PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF HIGHER EDUCATION
AND SCIENTIFIC RESEARCH

Educational Programme

in
Academic Bachelor degree

Field

Science of Nature and Life
Branch

Marine and Continental Hydrobiology

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

Compliance Canevas

TRAINING OFFER
L.M.D.

ACADEMIC BACHELOR DEGREE

2018 - 2019

Institution	Faculty / Institute	Department
University Djilali Bounaama of Khemis-Miliana	**Faculty of Natural and Life Sciences and Earth Sciences**	**Ecology & Environment**

Field	Branch	Speciality
Natural and Life Sciences	**Marine and Continental Hydrobiology**	***Aquaculture and Fish Farming***

الجمهورية الجزائرية الديمقراطية الشعبية

العلمـــي والبحـــث العالـــي وزارةالتعليـــم

مطابقة نموذج

تكوين عرض
ل. م . د

أكاديمية ليسانس

2018-2019

المؤسسة	الكلية/ المعهد	القسم
جامعة الجيلالي بونعامة	الطبيعة كليةعلوم والحياةوعلومالأرض	البيولوجيا

الميدان	الفرع	التخصص
علوم الطبيعة والحياة	هيدروبيولوجيا بحرية وقارية	تربية المائيات وتربيةالأسماك

CONTENTS

I – Bachelor's Degree Identity sheet

1 - Location of the course :

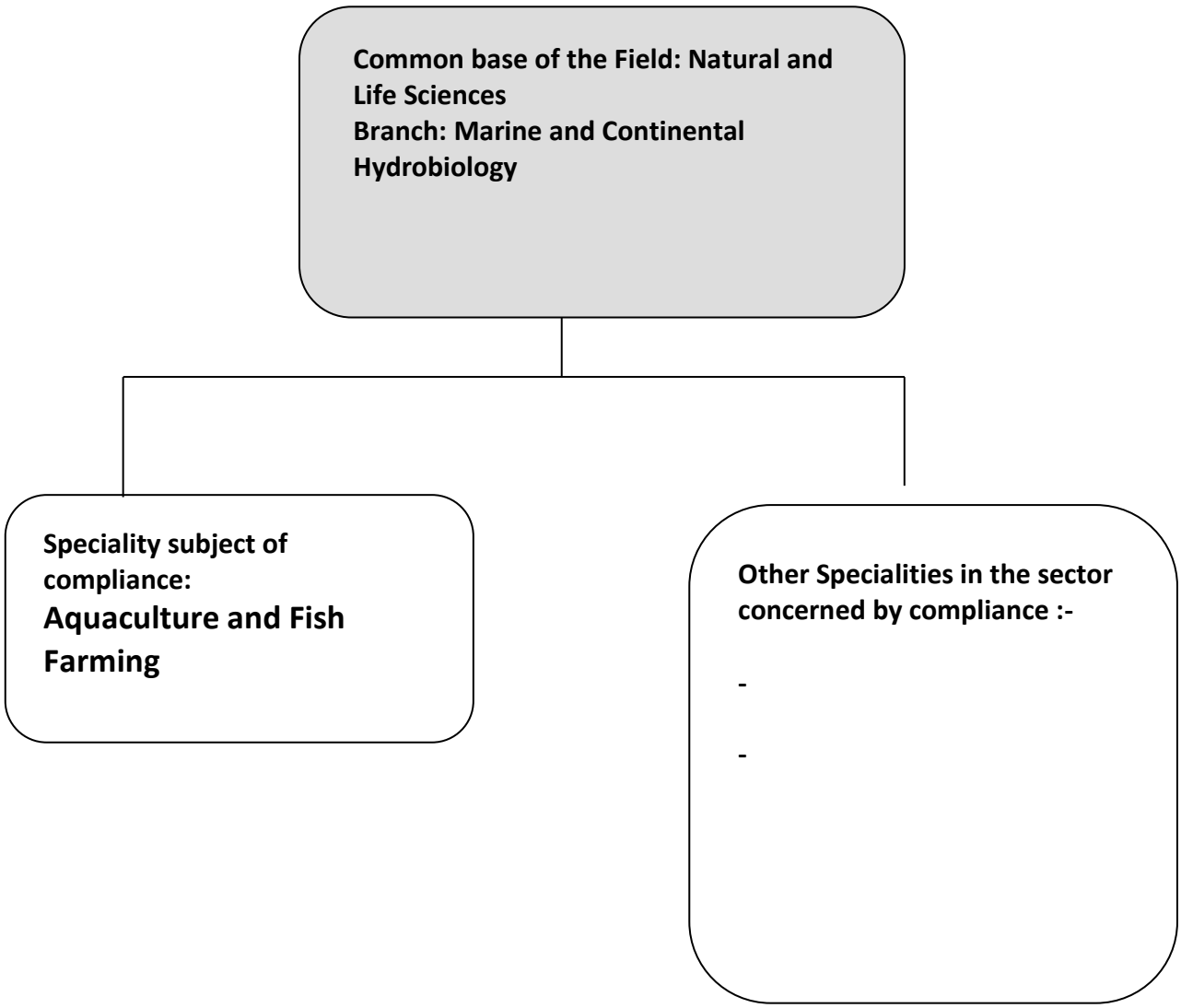
Faculty (or Institute) : Faculty of Natural and Life Sciences and Earth Sciences
Department : Biology

