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MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

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L.M.D.

ACADEMIC LICENSE

2018 – 2019

Establishment	Faculty	Department
Djilali Bounaama University of Khemis Miliana	Faculty of Natural and Life Sciences and Earth Sciences	Biology

Field	Branch	Specialty
Natural and Life Sciences	Biological Sciences	*MICROBIOLOGY*

الجمهورية الجزائرية الديمقراطية الشعبية
وزارة التعليم العالي والبحث العلمي

عرض تكوين
ل. م . د

ليسانس أكاديمية
2018-2019

المؤسسة	الكلية/ المعهد	القسم
جامعة الجيلالى بونعامة بخميس مليانة	كلية علوم الطبيعة و الحياة و علوم الارض	بيولوجيا

الميدان	الفرع	التخصص
علوم الطبيعة و الحياة	علوم بيولوجية	بيولوجيا و فيزيولوجيا حيوانية

SUMMARY

I - identity sheet of the license:

1 - Location Of The Training :

- **Establishment Applicant:** DJILALI BOUNAAMA UNIVERSITY - Khemis Miliana
- **Faculty of natural and life science and earth science.**
- **Department Of Biology**
- **Field: Sciences of nature and life**
- **Field: Biology**
- **Specialty: MICROBIOLOGY.**

2- External Partners

Other partner institutions:

- University of Chlef
- University of Blida.
- University of Telemcen.
- University of Bejaia.
- Pasteur Institute of Algiers
- Waniss Dairy, Khemis Miliana
- Dairy of ARIBS in Ain Defla
- Laboratories of hospitals (Khemis Miliana, Miliana, Ain Defla).
- Laboratory of Medical Analyses Dr Zibouche.
-Research laboratory: Valorisation....
- Research Laboratory: Water, Rock and Plant of the University Khemis-Miliana
- Direction of the Environment
- Companies and other socio-economic partners:
-Direction of Agricultural Services (DSA).
- Food industry (ARIBS Dairy, Waniss Dairy)
- Directorate of Health and Population.
- SAIDAL (Medea).

3-Context and objectives of the training

A - Access conditions

The Microbiology license is the result of 3 years of study in Biological Sciences
Biological Sciences: 1 year SNV and 2nd year Biological Sciences

B - Objectives of the training:

The license of Microbiology proposed in the framework of the reform of the Teaching of Higher Education (L.M.D. System) is motivated by the importance of this license and its multidisciplinary character that encompasses many fields which encompasses many fields: Medical, Biological, Agronomic, Environmental, Industrial, ...etc
This training will cover the different fundamental and applied fundamental and applied aspects of microbiology in order to allow the student to meet the needs of the different sectors of the national economy

The importance of this training quite important in the field of quality control,water treatment, and in the environment, as well as in the agri-food and medical sector medical and production sector (medicines, dairy products..).

The objectives of this training are the knowledge of the whole of microorganisms that surround us (bacteria, fungi, algae, viruses), the understanding and control of their activities when they are harmful (microbiological examination of samples and biological fluids, antibiotic therapy...), the use and improvement of their properties when they are beneficial (probiotics, yeasts, fermented milks, antibiotics, vitamins.)

This academic training also constitutes a specialization in direct contact with the socio-economic socio-economic realities. It responds to the need to train students who master the modern achievements in microbiology.

C - Profiles and skills aimed at :

This training aims to enable students to understand the biodiversity of the living world and to master the tools world and to master the tools necessary for their management, their conservation and their control. In addition, this degree provides training for biologists with an excellent professional knowledge professional knowledge in fields as varied as varied as bacteriology, virology, applied microbiology and genetic engineering as well as in environmental microbiology.

The diversity of the modules offers the student a training that prepares them for jobs in fundamental or clinical research, whether public or private.

This specialization intends to train students to current issues in microbiology both in the fundamental fields (genetics, molecular biology, etc.), medical (host-pathogen interactions host-pathogen interactions, prophylaxis, therapeutic approaches) and applied (industrial use of of microorganisms, new tools for investigation of the microbial world, microbial ecology environmental microbiology).

D - Regional and national employability potential

This training contributes to the creation of employment positions in the following sectors economic and social sectors as well as in the health sector:

-Laboratories of the food industry.

-Laboratories of hospitals.

-Water and hydraulic analysis laboratories.

Food industry.

-Pharmaceutical industries.

-Water services.

-Environmental services.

-Inspections of quality control.

-Pasteur Institute of Algiers.

-Border posts (Inspection of imported products).

E - Bridges to other specialties

At the end of their training, students who have graduated Microbiology" degree will have the possibility to have the possibility to continue their studies in Master in the same speciality or move on to other Masters close to this one such as the Masters : Microbiology and health, Food and Industrial Microbiology, Quality Control and Biotechnology, Food Science Food Science, Nutrition and Food Control...etc.

F - Performance indicators expected performance of the training :

The team of the training is composed of teachers specialists in the field for ensure the smooth running of the training, the availability of material means such as the various teaching or research laboratories with adequate equipment.

The methods of control of knowledge (final exam, questioning in TD, report of field trip, presentations, ...) are in conformity with the regulations in force.

There is compensation between subjects within the UE and compensation between the TU (Teaching unit) by semester.

A retest session in the form of a written exam is planned for all the TE (Teaching unit) not acquired at the end of at the end of the semester.

A Diploma of Academic License in Microbiology will be delivered to the student.

G - Supervision capacity

80 students

4 - Available human resources

A – Teachers involved in the speciality

B : Equipe pédagogique interne mobilisée pour la spécialité :

Nom, prénom	Diplôme de Graduation	Diplôme de spécialité (Magister, doctorat)	Grade	Matière a enseignée	Emargement
MOKABLI Aissa	Ingéniorat	Doctorat en protection des Végétaux	Professeur	Algologie	
GUETARNI Hacina	Ingéniorat	Doctorat en Microbiologie Alimentaire	MCB	Microbiologie Alimentaire	
AIT OUZZOU Abdenour	Licence	Doctorat LMD Bioconservation des Aliments	MCB	Virologie	
AOUN Omar	Licence	Doctorat LMD Science Biologique	MCB	Microbiologie de l'environnement	
MAHI Miloud	DES	Magister en Microbiologie Alimentaire	MAA	Systématique des Procaryotes	
KARA HACEN Tahar	Ingéniorat	Magister Protection des Végétaux	MAA	Anglais Scientifique	
MEKHATI Mohamed	Ingéniorat	Magister en Production Animale	MAA	Techniques de Documentations	
SAADI Fadhila	Ingéniorat	Magister en Science Alimentaire	MAA	Microbiologie Industrielle	
DAOUDI Ahlem	Ingéniorat	Magister en Science Alimentaire	MAA	Technique de Contrôle Microbiologique	
GHOUMARI Fatima Zahra	DES	Magister en Microbiologie Appliquée	MAA	Biochimie Microbienne	

BOURAS Hacen	DES Biochimie	Magister en Microbiologie	MAA	Toxicologie	
AMROUCHE Zouhir	Ingéniorat	Magister en Nutrition	MAA	Techniques d'Analyses Biochimiques	
BRAHIMI Lazali Samira	DES	Magister en Génie Microbiologique	MAB	Génétique Microbienne	
MOSTEFA SARI fouzia	Ingéniorat	Magister en Biotechnologie Végétale	MAB	Pharmacologie	
BOUSOUBEL Abdelkader	DES	Magister en Biologie Moléculaire et Cellulaire	MAA	Biologie Moléculaire et Génie génétique	
GHOZALANE Mohamed Khalil	Docteur en Médecine Vétérinaire	Magister en Science Vétérinaire	MAB	Mycologie	

B - Management External

C : Equipe pédagogique externe mobilisée pour la spécialité :

Nom, prénom	Diplôme	Etablissement de rattachement	Type d'intervention*	Emargement
ZIBOUCHE Abdellah	Docteur en Médecine, Spécialiste en Microbiologie Clinique	-Institut de Médecine Université d'Alger -Laboratoire d' Analyses médicales	Cours et TP encadrement de Stage	مخبر التحاليل الطبية Laboratoire d'Analyses Médicales Dr. A. ZIBOUCHE Médecin Spécialiste en Biologie Clinique Rue Emir AEK Ain-Defla Tél: 027.60.15.60 Fax: 027.60.44.14

*Cours, TD, TP, Encadrement de Stage

C- Overall summary of human resources mobilized for the L3 Microbiology specialty :

Grade	Internal staff	External Staff	Total
Professors	02		02
senitor lectuar A	02		02
senitor lectuar B	03		03
Master Assistant A	10		10
Master Assistant B	05		05
Other *	12		12
Total	34		34

(*) Technical and support staff

5 - Material resources specific to the specialty

A- Pedagogical laboratories and equipment :

Microbiology laboratory: Student capacity: 20

N°	Title of the equipment	Number	Observation: Inventory number/ Brand
1	magnetic stirrer	2	Good condition
2	Vortex shaker	3	VELP, Good condition
3	Autoclave	4	Witeg [38047/14] CertoClav [MC1619] Good condition
4	Water bath	2	Memmert[1204-096A], Witeg[38031/14], Good condition
5	Analytical balance	2	KERN [2170-9/10],OHAUS[38048/14] Good condition
6	Refrigerated centrifuge	1	SIGMA[38049/14] Good condition
7	Micro centrifuge	1	Good condition
8	Colony counter	1	BioBlock [6497] Good condition
9	Ultra-low freezer	1	Platilab370H] Good condition
10	Stainless steel distiller	1	GFL[38035/14] Good condition
11	Oven benchtop	1	Witeg[38033/14] Good condition
12	Hood vertical laminar flow	1	BIOBASE [38045/14] Good condition
13	Anaerobic incubator	1	Good condition
14	Bacteriological incubator	4	Memmert (02)[12914/07],JOWAN [12914/07], Witeg[38032/14] Good condition
15	Magnifier binocular	2	Motic [50943082-50848877]
16	Micro pipettes 1000µl,10-100µl, 5-50ul	4	Good condition
17	Fixed micro pipette of 50ul, 100µl, 25µl, 05 5000µl, 10000µl	5	Good condition
18	Micro pipette with variable volume of 10,100µl, 50-200µl, 20-200µl, 100-1000µl	4	Good condition
19	Microscope optical	15	Good condition
20	ZESS Microscope	3	Good condition
21	Digital pH meter	1	Good condition
22	PH Meter	2	Mettler Toledo[1230175332
23	Plate heating plate with Agitator	3	VMS-A[017747787], VELP[12906/07] Bansen SA[19947/09]
24	Refrigerator	3	Good condition
25	Stereo microscopes	2	OPTIKA [38034/14] Good condition
26	Thermocycler	1	Good condition
27	cooling system	1	Good condition

Biochemistry Laboratory: Student capacity: 20

N°	Title of the equipment	Number	Observation: Inventory number/ Brand
01	Sorbole fume hood	01	Good condition
02	Chlorine analyzer (comparator kit)	01	Good condition
03	Waterbath	02	Good condition
04	Sand water bath	01	Good condition
05	Precision scales 1000g, 10g, 1200g	03	21713/10, Good condition
10	Bench-top centrifuge	01	12482/001787, Good condition
11	Balloon heater	03	483/05.13860/08, Good condition
13	Conductivimeter	01	21703/10.3268, Good condition
14	Colorimeter	01	420/05, Good condition
16	Dryer	01	Good condition
17	Densimeter 1400/1500, 2000	04	Good condition
19	Dispenser 5ml	01	Good condition
20	Electrophoresis (vertical)	02	Good condition
21	Oven	01	Good condition
23	Hematocrit	01	8963/04, Bon état
25	Lactodensimeter	01	Bon état
31	Microscopes	07	21660.21661.21668.216669/ 10, Good condition
33	pH-meter	03	294/05.13891/08, Good condition
34	Agitator	02	287/05.19946/09, Good condition
35	Universal Oven 250°C	01	Good condition
36	Falling ball viscosimeter	01	Good condition
37	ELISA CHAIN Complete	01	Good condition
38	Magnetic hot plate	01	Good condition
39	Optical apparatus for measuring the size of inhibition zones	01	Good condition
40	Gerber Centrifuge for milk	01	Good condition
41	Double vertical cuvettes Kuro Gel Verti cooling electrophoresis	01	Good condition
42	Horizontal tank kuro Gel Maxi more 25	01	Good condition
43	Electrophoresis generator	01	Good condition

B- Internship sites and company training :

Place of trainig	Number of students	internship duration
Dairy of the ARIBS (Ain Defla)	08	07Days
Waniss Dairy (Khemis Miliana	08	07Days
Laboratory of Medical Analyzes (Dr. Zibouche Ain Defla	08	07Days
Laboratory of Bacteriology Miliana Hospital	08	07Days
Laboratory of Bacteriology Miliana Hospital	08	07Days
Laboratory of Bacteriology Miliana Hospital	08	07Days
Pasteur Institute of Algiers	08	07Days
SAIDAL (Ain-dhab Medea)	08	07Days
ADE Laboratory (the Algerian of the waters)	08	07Days

C- Personal work spaces and ICT

- Library of the Faculty of Natural and Life Sciences
- Central university library
- Department connected to the Internet network
- Internet room of the Faculty for students.

-Pedagogical laboratories connected to the Internet network.
-Research laboratory: Water, Rock and Plant.
-Laboratory of agricultural production and valorization of natural resources.

II - Semester organization sheet of the speciality courses (S1, S2, S3, S4, S5 and S6)

Common base « Natural and Life Sciences » domain

First Semester

Teaching units	Subjects		Credits	Coefficients	Hourly volume weekly			HVW (15 weeks)	Other *	Mode of evaluation			
	Code	Title			Course	DW	PW			CC*		Exam	
U E Fundamental Code: UEF 1. 1 Credits: 18 Coefficients: 9	F 1.1.1	General and organic chemistry	6	3	1H30	1H30	1H 30	67H30	82H30	X	40%	X	60%
	F 1.1.2	Cellular biology	8	4	1H30	1H30	3H 00	90H00	110H00	X	40%	X	60%
	F 1.1.3	Mathematics Statistics	4	2	1H30	1H30	-	45H00	55H00	X	40%	X	60%
U E Methodology Code: UEM 1.1 Credits: 9 Coefficients: 5	M 1.1.1	Geology	5	3	1H30	1H30	1H 00	60H00	65H00	X	40%	X	60%
	M 1.1.2	Communication and Expression Techniques 1 (in French)	4	2	1H30	1H30	-	45H00	55H00	X	40%	X	60%
U E Discovery Code : UED 1.1 Credits: 2 Coefficients: 2	D 1.1.1	Working Methods and Terminology 1	2	2	1H30	1H30		45H00	5H00	X	40%	X	60%
U E Transversal Code: UET 1.1 Credits: 1 Coefficients: 1	T 1.1.1	Universal History of Biological Sciences	1	1	1H30	-	-	22H30	2H30	-	-	X	100
Total Semester 1			**30**	**17**	**10h30**	**9h00**	**5h30**	**375h00**	**375h00**				

Other* = Additional work in semester consultation; CC* = Continuous control.

