

Valuation method:

- Final exam: 100%.

Bachelor's Title: International Trade and Logistics

Semester: Six

Unit Title: Exploratory Teaching Unit

Module 50: Law 04-08 related to conditions for conducting commercial activities

Credit: 2

Coefficient: 1

Teaching goals:

Empowering students to have control over the new mechanisms and regulations governing business activities in Algeria.

Required background:

To have a deeper understanding of the subject matter, it is advisable for the student to acquire prior knowledge about the principles of legislation, laws, and commercial law.

Subject matter content:

Explaining the content of Law (04-08) related to the conditions for practicing commercial activities.

Valuation method:

- Final exam: 100%.

Bachelor's Title: International Trade and Logistics

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Semester: Six

Unit Title: Horizontal Teaching Unit

Module 51: Foreign language
Credit: 1
Coefficient: 1

Teaching goals:

This course aims to teach students terms related to international trade and supply chain management, in addition to covering the basic concepts of the specialization and methods of drafting international commercial contracts.

Required background:

The prerequisite knowledge lies in the fundamental terms acquired in the previous semesters of study.

Subject matter content:

a. Concepts related to the specialization:

- International marketing.
- International trade and financial organizations: IMF, World Bank, WTO.
- International trade terms (incoterms) in Arabic and English (fundamental terms for drafting international commercial contracts, provided to students as a printed document).

b. Drafting letters, preparing reports, drafting international commercial contracts:

- Model for drafting administrative letters: purchase orders, invoices, etc.
- Templates for drafting international commercial contracts: transportation contracts, insurance contracts, purchase contracts, etc.

Valuation method:

- Continue valuation in oriented works: 40%.
- Final exam: 60%.