References of the decree of habilitation of the licence (join copy of the decree)
Order N°115 of 20 June 2007
2-External partners
- University Saad Dahlab of Blida
- University Hassiba Ben Bouali of Chlef
- École Nationale Supérieure des Sciences de la Mer et de l'Aménagement du littoral (ENSSMAL), Algiers
- École Nationale Supérieure de l'HydrauliqTU of Blida,
- Laboratory: Water, Rock and Plants of the Djilali Bounaama University, Khemis Miliana
- Ministry of Water Resources
- Ministry of Agriculture and Fisheries
- The National Agency for Hydraulic Resources (A.N.R.H.)
- The Directions and Subdivisions of Hydraulics (of Wilaya)
- The Directions of the Environment
- The National Agency for Dams (A.N.B.)
- The National Sanitation Office (O.N.A.)
- The Watershed Agency
- The Office of Irrigated Perimeters
- Private engineering firms
- The National Institute of Forestry Research (I.N.R.F.)
- National Centre for Research and Development of Fishing and Aquaculture of Bou-Ismail (CNRDPA)
- Directorate of Fisheries of the Wilaya of Ain Defla (DPRHW)
- **Companies and other socio-economic partners:**
- Pilot aquaculture farms
- Continental fishing concessionaires

3 - Context and objectives of the training

A - General organisation of the training: position of the project (Required field)

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



B - Objectives of the course

Training in aquaculture and fish farming aims to train managers in the fisheries and aquaculture sector, with a view to responsible fishing and sustainable aquaculture. Training for the start-up of this activity is essential. It addresses applications in very specific areas. Such as:

-Mastering the technical and economic management of a fish farming unit.
-The design and construction of a fish farm (ponds, basins, etc.)
-Mastery of the production cycles of farmed fish, knowledge of the stages of growth and reproduction.
-Mastery of fish feeding based on local resources.
-Management of a fish farm.
-Knowledge of the food requirements of each species and the principles of nutrition.
-Knowledge of the nutritional valTU of raw materials and their conditions of use.

C - Target profiles and skills:

He fisheries and aquaculture sector is now one of the important sectors of food production worldwide. It represents financial flows of the same order of magnitude as the meat production sector. Currently, an increasing share of fish production comes from various forms of farming using indoor environments. However, these different modes of production are confronted with competition or conflicts of use and real challenges: competition for space and resources, management of water resources and respect for the environment, quality and health of livestock, quality and safety of products, diversification and markets, regional planning and social development. It is therefore a multidisciplinary course that aims to provide the necessary foundations for understanding the functioning of aquatic ecosystems and resources and the dynamics of the farming system in all environments. Given the importance of the water resources offered by the region of Ain Defla with its six large capacity dams, it is important to evaluate the opportunity to develop aquaculture in this area, to identify the most appropriate breeding systems for the area, to contribute to the restructuring and to exploit the natural water resources. The exploitation of these natural resources, their conservation and the sustainability of ecosystems are now major issTUs that require the opening of this speciality.