Common base « Natural and Life Sciences » domain

Second Semester

Teaching units	Subjects		Credits	Coefficients	Hourly volume weekly			HVW (15 weeks)	Other *	Mode of evaluation			
	Code	Title			Course	DW	PW			CC*		Exam	
U E Fundamental Code: UEF 2. 1 Credits:18 Coefficients: 9	F 2.1.1	Thermodynamics and solution chemistry	6	3	1H30	1H30	1H30	67H30	82H30	X	40%	X	60%
	F 2.1.2	Plant Biology	6	3	1H30	-	3H00	67H30	82H30	X	40%	X	60%
	F 2.1.3	Animal Biology	6	3	1H30	-	3H00	67H30	82H30	X	40%	X	60%
U E Methodology Code: UEM 2.1 Credits: 9 Coefficients: 5	M 2.1.1	Physics	5	3	1H30	1H30	1H00	60H00	65H00	X	40%	X	60%
	M 2.1.2	Communication and Expression Techniques 2 (in English)	4	2	1H30	1H30	-	45H00	55H00	X	40%	X	60%
U E Discovery Code : UED 2.1 Credits: 2 Coefficients: 2	D 2.1.1	Life Sciences and Socio-Economic Impact	2	2	1H30	1H30	-	45H00	5H00	X	40%	X	60%
U E Transversal Code: UET 2.1 Credits: 1 Coefficients: 1	T 2.1.1	Working Methods and Terminology 2	1	1	1H30	-	-	22H30	2H30	-	-	X	100%
Total Semester 2			**30**	**17**	**10h30**	**6h00**	**8h30**	**375h00**	**375h00**				

Other* = Additional work in semester consultation; CC* = Continuous control.

Annex of the second year Bachelor's degree program
Natural and life sciences field « Biological Sciences » field

Third Semester 3

Teaching units	Subjects	Credits	Coefficients	Hourly volume weekly			HVW (15 weeks)	Other *	Mode of evaluation			
	Title			Course	DW	PW			CC*		Exam	
U E Fundamental Code: UEF 2.1.1 Credits: 6 Coefficients: 3	Zoology	6	3	3H00	-	1H30	67H30	82H30	X	40%	X	60%
U E Fundamental Code: UEF 2.1.2 Credits:12 Coefficients: 6	Biochemistry	6	3	3H00	1H30	-	67H30	82H30	X	40%	X	60%
	Genetics	6	3	3H00	1H30	-	67H30	82H30	X	40%	X	60%
U E Methodology Code: UEM 2.1.1 Credits: 4 Coefficients: 2	Communication and Expression Techniques (in English)	4	2	1H30	1H30	-	45H00	55H00	X	40%	X	60%
U E Methodology Code: UEM 2.1.2 Credits: 5 Coefficients: 3	Biophysics	5	3	1H30	1H30	1H00	60H00	65H00	X	40%	X	60%
U E Discovery Code : UED 2.1 Credits: 2Coefficients: 2	Environment and Sustainable Development	2	2	1H30	1H30	-	45H00	5H00	X	40%	X	60%
U E Transversal Code: UET 2.1 Credits: 1 Coefficients: 1	University Ethics and Deontology	1	1	1H30	-	-	22H30	2H30	-	-	X	100%
Total Semester 3		**30**	**17**	**15h00**	**7h30**	**2h30**	**375h00**	**375h00**				

Other* = Additional work in semester consultation; CC* = Continuous control

Annex of the second year Bachelor's degree program
Natural and life sciences field « Biological Sciences » field

Fourth semester

Teaching units	Subjects	Credits	Coefficients	Hourly volume weekly			HVW (15 weeks)	Other *	Mode of evaluation			
	Title			Course	DW	PW			CC*		Exam	
U E Fundamental Code: UEF 2.2.1 Credits: 6 Coefficients: 3	Botany	6	3	3H00	-	1H30	67H30	82H30	X	40%	X	60%
U E Fundamental Code: UEF 2.2.2 Credits: 12 Coefficients: 6	Microbiology	8	4	3H00	1H30	1H30	90H00	110H00	X	40%	X	60%
	Immunology	4	2	1H30	1H30	-	45H00	55H00	X	40%	X	60%
U E Methodology Code: UEM 2.2.1 Credits: 4 Coefficients: 2	Scientific methodology and techniques for studying life	4	2	1H30	-	1H30	45H00	55H00	X	40%	X	60%
U E Methodology Code: UEM 2.2.2 Credits: 5 Coefficients : 3	Biostatistics	5	3	1H30	1H30	1H00	60H00	65H00	X	40%	X	60%
U E Discovery Code: UED 2.2.1 Credits: 2 Coefficients: 2	General ecology	2	2	1H30	1H30	-	45H00	5H00	X	40%	X	60%
U E Transversal Code: UET 2.2.1 Credits: 1 Coefficients: **1**	Computer tools	1	1	1H30	-	-	22H30	2H30	-	-	X	100 %
Total Semester 4		**30**	**17**	**13h30**	**6h00**	**5h30**	**375h00**	**375h00**				

Other* = Additional work in semester consultation; CC* = Continuous control.

Annex of the teaching program of the third year
Licence « Microbiology »

Fifth Semester :

Teaching units	HVW	V.H weekly				Coeff	Crédits	Mode of evaluation	
	15 sem	C	TD	TP	Others			Continuous (40%)	Exam (60%)
U E Fundamental									
UEF 1 (O/P)									
Matter1 : Systematics of prokaryotes (Bacteria and Archaea)	67H30	3H00	-	1H 30	82H30	**3**	**6**	X	X
Matter 2 :Mycology-Algology-Virology	45H	1H30	-	1H 30	55H	**2**	**4**	X	X
UEF 2 (O/P)									
Matter1: Microbial biochemistry	45H	1H 30		1H 30	55H	**2**	**4**	X	X
Matter 2 **:** Molecular biology and genetic engineering	45H	1H 30	1H 30	-	55H	**2**	**4**	X	X
UE Methodology									
Matter 1 : Microbial genetics	60H	3H		1H	65H	**3**	**5**	X	X
Matter 2 : Hygiene and safety	45H	1H30		1H30	55H	**2**	**4**	X	X
U E Discovery									
Matter 1 **:** Pharmacology	45H	1H30	1H30		5H	**2**	**2**	X	X
U E Transversal									
Scientific English	22H30	1H30			2H30	**1**	**1**	X	X
Total Semester 5	**375H**	**15H**	**1H30**	**8H30**	**375H**	**17**	**30**	X	X

Sixth Semester :

Teaching units	HVW	H.V weekly				Coeff	Crédits	Mode of evaluation	
	15 sem	Cours	TD	TP	Others			Continuous (40%)	Exam (60%)
U E Fundamental									
UEF 3.2.1(O/P) : Applied Microbiology									
Matière1 : Industrial Microbiology	67H30	3H00	-	1H 30	82H30	**3**	**6**	X	X
Matière2: Environmental microbiology	67H30	3H00	-	1H 30	82H30	**3**	**6**	X	X
Matière3 : Food microbiology	67H30	3H00	-	1H30	82H30	**3**	**6**	X	X
UE méthodologie									
UEM1(O/P)									
Matter 1: Microbiological control techniques	45H00	1H30	-	1H30	55H00	**2**	**4**	X	X
Matter 2 Biochemical Analysis Techniques	60H00	1H30	1H30	1H00	65H00	**3**	**5**	X	X
U E Discovery									
UED1(O/P)									
Matter 1: Toxicology	45H00	1H30	1H30	-	05H00	**2**	**2**	X	X
U E Transversal									
UET1(O/P):									
Matter 1: Documentation techniques	22H30	1H30	-	-	02H30	**1**	**1**	X	X
Total Semestre 6	**375H**	**15H**	**03H**	**07H**	**375H**	**17**	**30**	X	X

5- Global summary of the training : (the global HV separated in courses, TD, for the 06 semesters of teaching, for the different types of UT: 1st SNL, L2 Biology and L3 Microbiology.

UT / HV	UF	UM	UD	UT	Total
COURSE	630H	292H30	135	135	1192H30
DW	202h30	180h	90h		472h30
PW					585h
Other Personal Work	1485h	720h	30h	15h	2250h
Memory	/	/	/	/	/
Total	2700h	1350h	300h	150h	4500h
Credits	108	54	12	6	180
% In Credits For Each Tu	60	30	6.67	3.33	100%

III - Detailed program by subject for semesters S1, S2, S3, S4 S5 and S6

1st year Common base
Natural and Life Sciences" field

First Semester

Semester : 1st Semester
F.U: Fundamental Teaching Unit
Subject 1: GENERAL AND ORGANIC CHEMISTRY

Credit: 6
Coefficient: 3

Objectives of the course

This subject consists in teaching the fundamental bases of organization and chemical structure of matter. It is a complement to the other subjects because it serves to facilitate the understanding of the chemical biological phenomena.

Recommended prerequisites (*brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).* The student must master the basic notions of general and organic chemistry, namely the structure of the atom, atomic bonds and redox reactions.

Content of the subject

1. General chemistry

1.1 Generalities
1.1.1. Atom, nucleus, isotopy,
1.1.2. Stability and cohesion of the nucleus, binding energy per nucleon,...
1.2 Radioactivity
1.2.1. Definition
1.2.2. Natural radioactivity: main types of radiation
1.2.3. Artificial radioactivity
1.2.4. Law of radioactive decay
1.2.5. Different types of nuclear reactions
1.3 Electronic Configuration of Atoms
1.3.1 Introduction of Quantum Numbers
1.3.2. Principles governing the electronic structure of an atom :
1.3.3. Energy rule (Klechkoweski rule)
1.3.4. Pauli's exclusion rule
1.3.5. Hund's rule
1.4. Periodic classification
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1.4.1. Group (Column), Period (Line)
1.4.2. Evolution of the physical properties within the periodic table: atomic radius, ionization energy radius, electronic affinity....
1.5. Chemical bonding
1.5.1 Introduction : strong and weak bonds
1.5.2. Representation of the chemical bond : Lewis diagram
1.5.3. Different types of strong bonds (covalent bond, ionic bond, metallic bond)
1.5.4. Ionic character of a covalent bond
1.5.5. Geometry of molecules: V.S.E.P.R theory (Gillespie rule)

2. Organic chemistry

2.1. Organic compounds, formulas, functions, nomenclature
2.1.1. Formulas of organic compounds
2.1.2. Functions, functional groups
2.1.3. Nomenclature
2.1.4 Study of the organic functions
- Saturated hydrocarbons, alkenes, alkanes, benzene hydrocarbons
- Halogen derivatives, halides
- Alcohols, thiols, thiothers, phenols, amine polyfunctional aldehydes

- polyfunctional heterocycles

2.2 Reaction mechanisms in organic chemistry

2.2.1. Resonance and mesomerism
2.2.2. Conjugation
2.2.3. Stereochemistry
2.2.4. Electronic Effects
2.2.5. Nucleophilic Substitution
2.2.6. Eliminations
2.2.7. Radical Reactions
2.2.8. Reduction Reactions
2.2.9. Oxidation Reactions

Directed work

- ✓ DW N°1: Fundamental notions of chemistry (atoms, molecules, gram atoms, moles, calculation of concentrations)
- ✓ DW N°2: Stability of the nucleus and radioactivity
- ✓ Practical training N°3: Electronic configuration and periodic classification of elements
- ✓ DW N°3: Chemical bonds
- ✓ Common Base L1: Natural and Life Sciences Page 10
- ✓ DW N°5: Nomenclature and stereochemistry
- ✓ DW N°6 : Reaction mechanisms

Practical work

- ✓ Practical work N°1: Principles of experimental chemistry

Objective : To evaluate the knowledge of the student on the material used in the chemistry
chemistry experiments and the security rules to respect in the laboratory.

- ✓ Practical work N°2: Determination of the quantity of matter

Objective : To determine the quantity of matter (expressed in number of moles) contained in a sample and to prepare a in a sample and to prepare a sample containing a fixed quantity of matter

- ✓ Practical work N°3: Preparation of solutions by dissolution and dilution

Objective: To prepare a solution of sodium chloride (NaCl) of normality 0.1N.
and to prepare a solution of hydrochloric acid (HCl) of normality 0,1N by dilution
of a solution of HCl of normality 1N.

- ✓ Practical work N°4 : Measurement of the density of some....

Objective : We try to determine the density of a saturated salt water solution
And to determine the density of iron.

- ✓ Practical work N°5 : Research of functional groups

Objective : Identify the functional groups : Alcohols and carbonyls

Evaluation method

Continuous control and semester exams

Reference *(Livres et polycopiés, sites internet, etc) :*

1. Jacques Maddaluno, Véronique Bellosta, Isabelle Chataigner, François Couty, et al., 2013- Chimie organique. Ed. Dunod, Paris, 576 p.
2. Jean-François Lambert, Thomas Georgelin, Maguy Jaber, 2014- Mini manuel de Chimie inorganique. Ed. Dunod, Paris, 272 p.
3. Elisabeth Bardez, 2014- Mini Manuel de Chimie générale : Chimie des Solutions. Ed. Dunod, Paris, 256 p.
4. Paula Yurkanis Bruice, 2012- Chimie organique. Ed. Pearson, 720 p.
5. Jean-Louis Migot, 2014- Chimie organique analytique. Ed. Hermann, 180 p.

Common Core L1 : Natural and Life Sciences Page 11

Semester : 1st Semester
F.U: Fundamental Teaching Unit
Subject 2: CELLULAR BIOLOGY
Credit: 8
Coefficient:4

Objectives of the course
The objectives of this course are to introduce the students to the living world at the cellular level, to acquire the basic notions of the cell, eukaryote and prokaryote, and to acquire the basic notions of the cell, eukaryote and prokaryote, and to study the to study the cellular constituents. These objectives are reinforced by practical sessions in the practical sessions in the laboratory.
Recommended prerequisites (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).
The student must have knowledge of general biology.

Content of the subject
1. General information
1.1 Classification and relative importance of kingdoms
1.2 Cell and cell theory
1.3 Origin and evolution
1.4. Cell types (Prokaryote, Eukaryote, Acaryote)
2. Methods of studying the cell
2.1. Optical and electronic microscopy methods
2.2 Histochemical methods
2.3 Immunological methods
2.4. Enzymological methods
3. Plasma membrane: structure and function
4. Cytoskeleton and cell motility
5. Cell adhesion and extracellular matrix
6. Chromatin, chromosomes and cell nucleus
7. Ribosome and protein synthesis
8. The endoplasmic reticulum-golgi apparatus system
9. The interphase nucleus
10. The endosomal system: endocytosis
11. Mitochondria
12. Chloroplasts
13. Peroxisomes
Common Core L1 : Natural and Life Sciences Page 12
14. Extracellular matrix
15. Plant wall
Practical work
1. Methods of studying cells
1.1 Separation of cellular components
1.2 Observation of cellular constituents
1.3 Identification of cellular components
1.4. Plant wall
2. Cell cultures
3. Testing of physiological functions
3.1 Reconstitution of the function from isolated constituents
3.2. Anatomical tests: autoradiography, fluorescence labeling, green fluorescent proteins

green fluorescent proteins
3.3. Physiological tests: control of protein expression, mutation, overexpression

Evaluation method

Continuous assessment and semester exam

Reference

1. B. Albert, A. Johnson, J. Lewis, M. Raff, K. Roberts et P. Walter, 2011- Biologie moléculaire de la cellule. Ed. Lavoisier, Paris, 1601p.
2. Abraham L. Kierszenbaum, 2006- Histologie et biologie cellulaire: Ed De Boeck, 619p.
3. Thomas Dean Pollard et William C. Earnshaw, 2004- Biologie cellulaire. Ed. Elsevier Masson, Paris, 853p.
4. Marc Maillet, 2006- Biologie cellulaire. Ed. Elsevier Masson, Paris, 618p.
Socle Commun L1 : Sciences de la Nature et de la vie Page 13

Semester : 1st Semester
F.U: Fundamental Teaching Unit
Subject 3: MATHEMATICS and STATISTICS
Credit: 4
Coefficient:2

Objectives of the course
This subject allows the student to integrate the statistical and computer tools in the biological
biological field, and to use numerical analysis, probability and calculation by the computer tool.
computing tools.

Recommended prerequisites (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).
The student must have knowledge of functions, integrals and random variables.
random variables.

Content of the subject

1. Mathematical analysis
1.1 Function in one variable, derivative and integrals.
1.2 Approximation method.
1.3. Series, positive term series, Rieman series.
1.4. Functions in several variables, partial derivatives, differentials
1.5 Double and triple integrals.
1.6. Calculation of surfaces and volumes.
2. Probabilities
2.1. Random variables, BERNOULLI variables
2.2. Statistical laws and bio-statistical applications
2.2.1. Discrete laws (Binomial and Poisson)
2.2.2. Continuous law (Gaussian law, normal law, chi-square law, Fischer law)
2.3. Parameters and properties
2.3.1. Position parameters (median, mode, mean,.....etc)
2.3.2. Dispersion parameters (variance, standard deviation, ...etc)
2.3.3. Shape parameters (symmetry, kurtosis,....etc)
2.4. Distribution function and density function
Evaluation mode
Continuous assessment and semester exam
Common base L1 : Natural and Life Sciences Page 14

Reference
1. Jean Bouyer, 2000- Méthodes statistiques : médecine-biologie. Ed. Estem.
2. Gilles Stoltz et Vincent Rivoirard, 2012- Statistique mathématique en action. Ed. Vuibert, Paris, 448p.
3. Maurice Lethielleux, 2013- Statistique descriptive. Ed. Dunod, Paris, 160p.
4. Maurice Lethielleux et Céline Chevalier, 2013- Probabilités : Estimation statistique. Ed. Dunod, Paris, 160p.
Socle Commun L1 : Sciences de la Nature et de la vie Page 15

Semester : 1st Semester
UM : Methodological Teaching Unit 1
Subject : GEOLOGY
Credit : 5
Coefficient: 3

Objectives of the course

The subject allows the students to see the constituents and the structure of the earth,
the interactions between these constituents, the external and internal geodynamics.
Recommended prerequisites (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).
Recommended prerequisites : No prerequisite
Content of the subject
1. General geology
1.1 Introduction
1.2. The terrestrial globe
1.3. The Earth's crust
1.4. Structure of the earth
2. External geodynamics
2.1. Erosion
2.1.1. The action of water
2.1.2. The action of the wind
2.2. Deposits
2.2.1. Study methods
2.2.2. Sedimentary rocks
2.2.3. Concept of stratigraphy
2.2.4. Concept of paleontology
3. Internal geodynamics
3.1 Seismology
3.1.1. Study of earthquakes
3.1.2. Origin and distribution
3.1.3. Soft and brittle tectonics (folds and faults)
3.2. Volcanology
3.2.1. Volcanoes
3.2.2. Magmatic rocks
3.2.3. Study of magmas
3.3. Plate tectonics
Common Core L1 : Natural and Life Sciences Page 16
Practical work

- ✓ Practical work N°1 : Topography
- ✓ Practical work N°2 : Geology (Sections)
- ✓ Practical work N°3 : Rocks and minerals

Evaluation mode

Continuous assessment and semester exam

References:*(Livres et polycopiés, sites internet, etc) :*

1. Jean Dercourt, 1999- Géologie : cours et exercices. Ed. Dunod, Paris,
2. Denis Sorel et Pierre Vergely, 2010- Initiation aux cartes et aux coupes géologiques.
Ed. Dunod, Paris, 115p.
3. Jean Tricart, 1965- Principes et méthodes de la géomorphologie. Ed. Masson, Paris,496p.
Socle Commun L1 : Sciences de la Nature et de la vie Page 17

Semester: 1st Semester
UM: Methodological Teaching Unit
Subject 2: Communication and Expression Techniques 1 (in French)
Credits: 4
Coefficient: 2

Objectives of the course
(Describe what the student is supposed to have acquired as skills after
(Describe what the student is expected to gain in terms of competencies upon successful completion of this course - maximum 3 lines).
The objective of this subject is to understand and write scientific documents in French and to use in French as well as the use and translation of scientific terms.

Recommended prerequisites (brief description of the knowledge required to follow this required to follow this course - Maximum 2 lines).
No prerequisite

Content of the course:
1. Scientific terminology
2. Study and understanding of texts
3. Written and oral expression techniques (report, synthesis, use of modern communications)
4. Expression and communication in a group. Study of proposed texts (observe, analysis, review, written expression).

Directed work
Proposed exercises related to the language points considered most important.

Evaluation method:
Continuous assessment and semester exam

Reference *(Livres et polycopiés, sites internet, etc) :*
Articles scientifiques et mémoires
Socle Commun L1 : Sciences de la Nature et de la vie Page 18

Semester : 1st Semester
D.U: Discovery Teaching Unit
Subject : Working Method and Terminology 1
Credit:2
Coefficient:2
Objectives of the course
To help the students to conceive the methods of research and synthesis of works according to scientific rules.

Recommended prerequisites (brief description of the knowledge required to follow this course required to follow this course - Maximum 2 lines).
The student is expected to have some knowledge of bibliographic research.

Content of the subject
Introduction to bibliographic research
Writing a scientific report
Introduction to reading and understanding a scientific article.

Evaluation method
Continuous assessment and semester exam

Reference (*Livres et polycopiés, sites internet, etc*) :
Socle Commun L1 : Sciences de la Nature et de la vie Page 19

Semester: 1st Semester
T.U: Transversal Teaching Unit
Subject: UNIVERSAL HISTORY OF BIOLOGICAL SCIENCES
Credits: 1
Coefficient: 1

Objectives of the course

This program should emphasize the history of biology, and the question of life through
through the eras and civilizations. It should highlight the place of technical progress in the evolution of the evolution of biology

Recommended prerequisites :(descriptif succinct des connaissances requises pour pouvoir suivre cet enseignement – Maximum 2 lignes).
No prerequisite

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Content of the subject

1. Prehistory
2. Antiquity
3. Middle ages
3.1. In the West
3.2. In the East (Muslim civilization)
4. Sixteenth and seventeenth centuries:
5. Eighteenth century: Darwin
6. Nineteenth century: Cell theory (microscopy), Sexuality Embryology, Biology
7. Molecular (DNA) Genetics
8. Twentieth century: gene therapy and cloning

Evaluation method
Semester **exam**

Reference

1. Denis Buican, 2008- Darwin dans l'histoire de la pensée biologique. Ed. Ellipses, 232p.
2. Christophe Ronsin, 2005- Histoire de la biologie moléculaire. Ed. De Boeck, 106p.
3. Jean Théodoridès, 2000- Histoire de la biologie. Ed. Puf, 127p.
Socle Commun L1 : Sciences de la Nature et de la vie Page 20

Semester : 2nd Semester
UF: Fundamental Teaching Unit
Subject 1: THERMODYNAMICS AND CHEMISTRY OF MINERAL SOLUTIONS
Credit:6
Coefficient:3

Objectives of the course

This course allows to acquire a certain understanding of the principles governing transformations and interactions of matter, the principle of thermodynamics, energy balance and energy equilibrium, and the kinetics of chemical reactions.

Recommended prerequisites (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).
The student must have knowledge of redox reactions.

Content of the subject

1. Chemical equilibria

1.1 Acid-base equilibrium
1.1.1. Definition according to: Arrhenius; Bronsted; Lewis
1.1.2. Equilibrium constant: dissociation of water, acidity and basicity
1.2.3. The pH: of water, of a strong monobasic acid, of a strong monobasic acid, ...
1.2 Redox equilibrium
1.2.1. Redox reaction: electron transfer
1.2.2. Oxidation number
1.2.3. Writing redox reactions
1.2.4. Electrochemical Cells
1.2.5. Redox Potential
1.3 Precipitation Equilibrium: Solubility and Solubility Product
1.3.1. Definition
1.3.2. Effect of the addition of an ion on the solubility
1.3.3. Effect of pH

2. Chemical kinetics

2.1. Definition
2.2. Reaction rate
2.3 Expression of the rate law and order of a reaction
2.4. Factors influencing the speed of reaction

3. Thermodynamics

Common Core L1: Natural and Life Sciences Page 21 3.1.
3.1 Thermodynamic systems and quantities: thermodynamic functions and transformations
thermodynamic transformations
3.2. First principle of thermodynamics
3.2.1. Expression of work and heat
3.2.2. Expression of internal energy and enthalpy
3.3. Second principle of thermodynamics
3.3.1. Expression of the entropy
3.3.2. Expression of the free energy and the free enthalpy
3.4. Thermochemistry
3.4.1. Heat of reactions
3.4.2. Enthalpy of reactions
3.4.3. Calculation of the internal energy of a reaction
3.4.5. Kincgoff's law

3.4.6. Hess's law
3.5. Predicting the direction of reactions
3.5.1. Isolated systems
3.5.2. Calculation of the reaction entropies
3.5.3. Reactions at constant temperature
3.5.4. Calculation of the free enthalpy and free energy of a system.

4. Inorganic Chemistry

Directed work

1. DW N°1: Chemical kinetics
2. DW N°2: Acid-base equilibria and precipitation equilibria
3. DW N°3: Oxidation-reduction equilibria
4. DW N°4: Thermodynamics and thermochemistry
5. DW N°5: Organic chemistry (Reaction mechanisms)

Practical work

Practical work N°1 : Chemical kinetics

Part 1 : Experimental determination of the reaction order

Objective : Determination of the order of the reaction with respect to sodium thiosulfate (Na2S2O3) using the initial velocity method.

Part 2 : Influence of the temperature on the reaction rate

Common Core L1: Natural and Life Sciences Page 22

Objectives : Determination of the reaction speeds for the same concentration of the reactants but for different temperatures.

TP N°2 : Acid-base titrimetric analysis method. The acid-base neutralization

Part 1 : Determination of the reaction by colorimetry

Objective:

- Determination of a strong acid solution (HCl) by a strong base (NaOH).
- Determination of the concentration of a weak acid solution (CH3COOH) by a strong base solution (NaOH).

Part 2: Determination of the concentration of a weak acid (CH3COOH) by a strong base solution (NaOH).

Objective : Determination of the concentration of a weak acid solution (CH3COOH) by a strong base solution (NaOH).

TP N°3 : Titration by the redox method. Manganimetric determination of Fe2+.

Objective:

- Determination of the normality of a given solution of KMnO4
- Determination of the concentration of Fe2+ contained in a solution of FeSO4.

Practical work N°4 : Identification of ions and separation of precipitates by centrifugation

Objective:

- To identify the ions present in a solution
- To write the chemical formulas of an ionic compound in solution
- Write the precipitation reactions
- Express the relation between the equilibrium constant and the solubility.

Evaluation method

Continuous control and semester exam

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

1. John C. Kotz and Paul M. Treichel, 2006- Chemistry of solutions. Ed. De Boeck, 376p.
2. René Gaborriaud et al, Thermodynamics applied to solution chemistry. Ed. Ellipses, 335p.

Socle Commun L1 : Sciences de la Nature et de la vie Page 23

Semester: 2nd Semester
UF: Fundamental Teaching Unit
Subject 2: **PLANT BIOLOGY**
Credits: 6
Coefficient: 3

Objectives of the course
The objective of this subject is to inculcate in the students the fundamental principles of the tissue organization of plants and their development.
Recommended prerequisites: (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).The student must have some knowledge of the different parts of a plant.
Content of the subject
1. Introduction to plant biology
2. Different types of tissues
2.1. Primary meristem (root and cell)
2.1.1. Primary tissues
2.1.2. Protective tissues (epidermis)
2.1.3. Filling tissues (parenchyma)
2.1.4. Support tissues (collenchyma and sclerenchyma)
2.1.5. Conductive tissues (primary xylem, primary phloem)
2.1.6. Secretory tissues
2.2 Secondary (lateral) meristems (cambium and phellogen)
2.2.1. Secondary tissues
2.2.2. Conductive tissues (secondary xylem and secondary phloem)
2.2.3. Protective tissues (suber or cork, phelloderma)
3. Anatomy of higher plants
3.1 Study of the root
3.2 Study of the stem
3.3 Study of the leaf
3.4. Comparative anatomy of mono- and dicotyledons. Common Core L1: Natural and Life Sciences Page 24
4. Morphology of higher plants and adaptation
4.1. Roots
4.2 Leaves
4.3. Stems
4.4 Flowers
4.5. Seeds
4.6. Fruits
5. Gametogenesis
5.1. Pollen grain
5.2 Ovule and embryo sac
6. Fertilization
6.1. Egg and embryo
6.2. Notion of development cycle
Practical work :
Practical work N°1 : Morphological study of Angiosperms (roots-stems-leaves-flowers)
Practical work N°2 : Morphological study of Gymnosperms (roots-stems-leaves-flowers)

Laboratory work N°3 : Primary meristems (root and stem)
Practical work N°4 : Covering tissues : epidermis - piliferous base - subereous base -suberoid
Practical work N°5 : Parenchyma (chlorophyll-reserve-air-aquiferous)
Practical work N°6 : Supporting tissues (collenchyma-sclerenchyma)
Practical exercises N°7 : Secretory tissues (hairs-glands-tannin cells-laticifers)
Practical exercise N°8 : Primary conductive tissues (phloem-xylem)

Evaluation mode

Continuous assessment and semester exam

Reference

1. Alain Raveneau et al., 2014- Biologie végétale. Ed. De Boeck, 733p.
2. Jean François Morot-Gaudry et al., 2012- Biologie végétale. Ed. Dunod, Paris, 213p.
Socle Commun L1 : Sciences de la Nature et de la vie Page 25

Semester : 2nd Semester
UF: Fundamental Teaching Unit
Subject 3: ANIMAL BIOLOGY
Credit:6
Coefficient:3

Objectives of the course
This module consists in making the students discover the particularities of the biology of
of certain animal species.
Recommended prerequisites: (brief description of the knowledge required to follow this course - Maximum 2 lines). required to follow this course - Maximum 2 lines).No prerequisite
Content of the subject
Part I: Embryology
1. Introduction
2. Gametogenesis
3. Fertilization
4. Segmentation
5. Gastrulation
6. Neurulation: fate of the leaflets
7. Delimitation: appendages of birds
8. Particularities of human embryology (Cycle, nidation, evolution of annexes, placenta)

Part Two: Histology
1. Coating epithelia
2. Glandular epithelia
3. Connective tissues
4. Blood tissues
5. Cartilaginous tissues
6. Bone tissue
7. Muscle tissues
8. Nerve tissue

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- ✓ **Titles PW-DW**
- ✓ N°1: Gametogenesis
- ✓ N°2: Fertilization and segmentation in sea urchins
- ✓ N°3: Gastrulation in amphibians and birds
- ✓ N°4: Exercises on gastrulation and neurulation
- ✓ N°5: Neurulation in birds
- ✓ N°6: Human embryology

Evaluation mode
Continuous assessment and semester exam

References:
Paul Richard W. HISTOLOGIE FONCTIONNELLE
Socle Commun L1 : Sciences de la Nature et de la vie Page 27

Semester : 2nd Semester
M.U: Methodological Teaching Unit
Subject 1: PHYSICS
Credit:5
Coefficient:3

Objectives of the course
The objective of this course is to enable students to acquire knowledge related to the basic knowledge in relation with the basic notions of physics which can be exploited in the exploited in the SNV field.