D - Regional and national employability potential

Graduates are eligible for employment in both the public and private sectors:

- Design offices.
- Municipal and wilaya administrations.
- Managers of aquaculture production companies.
- Consultants of aquaculture companies.
- Aquatic ecosystem managers.
- Research sector
- Education and teaching

Students will have the opportunity to continTU their studies to prepare a professional or academic master.
The employer sectors are :

- The Wilaya Environment Directorates
- The Wilaya Fisheries Directorates
- The Hydraulic Subdivisions
- The Communes,
- The National Agency for Hydraulic Resources,
- The National Agency for Dams,
- The Watershed Agencies,
- Design offices,
- The construction companies,
- The Offices of Irrigated Perimeters
- Aquaculture farms.

E - Gateways to other specialities

Graduates of the academic degree will be able to continTU their training with an academic or professional Master's degree in the same field and other related fields such as marine fisheries, oceanography, biodiversity of aquatic environments and natural sciences, etc.

F - Expected performance indicators of the training

The aim of the system is to diversify the methods of assessment in order to evaluate the students' skills as widely as possible. In this context, the following will be assessed: (1) student empowerment; (2) regular monitoring of knowledge acquisition; (3) acquisition of oral expression; (4) acquisition of teamwork and synthesis skills; (5) assessment of student skills rather than knowledge.
The distribution between the different forms of assessment is as follows
Knowledge control: 40% Oral expression: 20%
Oral expression: 20%
Personal work: 20%
Analytical and synthetic skills: 20%

I - Semester organisation sheet for the speciality courses (S1 to S6)

(Including annexes to the common field and branch order)

Common Core of the Sciences of Nature and Life Field

First Semester

Teaching units	Matter		Credits	Coefficients	Hourly volume per week			VHS (15 weeks)	Other*	Evaluation method			
	Code	Title			Course	TD	TP			CC*		Review	
TU Fundamental Code : TUF 1.1 Credits : 18 Coefficients : 9	FTU 1.1.1	General and organic chemistry	6	3	1h30	1h30	1h30	67h30	82h30	x	40%	x	60%
	F TU 1.1.2	Cellular biology	8	4	1h30	1h30	3h00	90h00	110h00	x	40%	x	60%
	FTU 1.1.3	Mathematics Statistics	4	2	1h30	1h30	-	45h00	55h00	x	40%	x	60%
TU Methodology Code : TUM 1.1 Credits : 9 Coefficients: 5	M TU 1.1.1	Geology	5	3	1h30	1h30	1h00	60h00	65h00	x	40%	x	60%
	M TU 1.1.2	Communication and ExpressionTechniqTUs 1 (in French)	4	2	1h30	1h30	-	45h00	55h00	x	40%	x	60%
TU Discovery Code : TUD 1.1 Credits : 2 Coefficients : 2	D TU 1.1.1	Working Method andTerminology 1	2	2	1h30	1h30		45h00	5h00	x	40%	x	60%
Transversal TUCode : TUT 1.1 Credits : 1 Coefficients : 1	TTU 1.1.1	Universal History of BiologicalSciences	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 Controls.

Second Semester

Teaching units	Matter		Credits	Coefficients	Hourly volume perweek			VHS	Other*	Evaluation method			
	Code	Title			Course	TD	TP			CC *		Review	
T U Fundamenta le Code: TUF 2.1 Credits : 18 Coefficients : 9	FTU 2.1.1	Thermodynamics and solutionchemistry	6	3	1h30	1h30	1h30	67h30	82h30	x	40%	x	60%
	FTU 2.1.2	Plant Biology	6	3	1h30	-	3h00	67h30	82h30	x	40%	x	60%
	FTU 2.1.3	Animal Biology	6	3	1h30	-	3h00	67h30	82h30	x	40%	x	60%
T U Methodology Code : TUM 2.1 Credits : 9 Coefficients : 5	MTU 2.1.1	Physics	5	3	1h30	1h30	1h00	60h00	65h00	x	40%	x	60%
	MTU 2.1.2	Communication and ExpressionTechniqTUs 2 (in English)	4	2	1h30	1h30	-	45h00	55h00	x	40%	x	60%
T U Discovery Code : TUD 2.1 Credits : 2 Coefficients : 2	DTU 2.1.1	Life sciences and socio-economicimpacts	2	2	1h30	1h30	-	45h00	5h00	x	40%	x	60%
T U Transversal Code : TUT 2.1 Credits : 1 Coefficients : 1	TTU 2.1.1	Method of Work 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 Controls