Recommended prerequisites (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).
Students should have a basic knowledge of mathematics and mechanics.

Content of the subject
1. Mathematical background
1.1 Physical quantities and dimensional analysis
1.2 Calculation of errors (different types of errors, calculation of uncertainties and significant figures).
2. Optics
2.1.1 Introduction (objective of optics)
2.1.2. Nature of light (spectrum of electromagnetic waves, photons, waves...)
2.2 Geometrical optics
2.2.1. Principles of geometrical optics and propagation of light.
2.2.2. Refraction (Snell-Descarte's laws, limit angle and total reflection)
2.2.2.1. Plane diopters, conjugation formula, parallel blade and prism.
2.2.2.2. Spherical diopters (convergent, divergent), conjugation formula and geometric construction (image construction).
2.2.2.3. Thin lenses (converging, diverging), conjugation formula,
magnification, association of two thin lenses and geometric construction (image construction).
2.2.3. Reflection
2.2.3.1. Plane mirror (image construction)
2.2.3.2 Spherical mirror (image construction, conjugation formula)
2.2.4 Optical Instruments
2.2.4.1. The eye. *Common Core L1 : Natural and Life Sciences Page 28*
2.2.4.1. The magnifying glass and the optical microscope
3. Fluid Mechanics
3.1. Definition and characteristics of a fluid.
3.2 Hydrostatics (Fundamental relationship of hydrostatics, buoyancy, float)
3.3 Hydrodynamics (deed, continuity equation, Bernoulli's theorem)
4. Notion of crystallography
5. Notions of spectral analysis

Directed Works:
- ✓ DW N°1. Exercises on dimensional analysis and error calculation.
- ✓ DW N° 2. Exercises on light propagation, plane diopters and prism
- ✓ DW N° 3. Exercises on spherical diopters and thin lenses.
- ✓ D WN° 4. Exercises on plane and spherical mirrors and the reduced eye.
- ✓ D WN° 5. Exercises on Pascal's law and Archimedes' thrust (Hydrostatics)
- ✓ DW N° 6. Exercises on Bernoulli's law (hydrodynamics)

Evaluation method
Continuous assessment (presentation + test) and semester exam

References: (Livres et polycopiés, sites internet, etc) :
1. Christophe Texier, 2015- Mécanique quantique. Ed. Dunod, Paris.
2. Eugene Hecht, 1998- Physique. Ed. De Boeck, 1304p.
3. Michel Blay, 2015- Optique. Ed. Dunod, Paris, 452p.
Socle Commun L1 : Sciences de la Nature et de la vie Page 29

Semester : 2nd Semester
MU: Methodological Teaching Unit
Subject 2: **COMMUNICATION AND EXPRESSION TECHNIQUES 2 (English)**
Credit:4
Coefficient:2

Objectives of the course
(Describe what the student is expected to gain in terms of skills upon successful completion of this subject - maximum 3 lines).
This subject completes the learning of understanding and writing scientific documents in English.
scientific documents in English.

Recommended prerequisites (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).
No prerequisites

Content of the subject:
1. Scientific terminology
2. Study and understanding of texts
3. Written and oral expression techniques (report, synthesis, use of modern communication communications)
4. Expression and communication in a group. Study of proposed texts (observe, analysis, review, written expression)

Directed Works:
Proposed exercises related to the language points considered most important.

Evaluation method:
Continuous assessment and semester exam

Reference
(Livres et polycopiés, sites internet, etc) :
Scientific research
Socle Commun L1 : Sciences de la Nature et de la vie Page 30

Semester : 2nd Semester
D.U: Discovery Teaching Unit
Subject: LIFE SCIENCES AND SOCIO-ECONOMIC IMPACTS
Credit:2
Coefficient:2

Objectives of the course

To help the students to conceive the professions directly or indirectly linked to the different specialties of the natural and life sciences.
Recommended prerequisites (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).No prerequisite

Content of the subject

I. Animal and plant production (breeding, processing, production...)
II. Toxicology and environmental health (effect of pollutants on plant and animal life animal life and on human health)
III. Biology and health (talk about the interest of biology in the diagnosis of animal and plant animal and plant diseases),
IV. Biotechnology and molecules of interest (pharmaceutical and food industry),
V. Biology and forensics
VI. Terrestrial and marine ecosystems (park management, ...)
VII. Technical-commercial biology (e.g.: commercial delegate).

Evaluation method

Continuous assessment and semester exam

References: (Livres et polycopiés, sites internet, etc) :

Socle Commun L1 : Sciences de la Nature et de la vie Page 31

Semester : 2nd Semester
T.U: Transversal Teaching Unit
Subject: WORKING METHODS AND TERMINOLOGY 2
Credit:1
Coefficient:1

Objectives of the course
To help the students to conceive the methods of research and synthesis of works according to scientific rules.

Recommended prerequisites (brief description of the knowledge required to follow this required to follow this course - Maximum 2 lines).
The student is expected to have some knowledge of bibliographic research.

Content of the subject
- Terminology
- Writing a scientific report
- Introduction to reading and understanding a scientific article

Evaluation method
Semester exam

References: (*Livres et polycopiés, sites internet, etc*) :
Scientific article

2nd year Field of study: Biological Sciences

Semester: 3rd Semester
FU : Fundamental Unit 1
Subject: ZOOLOGY
Credits : 6
Coefficient : 3

Objectives of the course
To know the main groups of groups of living organisms at the level of : General architecture, characteristics (Systematic, Morphology, Anatomy, Reproduction, Ecology), constraints, adaptations, and evolution.
Particular importance will be given to the updating of the classification and zoological groups of agricultural, medical, veterinary, fisheries or environmental interest,

Recommended Prerequisites
brief description of the knowledge required to follow this course - Maximum 2 lines).The student should have an idea of the different classes of the animal reign.

Content of the Subject
1. Presentation of the animal reign
1.1. Basics of classification
1.2 Zoological nomenclature
1.3 Evolution and phylogeny
1.4 Numerical importance of the animal reign
2. Subreign Protozoa
2.1 General information on protozoa.
2.2 Classification
2.2.1. Phylum Sarcomastigophora
2.2.2. Phylum Ciliophora
2.2.3. Phylum Apicomplexa
2.2.4. Phylum Cnidosproridia
3. Sub-reign
3.1 Embranchment Spongiaria
3.2 Phylum Cnidaria
3.3 Phylum Ctenaria
3.4. Phylum Plathelminthes
3.5. Phylum Nemathelminthes.
3.6. Phylum Annelidae
3.7. Phylum Molluscs
3.8. Phylum Arthropoda
3.9. Phylum Echinoderms
3.10. Phylum Chordates

Practical work
- ✓ PW N°1: Study of some typical species of Protozoa: Trypanosoma rhodesiense, Leishmania major, Leishmania infantum, Trypanosoma gambiense, Entamoeba histolytica,Paramecium sp
- ✓ PW N°2: Study of some typical Plathelminthes species : Moniezia expansa, Taenia hydatigena, Taenia pisiformis, Fasciola hepatica.
- ✓ PW N°3: Study of some Annelid species: Lumbricus terrestris, Hirudo officinalis
- ✓ PW N°4: Study of some typical species of Arthropods: Crustaceans (King shrimp, Squilla, morphology and biramed appendages), Chelicerates (Scorpion), Insects (Cricket, Bee).

- ✓ PW N°5: Study of the mouth parts of Insects : The different mouthparts and adaptation to food regimes, mouth parts of the crusher type (Orthoptera,Cricket).
- ✓ PW N°6: Study of some typical species of Echinoderms: Echinids (Sea Urchin), Asteroids Starfish).

- ✓ PW N°7: Study of some typical species of Vertebrates: Fish (Carp), Birds (Pigeon),Mammals (Rat, Mouse);

Projection of films
- Turtles.
- Birds
- Amphibians.

Evaluation method
Control continued and semester exam

Reference

1. Arab A., Cherbi M., Kherbouche-Abrous O., Amine F., Bidi Akli S., Haddou Sanoun G., 2013: Zoologie Tome 1. Polycopié, Oeuvres Et Publications Universitaires. Algérie. 152 P.
2. Arab A., Cherbi M., Kherbouche-Abrous O., Amine F., Bidi Akli S., Haddou Sanoun G., 2013 : Zoologie Tome 2 : Travaux Pratiques. Polycopié, Oeuvres Et Publications Universitaires. Algérie. 224 p.

Semester: 3rd Semester
F.U : Fundamental Teaching Unit 2
Subject1: BIOCHIMY
Credits : 6
Coefficient : 3

Objectives of the course
This matter consists in teaching the fundamental bases of biochemistry and enzymology, and to familiarize enzymology, and to familiarize the students with biochemical techniques.

Recommended Prerequisites
brief description of the knowledge required to follow this course - Maximum 2 lines).The student must have some knowledge of chemical bonds (weak and strong) and of the physicochemical properties of organic molecules.

Content of the Subject
1. Chemical bonds
1.1. Strong bonds
1.2. Weak bonds
2. Structure and physicochemical properties of carbohydrates
2.1. Simple bones
2.2 Oligosides
2.3. Polyholosides, heterosides.
3. Structure and physicochemical properties of lipids
3.1. Simple lipids
3.2. Complex lipids
4. Structure and physicochemical properties of amino acids, peptides and proteins
4.1. Amino acids, peptides, proteins
4.2. Structure (primary and secondary, tertiary and quaternary)
4.3. Properties and effect of treatments (solubility, electro-phoretic behavior, denaturation)
4.4. Separation of proteins
5. Concepts of enzymology
5.1. Definition, classification
5.2. Mechanisms of action
5.3. Active site
5.4. Enzymatic kinetics and types of representation
5.5. Enzymatic inhibition
5.6. Allostery phenomenon
6. Concepts of bioenergetics
6.1. Types of chemical reactions
6.2. The respiratory chain and energy production
6.3. Phosphorylation and redox reaction
7. Carbohydrate metabolism
7.1. Catabolism (glycolysis, glycogenolysis, pentose phosphate pathway, Krebs cycle, energy balance) energy balance)
7.2. Anabolism (neoglucogenesis and glycogenesis)
7.3. Regulation

8. Lipid metabolism
8.1. Catabolism of fatty acids (Beta-oxidation)
8.2. Catabolism of sterols
8.3. Biosynthesis of fatty acids and triglycerides
8.4. Sterol biosynthesis
8.5. Regulation
9. Peptide and protein metabolism
9.1. Catabolism of amino groups
9.2 Catabolism of carboxyl groups
9.3. Catabolism of the side chain
9.4. Glucoforming and ketogenic acids
9.5. Biosynthesis of essential amino acids
9.6. Nitrogen elimination, urea cycle
9.7. Example of peptide biosynthesis (case of peptides with biological activity)
9.8. Example of protein biosynthesis
9.9. Regulation
10. Structure and metabolism of other compounds of biological interest
10.1. Vitamins
10.2. Hormones

Evaluation method
Control continued and semester exam

Reference:
1. Cathérine Baratti-Elbaz Et Pierre Le Maréchal, 2015- Biochimie. Ed. Dunod, Paris, 160p.
2. Norbert Latruffe, Françoise Bleicher-Bardelett, Bertrand Duclos Et Joseph Vamecq, 2014- Biochimie. Ed. Dunod, Paris.
3. Serge Weinman Et Pierre Méhul, Toute La Biochimie. Ed. Dunod, Paris, 464p.
4. Françoise Lafont Et Christian Plas, 2013- Exercices De Biochimie. Ed. Doin, Paris, 410p.

Semester: 3rd Semester
FU : Fundamental Teaching Unit 2
Subject 2: GENETICS
Credits : 6
Coefficient : 3

Objectives of the course

This subject allows the student to acquire the notions and terminology of genetics, the transmission of structure of DNA, replication, transcription, alterations, regulation and mechanisms of gene expression.

Recommended prerequisites

brief description of the knowledge required to follow this course - Maximum 2 lines).The student should have knowledge of nucleic acids and Mendelian genetics

Content of the Subject

1. Genetic material
1.1 Chemical nature of genetic material
1.2 Structure of nucleic acids (DNA-RNA)
1.3. DNA replication: in prokaryotes and eukaryotes
1.4. Organization into chromosomes
2. Transmission of genetic characters in eukaryotes
3. Genetics of haploids
3.1. Independent genes
3.2 Linked genes
3.3 Genetic mapping
4. Genetics of diploids
4.1. Independent genes
4.2 Linked genes
4.3 Genetic mapping
5. Bacterial and viral genetics
5.1. Conjugation
5.2. Transformation
5.3. Transduction
5.4 Mixed infection in viruses
6. Protein synthesis
6.1. Transcription
6.2. Genetic code
6.3. Translation
7. Genetic mutations
8. Chromosomal mutations
8.1. Structural variation
8.2. Numerical variation (human example)
9. Gene structure and function: biochemical genetics
10. Regulation of gene expression
10.1. Lactose operon in prokaryotes
10.2. Example in eukaryotes
11. Notions of extra-chromosomal genetics
12. Notion of population genetics

DirectedWorks:

- ✓ DW N°1: Genetic material
- ✓ DW N°2: Transmission of traits
- ✓ DW N°3: Mono and di hybridism (Special cases)
- ✓ DW N°4: Linked genes
- ✓ DW N°5: Genetic maps
- ✓ DW N°6: Protein synthesis (genetic code)
- ✓ DW N°7: Fine structure of the gene (intragenic recombination)
- ✓ DW N°8: Conjugation and factorial map
- ✓ DW N°9: Population genetics
- ✓ DW N°10: DNA extraction
- ✓ DW N°11: DNA assay
- ✓ DW N°12: BARR corpuscle
- ✓

Evaluation method

Control continued and semester exam

Reference

1. Pasternak J.J., 2003- Génétique Moléculaire Humaine. Ed. De Boek, 522 P.
2. Harry M., 2008- Génétique Moléculaire Et Evolutive. Ed. Maloine.
3. Watson J., Baker T., Bell S., Gann A., Levine M. Et Losick R., 2010- Biologie Moléculaire Du Gène. Ed. Pearson.
4. Henry J.P. Et Gouyon P.H., 2003- Précis De Génétique Des Populations. Ed. Dunod

Semester: 3rd Semester
MU1 : METHODOLOGICAL TEACHING UNIT 1
Subject: Communication and Expression Techniques (in English)
Credits : 4
Coefficient : 2

Objectives of the course
To learn and apply research methods and the collection of useful and indispensable information and indispensable for the synthesis and the written formatting (report, oral, defense). Application of the grammar in a scientific context.

Recommended prerequisites
brief description of the knowledge required to follow this course - Maximum 2 lines).Some notions of terminology and research methodology acquired in L1

Content of the subject
1. Study of proposed texts (observation, analysis, review, written expression)
2. Terminology
3. Methodology of bibliographic research.
4. Methods of writing scientific reports.

Evaluation methods
Continuous assessment and semester exam

References
(Livres et polycopiés, sites internet, etc) :Research article.

Semester:3rd Semester
M.U: Methodological Teaching Unit 2
Subject: BIOPHYSICS
Credit: 5
Coefficient: 3

Objectives of the course

The general objective of the teaching of the biophysics course is to allow the students in
The general objective of the course is to enable students in NTS to acquire the basics of physics.

Recommended prerequisites: (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).

Content of the subject

I. The states of matter

I.1 Gases: elements of kinetic theory, equation of state of perfect or real gases, changes of state
I.2 Liquids: structure of water, dissolution
I.3 Solids: different structures
I.4 Intermediate states: glasses, liquid crystals, granular states, polymers deformable polymers

II. Generalities on aqueous solutions

II.1 Study of solutions: classification of solutions
II.2 Concentrations: molar fraction, molarity, molality, weight concentration, osmolarity, equivalent concentration.
II.3. Solubility
II.4. Electrolyte solutions: electrical conductivity, physical and chemical properties of electrolytes

III. Surface phenomena

III.1 Surface tension: definition, measurements and biological applications
III.2 Capillarity phenomenon: definition, measurements and biological applications
III.3. Adsorption

IV. Diffusion phenomenon

IV.1 Diffusion
IV.2 Osmosis and osmotic pressure: definition, measurements and applications biological
IV.3. Permeability: definition, measurements and biological applications

V. Study of the viscosity

V.1 Laminar and turbulent flow
V.2 Viscous resistance and viscosity measurements
V.3 Sedimentation
Common Core L2 : Biological Sciences Page 18
VI. Sound and ultrasonic waves
VI.1 The sound wave and its properties: production, nature and classification of sound and classification of sound waves.
VI.2 The Doppler effect: definition, measurements and biological applications.
VI.3. Ultrasound: definition, measurements and biological applications.

- ✓ Practical work: (do 3 practical exercises at least)
- ✓ Practical work N°1 : Surface tension
- ✓ Practical work N°2: Conductimetric titration

- ✓ Practical exercise N°3: Titration by PH-meter
- ✓ Practical training N°4: Viscosity measurement
- ✓ Practical work N°5: Spectrophotometer
- ✓ Practical work N°6: Refractometer.

Mode of evaluation
Continuous controls (presentation + test) and semester exam.

Reference

(Livres et polycopiés, sites internet, etc) :
- F. Grémy et J. Perin. Eléments de Biophysique. Tome 1 et 2. Flammarion. Paris.
- C. Bénézech et J. Llory. Physique et Biophysique. Masson et Cie. Paris, 1973.
- Y.THOMAS, 2000, Biophysique à l'usage des étudiants en sciences biologique, Bréal,Paris.
- A. Bertrand, D. Ducassou et JC. Healy. Biophysique. Utilisation médicale des rayonnements– Vision – Audition.

Semester: 3rd Semester
D.U: Discovery Teaching Unit
Subject 1: ENVIRONMENT AND SUSTAINABLE DEVELOPMENT
Credit: 2
Coefficient: 2

Objectives of the course

- ✓ The objective of this course is to make students aware of the stakes, contents and actions of sustainable development. It is to make them aware that it is possible to act for the preservation of the environment, through their training, as well as at their level, on their consumption, their daily activities and their society. During their university education, whatever their speciality and their ambition for their future professional orientation, the student will have the opportunity to learn and experience his knowledge about sustainable development.
- ✓ Sustainable development is currently one of the answers that is emerging worldwide, to face the current to face the current conjunction of the great ecological, economic and societal challenges of the world, economic and societal issues.

Recommended prerequisites (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).No prerequisite

Content of the subject
1. Definitions: Environment, components of an environment, sustainable development development.
2. Meaning of development?
2.1. The main dimensions of the environmental crisis: human demography,
Global warming, Fossil fuels (non-renewable), Depletion of natural resources
resources, drinking water, biodiversity and agriculture
2.2. Sustainable development, why?
2.3. The concept of sustainable development
2.4. The fields of sustainable development
2.5. The principles of SD and their origins: precaution, prevention, responsibility
solidarity, equity, polluter pays
2.6. Some indicators of sustainable development: ecological footprint and bio
capacity, environmental impact, environmental performance index, human development index
development index, GDP: gross domestic product (economic) and school enrolment rate
boys/girls (societal), accessibility to health care (societal).
Common Core L2: Biological Sciences Page 20
2.7. Environmental education, sensitization and nature animation, communication
environment,
Program for personal work
1- Find examples in the press (international and national) illustrating the principles of sustainable
of sustainable development (precaution, responsibility for example). Presentation and
discussion.
2- Test ecological reflexes
3- Comparison of the life cycle of a biodegradable product and a non

biodegradable product
4- To illustrate the principle of the polluter pays by taking an example of a polluting company in Algeria, taking into account the national legislation.
5- To give examples of the implementation of preservation, conservation or restoration environments.

Evaluation method
Continuous assessment and semester exam

Reference
(Books and handouts, websites, etc) :

T.U: Transversal Teaching Unit
Subject: ETHICS AND UNIVERSITY DEONTOLOGY
Credit:1
Coefficient:1

Objectives of the course

The general objective of thiSemester:3rd Semesters course is to enable students in the VNS program to acquire the resources of deontology and professional ethics.

Recommended prerequisites :(brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).

Content of the subject

1. Introduction: Context of the Algerian university

2. Concepts

2.1 Moral
2.2 Ethics
2.3 Deontology
2.4 Law
2.5 Professional Values
2.6 Learning and teaching
2.7 Didactics and pedagogy

3. The Charter Of Ethics And University Deontology

3.1 Basic principles
3.2 Rights
3.3 Obligations and duties

4. Applications

4.1 Teaching: courses, evaluation of knowledge and behaviour .....
4.2 Scientific research: research methodology, plagiarism, copyright scientific writing.....

Evaluation method

Semester exam

References:

- Bergadaà, M., Dell'Ambrogio, P., Falquet, G., Mc Adam, D., Peraya, D., & Scariati, R. (2008). La relation éthique-plagiat dans la réalisation des travaux personnels par les étudiants.
- Charte de l'éthique et de la déontologie universitaires, Alger, mai 2010 www.mesrs.dz
- Gilbert Tsafak, Ethique et déontologie de l'éducation Collection Sciences de l'éducationPresses universitaires d'Afrique, 1998
- Gohier, C., & Jeffrey, D. (2005). Enseigner et former à l'éthique. Presses Université Laval.
- Jaunait, A. (2010). Éthique, morale et déontologie. Poche-Espace éthique, 107-120.Socle Commun L2 : Sciences Biologiques Page 22

Semester: 4th Semester
F.U: Fundamental Teaching Unit 1
Subject : Botany
Credit : 6
Coefficient: 3

Objectives of the course

This subject aims to introduce the classification and anatomical characterization of the of the major groups of the plant kingdom. The teaching also attempts to provide students with also to provide students with the modalities of reproduction.

Recommended prerequisites :The student must have knowledge in plant biology (morphology, anatomy, physiology).

Content of the subject

Introduction to botany

- Definitions, concepts and classification criteria. Systematics of the major groups of the plant kingdom

Part One: Algae and Mushrooms

1. The Algae

1.1. Prokaryotic algae (Cyanophytes / Cyanobacteria)
1.2. The eukaryotic algae
1.2.1. Morphology
1.2.2. Cytology
1.2.3. Reproduction (notion of gamie, development cycle)
1.3. Systematics and particularities of the main groups
1.3.1. The Glaucophyta
1.3.2. The Rhodophyta
1.3.3. Chlorophyta and Streptophyta
1.3.4. Haptophyta, Ochrophyta, Dinophyta, Euglenozoa, Crytophyta, Cercozoa

2. Fungi and lichens

2.1. Problems in the classification of fungi
2.2. Structure of the thallus (mycelia, stroma, sclerotia)
Common Core L2 : Biological Sciences Page 23
2.3 Reproduction
2.4. Systematics and particularities of the main groups of fungi
2.4.1. The Myxomycota
2.4.2. The Oomycota
2.4.3 Eumycota (Chrytridiomycota, Zygomycota, Glomeromycota, Ascomycota, Basidiomycota)
2.5. A particular alga-fungus association: the lichens
2.5.1. Morphology
2.5.2. Anatomy
2.5.3. Reproduction

Part Two: Embryophytes

1. Bryophytes : Morphology and reproduction of the different phyla
1.1 Marchantiophytes
1.2. Anthocerotophytes

1.3. Bryophytes s. str
2. Pteridophytes: Morphology and reproduction of the different phyla
2.1. Lycophytes
2.2. Sphenophytes (= Equisetinae)
2.3 Filicophytes
3. Gymnosperms sensu lato
3.1. Cycadophytes: notion of ovule
3.2. Ginkgophytes
3.3. Coniferophytes: notion of flower, inflorescence and seed
3.4. The Gnetophytes: pivotal group
4. Angiosperms
4.1. Vegetative apparatus and notion of morphogenesis: growth of stems, leaves and roots
4.2 Floral morphology (organization of the flower, inflorescences)
4.3. Floral biology: microsporogenesis and macrosporogenesis
4.4 Seeds and fruits
4.5. Concept of modern systematics, cladogenesis and main taxa. Presentation
classifications (Engler 1924, APG II)

Practical work (3 weeks) :

- ✓ PW N° 1. Algae (Phycophytes) Morphology and reproduction of some species like Ulva lactuca a Cystoseiramediterranea.
- ✓ PW N°2. Mushrooms (Fungi) Morphology and reproduction of Rhizopus nigricans (Zygomycetes), Agaricus campestris (Basidiomycetes)
- ✓ PW N°3. Lichens Morphology of different types of lichens and study of Xanthoria parietina
- ✓ PW N° 4. Bryophytes Morphology and reproduction of Bryum sp.
- ✓ PW N°5. Pteridophytes Morphology and reproduction of Polypodium vulgare and Selaginella denticulata
- ✓ PW N°6. Cycadophytes
- ✓ Morphology and reproduction of Cycas revoluta
- ✓ PW N°7. Coniferophytes (Gymnosperms sensu stricto)Morphology and reproduction of Pinus halepensis and Cupressus sempervirens
- ✓ PW N°8 and 9 : Angiosperms Monocotyledons and Eudicotyledons.
  Illustration of the notion of trimeria and pentameria, of the notion of actinomorphy and zygomorphy; dialypetaly, gamopetaly, hypogynous flower, epigynous flower... .
- ✓ PW N°8. Floral morphology of Angiosperms Monocotyledons on examples as Asphodelus (or Allium) Practical Work N°9. Floral morphology of Eudicotyledonous Angiosperms on examples as Lathyrus or Vicia.

Practical Work N°10. Sexual reproduction in Angiosperms Pollen grain, pollination and fertilization in angiosperms Types of fruits and types of seeds.

Evaluation method
Continuous assessment and semester exam

Reference (Livres et polycopiés, sites internet, etc) :
1. APG II. 2003. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. Bot. J. Linnean Society 141:399–436.

Socle Commun L2 : Sciences Biologiques Page 25
2. APG III. 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. Bot. J. Linnean Society 161:105–121.
3. Lecointre G. et Le Guyader H. 2001. Classification phylogénétique du vivant. Ed. Belin.
4. Reviers de B. 2002. Biologie et Phylogénie des algues. Tome 1 et 2. Ed. Belin.
5. Meyer S., Reeb C. et Bosdeveix R. 2004. Botanique: Biologie et Physiologie végétales.Ed. Maloine.
6. Dupont F., Guignard J.L. 2012. Botanique Les familles de plantes. Ed. Elsevier-Masson

Semester: 4th Semester
U.F: Fundamental Teaching Unit 2
Subject 1: MICROBIOLOGY
Credit: 8
Coefficient:4

Objectives of the course
The student must acquire the notions of the microbial world, the techniques used to microorganisms, bacterial growth and classification.

Recommended prerequisites (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).
The student must have a general notion of pathogens.
Content of the subject
1.The microbial world
1.1 Historical background
1.2. Place of microorganisms in the living world
1.3 General characteristics of the prokaryotic cell
2. The bacterial cell
2.1. Observation techniques of the bacterial cell
2.2. Cell morphology
2.3. The cell wall
2.3.1. Chemical composition
2.3.2. Molecular structure
2.3.3. Functions
2.3.4. Gram staining
2.4. The plasma membrane
2.4.1. Chemical composition
2.4.2. Structure
2.4.3. Functions
2.5. The cytoplasm
2.5.1. Ribosomes
2.5.2. The reserve substances
2.6. The chromosome
2.6.1. Morphology
2.6.2. Composition
Common core L2 : Biological sciences Page 27
2.6.3. Chemical replication
2.6.4. Structure
2.7. Plasmids
2.7.1. Structure
2.7.2. Replication
2.7.3. Properties
2.8. Pilli
2.8.1. Structure
2.8.2. Function
2.9. The capsule
2.9.1. Morphology

2.9.2 Chemical composition
2.9.3. Functions
2.10. Cilia and flagella
2.10.1. Mise en évidence
2.10.2. Structure
2.10.3. functions
2.11. The spore
2.11.1. Morphology
2.11.2. Structure
2.11.3 Sporulation phenomena
2.11.4. Properties
2.11.5 Germination3.

3. Bacterial classification

3.1 Phenetic classification
3.2 Phylogenic classification
3.3 Bergey's classification

4. Bacterial nutrition

4.1. Basic needs
4.2 Growth factors
4.3. Trophic types
4.4. Physico-chemical parameters (temperature, pH, O2 and aW)

5. Bacterial growth

5.1. Measurement of growth
5.2. Growth parameters
Common Core L2 : Biological Sciences Page 28
5.3. Growth curve (discontinuous culture)
5.4. Bacterial culture
5.5. Antimicrobial agents.

6. Concepts of mycology and virology

6.1. Mycology (yeast and mould)
6.1.1. Taxonomy
6.1.2. Morphology
6.1.3. Reproduction
6.2. Virology
6.2.1. Morphology (capsid and envelope)
6.2.2. Different types of virus

Practical work :

- ✓ Practical W N°1: Introduction to the microbiology laboratory
- ✓ Practical W N°2: Method of study of microorganisms and the different processes of sterilization
- ✓ Practical W N°3: Methods of inoculation;
- ✓ Practical W N°4: Microscopic study of bacteria, simple staining
- ✓ Practical W N°5: Morphological study of different bacterial colonies on culture medium
- ✓ Practical W N°6: Gram staining
- ✓ Practical exercise N°7: Culture media
- ✓ Practical WN°8: Study of bacterial growth
- ✓ Practical W N°9: Criteria of biochemical identification of bacteria
- ✓ PW N°10: Yeasts and cyanobacteria
- ✓ PW N°11: Growth inhibitors, antibiogram
- ✓ PW N°12: Isolation of the total and specific flora of some products (water, milk...)

Evaluation method

Reference

1. Henri Leclerc, Jean-Louis Gaillard et Michel Simonet, 1999- Microbiologie générale. Ed. Doin, Paris, 535p.
2. Jerome Perry, James Staley et Stephen Lory, 2004- Microbiologie-Cours et questions de révision. Ed. Dunod, Paris, 889p.
3. Jean-Pierre Dedet, 2007- La microbiologie, de ses origines aux maladies émergentes. Ed. Dunod, Paris, 262p.

Semester: 4th Semester

U.E: Fundamental Teaching Unit 2
Subject 2: IMMUNOLOGY
Credit: 4
Coefficient: 2

Objectives of the course
The objective of this course is to introduce students to the role of immunity, immune defense systems, types of immune response and the dysfunctions of the dysfunctions of the immune system.

Recommended prerequisites (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines).
The student should have a basic understanding of the immune system.

Content of the subject
1. Introduction to immunology.
1.1 Role of immunity
1.2 Relationship to daily life and major discoveries
2. Ontogenesis of the immune system
2.1. B cells and lymphoid organs
2.2 T cells
2.3 Education of B cells within the marrow
2.4. Education of T cells inside the thymus
2.5. Other cells (myeloid cells)
3. MHC
4. The non-specific immune response Involved cells and complement
5. The specific immune response
5.1. Cellular
5.2. Humoral
6. Cellular and humoral cooperation
6.1. Cooperation between different cells
6.2. Cytokines
7. Dysfunction of the immune system
8. The main tests in immunology
8.1. Agglutination
Common Core L2 : Biological Sciences Page 30
8.2 Immunoprecipitation
8.3 Immunoelectrophoresis
8.4 Immunofluorescence
8.5. Elisa Techniques

Directed work
DW N°1: Ag-Ac reaction (precipitation : immunodiffusion, ELISA, RIA....)
DW N°2: Preparation of lymphocytes and monocytes from whole blood
DW N°3 : Separation of T and B lymphocytes
DW N°4 : Lymphomicrocytotoxicity test
Evaluation mode
Continuous assessment and semester exam

Reference
1. Marie-Christine Bené, Yvon Lebranchu, François Lemoine et Estelle Seillès, 2013-

Immunologie fondamentale et immunopathologie. Ed. Elsevier Masson, Paris, 260p.
2. Judy Owen, Jenni Punt et Sharon Stranford, 2014- Immunologie. Ed. Sciences de la vie, 832p.
3. Abul-K Abbas et Andrew-H Lichtman, 2013- Les bases de l'immunologie fondamentale et clinique. Ed. Elsevier Masson, Paris, 284p.
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Semester: 4th Semester
U.M: Methodological Teaching Unit 1
Subject : SCIENTIFIC METHODOLOGY AND TECHNIQUES OF STUDY OF LIVING
Credit: 4
Coefficient: 2
Objectives of the course
This subject allows the students to have notions on the methods applied to the study of Cytological methods, methods for studying the biochemical composition of cells and techniques of approach to living organisms.

Recommended prerequisites (brief description of the knowledge required to follow this course - Maximum 2 lines (Brief description of the knowledge required to follow this course - Maximum 2 lines).
Content of the subject
Title of the module: Scientific methodology and techniques for the study of life
General introduction.
Different scientific practices on observation (descriptive methods), manipulation (analytical methods) and exploration (synthetic methods) of animal and plant life.

Part one: methods of study of the morphology of cells
I. Cytological methods
1. Microscopy
1.1. Light microscopes or photonic microscopes
1.1.1. Transmission microscopes
1.1.2. Other photonic microscopes
- ✓ The phase contrast microscope
- ✓ Darkfield microscope
- ✓ Polarized light microscope
- ✓ UV microscope (= fluorescence microscope)
- ✓ The scanning microscope

1.2. Electron microscopes
1.2.2. The transmission electron microscope
1.2.3. The scanning electron microscope
Common Core L2 : Biological Sciences Page 32
II. Methods for studying the biochemical composition of cells
1. Cellular materials
1.1 Whole cells or cell sections
1.2. Cellular shreds = cellular homogenates (different techniques can be used)
1.3. Cellular fractions
- ✓ Principle of the separation of cellular organelles
- ✓ The differential ultracentrifugation
- ✓ Ultracentrifugation on density gradient

2. The methods
2.1. Electrophoresis
2.2. Biochemical analysis and dosage methods
2.2. Cytochemical methods.
2.3 Immun cytology / immunology technique.
Iii. Genetic Techniques (Dna Sequencing)
Part Two: Methods And Techniques Of Approach To Living Organisms.
I. THE HERBARY: Collection of dry plants, indispensable basis for research.

II. Techniques of approaches to the living.

1. Breeding.
2. Cultures.
3. Collecting.
4. Dissections.

III. Access to demographic parameters of animal and plant populations.

Evaluation method

Continuous assessment and semester exam

Subject: BIO STATISTICS
Credit: 5
Coefficient:3

Objectives of the course
The objective of this course is to provide some methodological tools
classically used to describe and test biological phenomena.

Recommended prerequisites (brief description of the knowledge required to follow this course - Maximum 2 lines) required to follow this course - Maximum 2 lines).
The student must have notions of probability and numerical analysis already seen in the first year.

Content of the subject
1. Reminders
1.1 Reminders on descriptive statistics
1.1.1. Parameters of positions
1.1.2. Parameters of dispersion
1.1.3. Shape parameters
2. Recall the main distribution laws: normal and log normal, Student, Pearson, Fischer-Snedecor...
3. Statistical inference: Hypothesis testing
3.1 Conformity test
3.2. Comparison test
3.3. Test of independence
4. Correlation study and Regression
4.1. Correlation coefficient
4.2 Significance test of the correlation
4.3. Simple linear regression
4.3.1. Regression line (least squares method)
4.3.2 Confidence interval of the regression estimate
4.3.3. Significance test of the regression coefficients
5. One and two factor analysis of variance
Common Core L2 : Biological Sciences Page 34
The use of software such as Statistica or SAS as a practical exercise for each chapter which
will be discussed in detail in the third year.
Directed Works:
Series of exercises on each chapter of the course.

Evaluation method
Continuous assessment and semester exam

References: (Livres et polycopiés, sites internet, etc) :
1. BENZEON J.P., 1984- L'analyse des données. Ed. Bordas, Tomes I et II.
2. HUET S., JOLIVET E. et MESSEON A., 1992- La régression non linéaire : méthodes et applications en biologie. Ed. INRA.
3. TROUDE C., LENOUR R. et PASSOUANT M., 1993- Méthodes statistiques sous Lisa - statistiques multi variées. CIRAD-SAR, Paris, PP : 69-160.
Socle Commun L2 : Sciences Biologiques Page 35

Semester: 4th Semester
TU : Discovery Teaching Unit
Subject : **GENERAL ECOLOGY**

Credit : 2
Coefficient: 2

Objectives of the course
The objective of the subject is to make the students understand the notion of ecosystem, the abiotic and biotic abiotic and biotic factors and the interactions between these factors, the components of the the ecosystem and its functioning.

Recommended prerequisites (brief description of the knowledge required to follow this course – Maximum required to follow this course - Maximum 2 lines). No prerequisite
Content of the subject
Chapter I
1.1. Definition of the ecosystem and its constituents (Notions of biocenosis and ecological
ecological factors)
1.2 Areas of intervention
Chapter II: Factors of the environment
2.1. Abiotic factors
2.1. Climatic
2.2 Edaphic
2.3 Hydric
2.2. Biotic factors
2.2.1. Competitions
2.2.2. Pests and Predators
2.2.3 Cooperative and symbiotic interactions
2.2.4. Parasitism
2.3 Interaction of environments and living beings
2.3.1. Role of ecological factors in the regulation of populations
2.3.2. Notion of ecological optimum
2.3.3. Ecological valence
2.3.4. Ecological niche.
Common Core L2 : Biological Sciences Page 36
Chapter III: Structure of ecosystems
3.1 Structure of food chains; relationships between producers (autotrophs)
and their dependence on nutrients and light or chemical energy.
3.2. Consumers (Heterotrophs) who are linked to the producers and finally the
decomposers who ensure the recycling and mineralization of organic matter.
Chapter IV: Functioning of ecosystems
4.1. Energy flows in the biosphere :
4.2. Notions of ecological pyramids, production, productivity and yield
bioenergy yields
4.3. Circulation of matter in ecosystems and main bio
geochemical cycles
4.4 Influence of human activities on biological equilibrium and particularly on the disturbance of the bio geochemical cycles (consequences of the pollution of the aquatic environments and atmospheric pollution (eutrophication, greenhouse effect ,
ozone, acid rains)
Chapter V: Summary description of the main ecosystems
5.1. Forest, grassland, surface water, ocean
5.2 Evolution of ecosystems and notion of climax
Directed Works :

The Directed Works concern the methods applied for the study of the environment.

Evaluation method
Continuous assessment and semester exam

Références (Livres et polycopiés, sites internet, etc) :
1. DAJET P. et GORDAN M., 1982- Analyse fréquentielle de l'écologie de l'espèce dans les communautés. Ed. Masson.
2. RAMADE F., 1984- Eléments d'écologie : Ecologie fondamentale. Ed. Mc Graw-Hill.

T.U.: Transversal Teaching Unit
Subject : COMPUTER TOOLS
Credit:1
Coefficient:1

Objectives of the course
Introduction to the basic definitions of the operating system of computer resources. At the end of this course, the student will be able to design documents and documents and tables in Word and Excel.

Recommended prerequisites (brief description of the knowledge required to follow this required to follow this course - Maximum 2 lines).
.
Content of the subject
I. Discovery of the operating system
Definition of an OS
Different existing OS: Windows, Linux and Mac OS.
II. Discovery of the office suite
Designing documents with WORD.
Designing tables with EXCEL.
Designing a presentation with Powerpoint.
Introduction to Latex.
III. Software and Algorithms

- ✓ Definition of software.
- ✓ Definition of algorithmic.
- ✓ Use of algorithmic in biology.

Evaluation method:
Semester exam

3RD YEAR OF MICROBIOLOGY LICENCE

Semester :5
FU: Fundamental teaching unit (UEF 3.1.1) :**Microbial taxonomy**

Subject 1: **SYSTEMATICS OF PROCARYOTES** (Bacteria and Archaea)
Credits : 6
Coefficient : 3

Objectives of the course:
This course is the continuation and the deepening of the knowledge acquired in L2 (S4) :
U.E. of General Microbiology. It must lead to a bacteriological diagnosis of all bacteria and archaea according to the data of the new edition of Bergey's Manual (Vol 1, 2, 3, 4 and 5). In addition to the classical characters of determination of prokaryotes, the contribution of molecular tool on which the Bergey's Manual is based for the identification of bacteria and Archaea is of great importance.

Recommended prerequisites: No prerequisites.

Content of the subject:

I. Introduction to systematics (Definitions, different taxonomic approaches)
II. The different bacterial and archaeal groups: The presentation is based much more on physiology, morphology and ecology,physiology, morphology and ecology than on phylogeny with for example the photosynthetic photosynthetic bacteria are presented together even if they are distributed in several phyla.
III. Principles of taxonomy in bacteria: the main bases of taxonomy based on "Bergey's Manual of Systematic Bacteriology "2013.
IV. Main types of classification : are represented by the different approaches taxonomic approaches: molecular taxonomy, chemotaxonomy, numerical taxonomy, Phenotypic taxonomy.....
V. Studies of the major bacterial groups :
1. Photosynthetic bacteria
2. Autotrophic bacteria.
3. Gram-negative heterotrophic bacteria
4. Gram positive heterotrophic bacteria
5. Actinomycetes
6. Rickettsiae and chlamydia
7. Mycoplasma

VI. The major bacterial phyla according to the Bergey's Manual classification: biology, taxonomy, morphology and ecology :
1. Phylum Proteobacteria :
   - ✓ Class 1: Alphaproteobacteria
   - ✓ Class 2: Betaproteobacteria
   - ✓ Class 3: Gammaproteobateria
   - ✓ Class 4: Epselonproteobateria

VII. The five Phyla of Archaea :
The first two phyla will be studied in more detail because they are the best known and those which the largest number of taxa:

The Euryarchaeota.
- ✓ The Crenarchaeota

- ✓ The Koraarchaeota
- ✓ The Nanoarchaeota
- ✓ The Taumarchaeota :
- ✓

Directed Work:

- ✓ DW1: Techniques used in bacterial systematics (classical and molecular) with a presentation of
- ✓ presentation of the PCR).
- ✓ DW2 : Principles of classification of archaeobacteria, giving examples for each group in the form of group in the form of presentations and personal work.

Practical work:

- ✓ PW 1: Enterobacteria: Gram staining, physiological tests (respiratory type,
- ✓ Nitrate reductase, catalase, oxidase, metabolism of carbohydrates on API gallery
- ✓ Lab 2: Other Gram-negative bacteria (Pseudomonas, Vibrio...): Gram staining, King A and B, Carbohydrate attack pathway, Antibiotic resistance
- ✓ PW3: Gram positive cocci bacteria: Gram staining, Physiological tests between Streptococci and Staphylococci, Presumptive and confirmatory test of pathogenicity, Staphylocoagulase test.
- ✓ PW4: Gram-positive bacilli spores: Gram with observation of the spore (shape, position, deformity), Biochemical tests (Indole, Gelatin, hemolysis)

Evaluation method:
Continuous assessment and semester exam

References:

1. Bergeys manual of Determinative Bacteriology Volume 1 (Archaea), 2, 3, 4 et 5 pour les Bacteria.
2.Microbiologie - 2ème Édition, Paul Klein. De Boeck Edition.

Semester :5
FU: Fundamental teaching unit (UEF 3.1.1) **Microbial taxonomy**
Subject 2: **MYCOLOGY, ALGOLOGY AND VIROLOGY**
Credits : 4

Coefficient : 2
Objectives of the course
Recommended prerequisites:

Content of the subject :MYCOLOGY:
I. General characteristics of fungi (molds and yeasts)
- Chemical composition and structure of cells
- Growth and reproduction
- Laboratory and large scale culture

II. Classification of fungi
- Yeasts
- Chitridomycetes
- Oomycetes
- Zygomycetes
- Ascomycetes
- Imperfect fungi
- Basidiomycetes
- Ectotrophic and endotrophic mycorrhizae

III. interest in the use of fungi in: food, agriculture and public health public health
A. Agro-food
1. Use of molds:
- The main phases of mold growth
- Examples of cultures on solid and liquid media
- Development and differentiation
- Production of metabolites (primary and secondary)
- Use in the elaboration of dairy products
- Edible fungi

2. Use of yeast :
- Beer production
- Bread fermentation

B. Pharmaceutical industry Mushrooms producing metabolites: vitamins, antibiotics and enzymes
- Origin
- Isolation
- Extraction and purification
- Applications and therapeutic uses

IV. Pathological aspects
A. In humans and animals :
- Candidiasis
- Dermatophytes

B. In plants:
- Storage fungi
- Mycotoxins

Directed work :
- ✓ DW: Characterization of fungi
- ✓ Practical work: Isolation and characterization of some yeasts
- ✓ DW: Mastery of some techniques of identification of molds
- ✓ Practical work: Isolation of some molds from moldy foodstuffs

- ✓ DW: Mastery of microcultures.

Practical work: Microscopic characterization of fungi

Evaluation method:
Continuous assessment and examination

References :
1.Précis De Mycologie. Mycologie Générale, Mycologie Humaine et Animale. Techniques.Langeron, Ed. Masson.
2.Les Champignons - Mycologie Fondamentale et Appliquée. Jean Louis Guignard. Ed. Masson.

ALGOLOGY :
1. General characteristics of algae
2. Structure and morphology of algae
3. Reproduction cycle of algae (sexual and asexual)
4. Taxonomy of algae :
4.1. The Chlorophyta
4.2. The Phaeophyta
4.3. The Rhodophyta
4.4. The Bacillariophyta (Diatoms)
4.5. The Dinoflagellata
4.6. The Oomycota
5. Importance of algae (deleterious and useful effects of algae).
-Food (food, agar-agar, POU, additives,...)
-Pharmaceutical industry -cells, carageenan, ...)
-Industry (cosmetics, textiles, gels,...).

VIROLOGY
Objectives of the course:
Viruses are briefly introduced in L2 (U.E. of Microbiology). The aim is to deepen the knowledge of the different types of viruses and in particular those responsible for viral infections in humans, animals and plants. Also, their recognition, their mode of transmission and multiplication, the mechanisms involved in their multiplication, in the processes of infection processes and the methods of prevention and control of viral infections are the main steps constitute the main steps in the teaching of this module.

Recommended prerequisites:

Content of the subject:
1. Introduction to virology
2. Viruses and virions :
3. General properties
4. The structure of viruses and bacteriophages
5. Viral systematics
6. Viral genomes
7. Viral replication: general characteristics of viral replication; multiplication of single-stranded RNA viruses of + and - polarity, double-stranded RNA viruses, single-stranded DNA viruses
DNA viruses and double-stranded DNA viruses, multiplication of RNA viruses through
DNA intermediates and DNA viruses passing through RNA intermediates
8. Animal viruses and plant viruses: comparison of the two types of viruses

9. Latent infections, cytocides
10. Viral restriction.

Evaluation method:
Continuous assessment and semester exam.

References
(Books and handouts, websites, etc):

Credits : 4
Coefficient : 2

Objectives of the course

- ✓ This subject is to be correlated with the subject 1 of bacterial systematics UEF7. Also, the study of energy metabolism of microorganisms and in particular in prokaryotes the catabolism of catabolism of carbohydrates and other organic compounds, which will allow the student to know the biochemical the biochemical mechanisms involved and used by bacteria.
- ✓ This subject should enable the student to characterize and identify bacteria and Archaea from a biochemical point of view

Recommended prerequisites:

Content of the subject:
I. Introduction: Energy, anabolism, catabolism
II. Energy metabolism of microorganisms:

- ✓ -Energy source and trophic types;
- ✓ -Final electron acceptor and types of respiration

III. Carbohydrate catabolisms:

- ✓ Glycolysis or embden-meyer hoff pathway
- ✓ The alternatives of glycolysis
- ✓ Anaerobic metabolism of pyruvate
- ✓ The tricarboxylic cycle of krebs
- ✓ The glyoxylic shunt
- ✓ Fermentations derived from the krebs cycle or the glyoxylic shunt. Importance
- ✓ of these metabolic pathways in different types of microorganisms: - bacteria, yeasts, molds
- ✓ bacteria, yeasts, molds
- ✓ Carbohydrate catabolism in yeast (anaerobic and aerobic, applications).

IV. Study and interest of some metabolic types :
1. Aerobic lithotrophs (case of nitifying bacteria)

2. The anaerobic lithotrophs (case of sulfate-reducing bacteria, methanogenic bacteria methanogenic bacteria,...)

3. Aerobic and anaerobic organotrophs (case of pseudomonas, acetic bacteria acetic bacteria,...)

4. Fermenting organisms
- case of alcoholic fermentation

- case of lactic fermentation

- case of mixed acid and butanediol fermentation

- case of butyl fermentation

- case of propionic fermentation

V. Catabolism of other organic compounds :

- lipids

proteins

- carbohydrates

- monocarbon compounds ethanol and glycerol

- applications

VI. Anabolism and production of biomass and metabolites :

- production of amino acids

- production of lipids

- production of nucleotides

- production of antibiotics

- production of hormones

- production of toxins

- production of polysaccharides

- production of enzymes

Practical work:

- ✓ PW1: Alcoholic fermentation by yeasts (case Saccharomyces cereviceae) in bioreactor.
- ✓ PW2: Lactic fermentation of some lactic strains (bioreactor tests).
- ✓ DW: Exercises on microbial metabolism, the major metabolic cycles.

Evaluation method:
Continuous and Semester Exam.

References:

1. Cours De Microbiologie Générale Avec Problèmes Et Exercices Corrigés. Alphonse Meyer. Ed. Doin.
2. Microbiologie - 2ème Édition. Paul Klein. De Boeck Édition.
3. Microbiologie - Hygiène - Bases Microbiologiques De La Diététique. Cristian Carip. Tec et Doc Lavoisier.
Introduction À La Microbiologie . Gerard Tortora. Erpi .

Semester : 5
FU:Fundamental teaching unit 2 (UEF 3.1.1): Molecular microbiology
Subject 2: Molecular biology and genetic engineering
Credits : 4

Coefficient : 2

Objectives of the course

The subject aims at giving the basic notions of both molecular biology and genetic engineering. A general introduction in bioinformatics concerning genomic databases is introduced at the end of this
databases is introduced at the end of this course. Three goals are targeted in this module:

- ✓ the subject will enable students to understand the structure and organization of the genome
- ✓ the subject will allow students to understand the structure and organization of the genome with all its complexity of transcription, translation, replication and repair.
- ✓ The second goal is to understand the manipulation of DNA: gene transfer, Mutagenesis...
- ✓ The third goal is to familiarize students with the techniques and tools associated with the study of DNA (PCR, sequencing, etc.), sequencing...)

Recommended prerequisites:
Part I: Molecular Biology :

1. Expression of genetic information: protein synthesis

(Transcription, Translation).

2. Regulation of gene expression: transcriptional regulation,

Transcriptional regulation.

3. Basic techniques of molecular biology:

- ✓ Nucleic acid preparation (extraction and purification)
- ✓ Nucleic acid separations (agarose gel electrophoresis, pulsed field
- ✓ pulsed field, ...).
- ✓ detection, characterization and identification of nucleic acids (membrane transfer, labeling, hybridization membrane transfer, labelling, hybridization...).
- ✓ DNA sequencing.
- ✓ In vitro amplification of nucleic acids (PCR, RT (reverse-transcriptase)-

PCR ...).
Part II: Genetic Engineering:
1. in vivo cloning :
1.1 Necessary elements for cloning: DNA to be cloned, restriction enzymes,

ligation enzymes, cloning vectors, their construction and characteristics, host

host cells.

1.2. The steps of cloning: construction of the vector, insertion of the DNA to be

cloning, transformation of bacteria, selection of recombinants, analysis of recombinants.

4. Recombinant DNA technology: Synthesis of recombinant proteins, cDNA and expression vectors. Example of protein production by E. coli and Saccharomycescerevisiae.

5. **Directed work** :
6. DWN°1. Restriction enzymes.
7. DWN°2. Molecular hybridization.
8. DWN°3 : DNA sequencing.
9. DWN°4 : PCR.
10. DW. N°5 : Cloning.

11. **Mode of evaluation :**
12. Continuous assessment and semester exam

Semester : 5
UM:Teaching unit Methodology
Subject1 : **MICROBIAL GENETICS**
Credits : 5

Coefficient : 3

Objectives of the course:
Recommended prerequisites:

Content of the subject:

I- Structure and organization of genetic material: chromosome, plasmids, viral genetic material.

II - Mutation and DNA repair mechanisms: Mutation size, mutagenic effect mutagenic effect, mutagenic agents, DNA repair mechanisms.

III- Genetic recombination and transposable genetic elements:
Homologous recombination, site-specific recombination, transposable genetic elements and
IV -Genetic transfers in bacteria: genetic analysis and construction:
conjugation, transformation, transduction and transducing phages, applications, genetic mapping genetic mapping.

V - Phenomenon of restriction modification: restriction modification system, enzymes restriction enzymes, restriction mapping and applications.

VI - Regulation of gene expression: transcriptional regulation (examples: E.coli, Saccharomyces cerevisiae), translational regulation.

VII - Genetics of bacteriophages: replication of the viral genome, genetic recombination in viruses, mechanisms of gene expression cascade in viruses and maintenance in the prophage state.

Directed work :
- ✓ Mutation.
- ✓ Genetic transfers and genetic mapping.
- ✓ Restriction enzymes, restriction mapping.

Practical work :
- ✓ Extraction of plasmid DNA and analysis by electrophoresis
- ✓ UV mutagenesis and observation of photoreactivation
- ✓ Bacterial conjugation and transformation experiments

Evaluation method:

Continuous assessment and semester exam

References :
1. Biologie Moléculaire De La Cellule. Harvey Lodish. De Boeck.
2. Biologie Cellulaire & Moléculaire. Gérald Karp. De Boeck.
3. Principes De Génie Génétique. S. Primrose. De Boeck.

Semester : 5
MU:**Teaching unit Methodology :**
Subject 2: **HYGIENE AND SAFETY**
Credits : 4

Coefficient : 2

Objectives of the course:
This training aims at introducing students to the risks in an analytical and/or research laboratory. research laboratory. The aim of this initiation is to alert the students to the risks and to give them some keys to practice in a laboratory and prepare their manipulations.

Recommended prerequisites:
Basic knowledge of chemistry, biochemistry, microbiology and chemistry of the environment, biochemistry, microbiology and legislation.

Content of the course:

1. Organization of laboratories

- Basic installations

- Storage of chemical products

2. Hygiene in the laboratories

3. Risks of handling in laboratories

- Chemical risks (dangerous chemical products, explosions, poisoning)

- Physical risks (fire, radioactivity...etc)

- Biological risks (DNA, Plasmids, Viruses, Bacteria, Moulds...)

4. Safety measures in laboratories

5. environmental protection (waste recovery and treatment)

6. Emergency measures in case of accidents

- What to do in case of spillage of chemical and biological liquids

- Procedure in case of fire

- Conduct in the event of an accident to a person.

Evaluation method:

Continuous assessment and semester exam.

References :

- Favelier J. 1995. Manuel de prévention des risques associés aux techniques biologiques.Elsevier, 367 p.

- FAO, 2007. Analyse des risques relatifs à la sécurité sanitaire des aliments: guide àl'usage des autorités nationales responsables de la sécurité sanitaire des aliments.

FAO, 2001. Systèmes de qualité et de sécurité sanitaire des aliments: manuel deformation sur l'hygiène alimentaire et le Système d'analyse des risques - points critiques pour leur maîtrise (HACCP).

- Dellaras C. 2014. Pratique en microbiologie de laboratoire ? Recherche de bactéries etde levures-moisissures. Ed : Lavoisier.

- FAO,1992. Assurance de la qualité dans le laboratoire d'analyse microbiologique desaliments.

Semester : 5
DU:Discovery teaching unit :
Subject : PHARMACOLOGYTOXICOLOGY
Credits : 2
Coefficient : 2

Objectives of the course:

- ✓ To deepen the chemical and biological concepts useful in the field of life and health sciences in pharmacology and their dangers,
- ✓ To acquire a double competence in Chemistry and Biology with a specialization in Microbiology.
- ✓ Understand the interest of microorganisms in pharmaceutical production (antibiotics, vitamins...).

Recommended prerequisites:
Structural Biochemistry, Organic Chemistry, General Microbiology, Plant Biology.

Content of the subject Pharmacology :

I**. Generalities**

II. Nature and structure of different groups of drugs

- ✓ Antibiotics
- ✓ Hormones and derivatives
- ✓ Dyes
- ✓ Antidotes

III. General pharmacodynamics

- ✓ Routes of administration
- ✓ Metabolism
- ✓ Transformation
- ✓ Binding to biological receptors and competition

IV. General pharmacokinetics

- ✓ Drug dependence
- ✓ Biological and clinical parameters
- ✓ Side effects

V. Analytical study of the main drug intoxications

Physiopathological effects

Acute intoxication

Chronic intoxication

Allergies

Evaluation method :
Continuous assessment and semester exam

References :-*Pharmacopée Européenne: 2008, 6eme Edition Tome I, 1218P*
Semester : 5
TU:Transversal teaching unit :
Subject : Scientific English
Credits : 1
Coefficient : 1

Objectives of the course:

- ✓ Mastery of the scientific English language.
- ✓ -As books and articles published abroad are more and more rarely translated into French, the future graduate in Licence and then master and especially the one who intends to do research, must be research, must be trained to understand them at first reading and to extract the essential without making any misunderstandings.

Recommended prerequisites : French, English.

Content of the course:
English: Mastery of the English language in a professional scientific setting;
participate in a debate; present a topic in a 15-minute presentation; write a report, a book, a booklet, or a minutes; writing a report,
- Mastery of basic grammar,
- Sentence structure and word order,
- Scientific Communication (overview of the different forms of scientific communication).
-Scientific Communication (overview of the different forms of scientific communication), Reading and Writing a Scientific Article.
- English classes (written and spoken) with support from articles and publications written in English.

-Oral communication of research results.

-Evaluation method:
Content and Examination (01 exam of 1 h 30 at the end of the semester).

-References:
(*Livres et polycopiés, sites internet, Articles et Revues Scientifiques..etc),Ouvrageset CD*.

Semester :6
FU: Fundamental teaching unit (UEF 3.2.1) : **Applied Microbiology**
Subject 1 : **INDUSTRIAL MICROBIOLOGY**
Credits : 6

Coefficient : 3

Objectives of the course::
This subject allows the study of:

- ✓ The functioning of fermenters and the industrial practice of fermentations.
- ✓ The potential of microbial strains in the biosynthesis of important metabolites (vaccines, antibiotics important metabolites (vaccines, antibiotics, enzymes, proteins, yeasts, P.O.U., cheeses,flavors,...)
- ✓ Optimizations and improvements of wild strains (environmental factors and conditions, mutagenesis mutagenesis, genetic recombination for a maximum production of metabolites.

Methods of isolation, purification and obtaining metabolites.

Recommended prerequisites:
Content of the subject:

1. Introduction: The fields of activity of industrial microbiology and the interest of the use of of microorganisms, bacterial cell: microbial product of industrial interest
2. Useful microorganisms (Archaea, bacteria, fungi, algae and viruses) : Reminder of Taxonomy, importance of microorganisms in industry.
3**. Industrial culture media.**
4. Industrial fermentations:
-The fermenter
-Proteins from unicellular organisms: the P.O.U. or SCP, the organisms used and the most suitable cheap substrates
5. The products of industrial fermentations :
5.1. Primary metabolites obtained by microbial fermentation:
-Amino acids
-Organic acids
-Biogas (H2, CH4, ...)
-Vaccines
5.2. Secondary metabolites :
-Antibiotics (penicillin, streptomycin, tetracycline)
-Vitamins (B12)
-Polysaccharides
5.3. Enzymes.
Practical work :

- ✓ PWN°1: Introduction to antibiotic screening techniques
- ✓ PWN°2: Conservation techniques for industrial microbial strains
- ✓ PWN°3: Production of P.O.U. yeast
- ✓ PWN°4: Production of a microbial enzyme.

Evaluation method :
Control and semester exam.

Semester :6
FU: Fundamental teaching unit (UEF 3.2.1) : **Applied Microbiology**
Subject 2 : **Environmental microbiology**
Credits : 6
Coefficient : 3

Objectives of the course:

- ✓ This course allows the knowledge of the existing relations between the microorganism and the environment constituted by water, soil or the digestive tract of man and animal.
- ✓ The main groups of microorganisms (indicators or specific) in these different ecosystems and the interactions microbes-(fauna, water, plants, soils) are particularly studied. The role of microorganisms in the different cycles of living matter (biogeochemical cycles of biogeochemical cycles of elements) is also widely discussed.

Recommended prerequisites:

Content of the course :
Introduction: Concept of ecosystem; place, diversity and specificity of microorganisms

Chapter I: The microbiology of water
Natural waters
Wastewater
Raw water and its potability

Chapter II: Soil microbiology
Specificity of the soil ecosystem
Soil microflora: main microbial groups
Interactions with fauna, water and plants
Nitrogen fixation: legume-Rhizobium symbiosis
Chapter III : Elements of microbiology of the digestive tract
The digestive microflora of man
The microflora of the digestive tract of ruminants
Chapter IV : Contaminations and hygiene of the premises
Sources of microbial contamination: air, water, raw materials, personnel
Main contaminations: hospital environments, industrial environments
Hygiene rules and safety standards
Disinfection of premises
Practical work :

- ✓ PW1: Isolation and characterization of microorganisms from water:
- ✓ Waste water, tap water, natural spring water (not conditioned)
- ✓ PW 2: Isolation and characterization of microorganisms from soil
- ✓ PW 3 : Isolation and characterization of microorganisms from air

N.**B: PW 2 can be done in three sessions.**
Evaluation mode:

Continuous assessment and semester exam
References:
1. Microbiologie. Linda Sherwood. De Boeck.
2. Microbiologie Générale Et Santé. Claudine Bosgiraud. Editions Eska

Semester :6
FU: Fundamental teaching unit (UEF 3.2.1) : **Applied Microbiology**
Subject 3 : FOOD MICROBIOLOGY
Credits : 6

Coefficient : 3

Objectives of the course:
This U.F.T. Allows the study of :

- ✓ Different foods: dairy products, meats and derivatives,
- ✓ The behavior of microorganisms in food environment, microbiological aspects of food safety and quality food safety and quality, food fermentation and the useful or harmful effects they cause.
- ✓ or harmful effects that they cause:
- ✓ Lactic fermentations, breads, cheeses, drinks, ...
- ✓ intoxications and food poisoning (bacterial or fungal origin)
- ✓ Alteration of foodstuffs such as meats and derivatives, preserves, ...
- ✓ Different means of control, elimination and inhibition of microbial growth in food.
- ✓ microbial growth in foods.
- ✓

Recommended prerequisites:

Content of the subject:
I. Brief introduction to the major food groups: (Classification of foods according to
(Classification of foods according to their constituents: proteins, lipids, carbohydrates, water, minerals, vitamins, etc.)
I.1/Microorganisms and food (pathogens related to intoxication, toxinfection and virulent infection ....)
I.2/Lactic bacteria (Lactococci, Lactobacilli, Leuconostoc, Bifidobacteria....):Beneficial and harmful effects of lactic bacteria, lactic yeast: Pure, mixed and natural; Use of lactic bacteria in milk processing (yogurt and cheese).
II. Microbial alterations of food and means of control :
II.1 Factors influencing food spoilage flora:
a. Intrinsic factors (relative humidity, water activity, osmotic pressure,
temperature, ...)
b. Extrinsic factors (temperature, additives, radiation ...).
II.2 Food alterations : Milk and derivatives (Pasteurized, UHT, butter....); meats (red meat, fish, poultry...); cereals and derivatives.
II.3 Means of control:
a.physical means:
- low temperature inhibition (refrigeration, freezing), thermal destruction (thermisation, blanching, pasteurisation, sterilisation, etc...), the effect of radiation, the effect of bacterofugation and filtration
b. chemical means: antiseptic and antibiotic substances.

Practical work:

Presentation of microorganisms of interest in food microbiology classification, description of genera and species, role and beneficial and harmful effects beneficial and harmful effects): enterobacteria, saprophytic bacteria, micrococci, spore-forming spore-forming bacteria, vibrios, actinobacteria, brucella, molds, yeasts.
Practical work :

- ✓ **PW1**: Microbiological analysis of pasteurized milk and cow's milk; Enumerate and identify the microorganisms present in these foods; Express the results according to the Algerian standards.
Algerian standards.

- ✓ **Practical work 2**: Enumeration of the flora of different dairy products: Observe, enumerate and compare the microorganisms present in two different dairy products: yogurt (classic or bifidus with bifidus), cheese and follow-up of a contamination by S. aureus

Lab 3: Analysis of a meat product: Observe and identify potentially contaminating flora meat products mainly composed of meat such as merguez....etc.

- ✓ **PW4**: Analysis of a cereal product: Observe, count and compare the microorganisms present in a cereal food such as flour...etc..: Observation and identification of molds according to their morphological characteristics, identification of clostridium sulphite-reducers.

Evaluation method:
Continuous assessment and semester exam

References:

1.Microbiologie Alimentaire. Christiane Joffin. CRDP D'aquitaine.
2.Microbiologie Alimentaire - Tome 2, Aliments Fermentés Et Fermentations Alimentaires.C M Bourgeois.Tec et Doc Lavoisier.
3.Les Critères Microbiologiques Des Denrées Alimentaires - Réglementation, Agents Microbiens, Autocontrôle. Eric Dromigny. Tec & Doc Lavoisier.

Semester : 6
MU:Methodological teaching unit (UEM):
Topic 1: **MICROBIOLOGICAL CONTROL TECHNIQUES**
Credits : 4

Coefficient : 2

Objectives of the course:

This U.E. allows the study of the techniques of analysis and microbiological control:

- ✓ General handling techniques;
- ✓ Techniques of estimation of microbial populations;
- ✓ Techniques of study and microbial identification.

Recommended prerequisites:
Prior knowledge in the following areas: general microbiology, immunology, biochemistry.

Content of the subject:

I. Introduction: reminders of general microbiology
II. General handling techniques :

1. Basic microbiological equipment and techniques.

2. Media and general culture techniques.

3. Selection and isolation techniques.

III. Techniques for estimating microbial populations :

1. Counting techniques.

2. Techniques for estimating the amount of biomass.

IV. Microbial study and identification techniques :

1. Microscopic study.

2. Biochemical and physiological study.

3. Immunological study.

V.Application to the study of the main microbial groups

1. Techniques for the study of bacteria

2. Techniques for the study of yeasts.

3. Techniques for the study of molds.

4. Other microorganisms.

Practical work :

- ✓ PW1: the microbiology laboratory: basic equipment and handling.
- ✓ PW 2: general techniques of culture and conservation of microorganisms.
- ✓ PW 3: techniques of isolation of microorganisms: selective isolation, use of differential media.
- ✓ PW 4: microscopic preparations and examinations.
- ✓ PW 5: techniques for counting microorganisms: dilution techniques, counting by

- ✓ counting, counting after culture in solid medium, counting after culture in liquid medium.
- ✓ liquid medium.
- ✓ PW 6: identification techniques of microorganisms: microscopic character,
- ✓ cultural characteristics, study of metabolism.

Evaluation method :

Continuous assessment and semester exam.

References:

- DELARRAS C., (2014). Pratique en microbiologie de laboratoire. Technique et Documentation, Lavoisier.
- PRESCOTT R., (2013). Microbiologie. De Boeck.
- DELARRAS C., (2007). Microbiologie pratique pour le laboratoire d'analyses ou de contrôle sanitaire. Technique et documentation, Lavoisier.
- BRANGER S., (2007). Alimentation, sécurité et contrôles microbiologiques. Educagri

Semester 6
MU:Methodological teaching unit (UTM)
Subject 2 : **BIOCHEMICAL ANALYSIS TECHNIQUES:**

Credits : 5
Coefficient :3

Objectives of the course:
The teaching of biochemical analysis techniques aims to develop in the students the concepts of biochemical methods involved in food and medical control.

Recommended prerequisites:
Structural and metabolic biochemistry, Organic chemistry, Solution chemistry, Immunology, Enzymology, Biochemical techniques.

Content of the subject:
1. General introduction.
2. Chromatographic methods: -
Introduction ;
- General principle;
- Different types of chromatography: partition, adsorption, exclusion chromatography, affinity, ion exchange, chiral, steric exclusion.
3. Protein electrophoresis:
- On polyacrylamide gel;
- On agarose gel;
- By isoelectric focusing.
4. Spectroscopic methods:
- General principle;
- BEER-Lambert law ;
- UV spectroscopy ;
- IR spectroscopy ;
- Emission spectroscopy ;
- Atomic adsorption spectroscopy,
- NMR ;
- Mass spectroscopy.
5. Fluorometry.
6. Polarimetry
7. Separation methods: Dialysis, Electrodialysis, Ultrafiltration, Centrifugation, Sedimentation
8. Isotonic methods:
- Fundamental Laws of Radioactivity;
- Measurement technology ;
9. Antigen-antibody reaction;
10. Immunohistochemistry.

-Practical work (with report):
-PW1 : Fractionation and identification of sugars by thin layer chromatography ;
- PW 2 : Determination of Na+ and K+ ions by flame photometer;
- PW 3: Determination of sugars by colorimetry;
- PW 4: Determination of the initial rate of an enzymatic reaction.
- PW 5: Purification of proteins by electrophoresis.
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Evaluation method :
-Continuous assessment, Semester exam.

References:

-Audigié Cl., Dupont G., Zonszain F. 1992. Principes des méthodes d'analyses biochimiques, Ed :Doin, France, Tome 2.
-Gavrilovic M., Maginot M-J., Schwartz-Gavrilovic C., Wallach J., 1996. Manipulations d'Analyse Biochimique. Ed: Doin, France .

Semester 6:
UD:Discovery Teaching Unit
Subject 1: **TOXICOLOGY**

Credit: 2
Coefficient: 2

Objectives of the course:

- ✓ To deepen the chemical and biological concepts (toxins of microorganisms,...) useful in the field of life and health sciences in toxicology and their danger, Understand the interaction of any toxicological substance (contaminant of bacterial or fungal origin To understand the interaction of any toxicological substance (bacterial or fungal contaminant, pollutant, drug...) with a living organism.
- ✓ Acquire a double competence in Chemistry and Biology with a specialization in Microbiology.

Recommended prerequisites:

Structural biochemistry, organic chemistry, general microbiology, plant biology.

Content of the course Toxicology :

I. Generalities

1) Basics of food hygiene

2) Standards and legalization

II. Nature and structure of the different groups of toxic agents

1) Plants

- ✓ Plants
- ✓ Moulds
- ✓ Fungi

2) Pesticides

- ✓ Organophosphates

3) Metals and metal salts

4) Hydrocarbons

5) Nitrosamines and derivatives

6) Hormones of synthesis

7) Food additives

8) Radioactive fallout

III. Pathophysiological effects due to the action of toxic agents

1) Acute intoxication

2) Chronic intoxication

IV. Metabolization and elimination

Semester 6:
TU:Transversal Teaching Unit:
Subject 1: **DOCUMENTATION TECHNOLOGY**:
Credit:1
Coefficient:1

Objectives of the course: To learn how to carry out scientific research at the experimental and theoretical levels and how to write the resulting document.
and theoretical levels and to know how to write the resulting document.

Recommended prerequisites:

Subject Content:
Research and information management :
- scientific literature (primary and secondary sources)
- access to information ;
- strategy of a bibliographic research ;
- principles of bibliographic references

Planning of an experimental work
Drafting of the written document:
- general subdivisions and respective contents ;
- presentation and analysis of results.
-How to choose a scientific journal for publication (impact factor, ISSN, author, bibliographic references....).
-choice and distribution of articles/ Informal discussion on the working methods to be used.

Evaluation method:
The modalities of knowledge control (Content, semester exam, contraction of articles...)