Third Semester

Teaching unit	Matter	Credit	Coefficient	C	TD	PW	HV
Fundamental Unit	**Zoology**	4	2	1h30		1h30	45h00
	Limnology	2	1	1h30			22h30
	Biochemistry	6	3	3h00	1h30		67h30
	Genetics	6	3	3h00	1h30		67h30
Methodological unit	**Communication and Expression TechniqTUs (in English)**	4	2	1h30	1h30		45h00
	Biophysics	5	3	1h30	1h30	1h30	60h00
Discovery unit	**Environment and Sustainable Development**	2	2	1h30	1h30		45h00
Transversale Unit	**University Ethics and Deontology**	1	1	1h30			22h30

Fourth semester

Teaching unit	Matter	Credit	Coefficient	C	TD	PW	HV
Fundamental Unit	**Oceanology**	4	2	1h30	1h30	-	45h00
	Microbiology	8	4	3h30	1h30	1h30	90h00
	Botany	6	3	3h30	-	1h30	67h30
Methodological unit	**Plants Physiology**	4	2	1h30	-	1h30	45h00
	Biostatistics	5	3	1h30	1h30	1h30	60h00
Discovery unit	**General ecology**	2	2	1h30	1h30	-	45h00
Transversale Unit	**Computer science Tools**	1	1	1h30	-	-	22h30

Fifth semester

Teaching Unit Semestre 5	VHS	V.H weekly			Other *	Coeff.	Credits	Assessment method	
	15 week.	C	TD	TP/Trip				Continu (40%)	Exam (60%)
TUF 3.1.1 (O/P): Water environment Crédits=9 ; Coefficients= 3									
Matter 1: Ecology of marine and continental environments	67h30	3h00	-	1h30	82h30	**3**	**6**	X	X
Matter 2: Hydrogeology	45h00	1h30	-	1h30	55h00	**2**	**4**	X	X
TUF 3.1.2 (O/P): Biology and physiology of aquatic organisms Credits=9; Coefficients= 3									
Matter 1: Physiology of aquatic organisms	67h30	3h00	-	1h30	82h30	**3**	**6**	X	X
Matter 2: Biodiversity	22h30	1h30	-	-	27h30	**1**	**2**	X	X
TU methodological teaching unit									
TUM1 (O/P)									
Hydraulics	45h00	1h30	1h30	-	55h00	**2**	**4**	X	X
TUM2 (O/P)									
Hydrology	60h00	1h30	1h30	1h00	65h00	**3**	**5**	X	X
TU transversal teaching unit									
TUT1 Water treatment	22h30	1h30	-	-	2h30	1	1	x	x
TUT2 Endocrinology of fishes	22h30	1h30	-	-	2h30	1	1	x	x
TU discovery teaching unit									
Selection and Genetic Improvement	22h30	1h30	-	-	2h30	1	1	X	X
Total Semester 5	**375h00**	**16h30**	**3h00**	**5h30**	**375h00**	**20**	**30**		

Sixth Semester

Teaching Unit Semestre 6	VHS	V.H weekly			Others *	Coeff.	Crédits	Assessment method	
	15 week.	C	TD	TP/Sortie				Continu (40%)	Exam (60%)
TUF 3.2.1 (O/P) : Aquaculture Crédits=11 ; Coefficients= 4									
Matter 1: General Aquaculture	67h30	3h00	-	1h30	82h30	**3**	**6**	X	X
Matter 2: Fish farming	45h00	1h30	-	1h30	55h00	**2**	**4**	X	X
Matière 3: Processing technologies for aquaculture products	22h30	1h30	-	-	27h30	**1**	**2**	X	X
TUF 3.2.2 (O/P) : Aquaculture engineering and pathology of aquatic organisms Crédits=7; Coefficients= 2									
Matter 1: Aquaculture engineering	22h30	1h30	-	-	27h30	**1**	**2**	X	X
Matter 2: Pathology of aquatic organisms	45h00	1h30	-	1h30	55h00	**2**	**4**	X	X
TU methodological teaching unit									
TUM1 : Fisheries sciences	60h00	1h30	1h30	1h00	65h00	**3**	**5**	x	x
TUM2 : Agro-fertilisation and pond management	45h00	1h30	1h30	-	55h00	**2**	**4**	x	x
TU transversal teaching unit									
TUT1 Nutrition and food biotechnology	22h30	1h30	-	-	2h30	1	1	x	x
TUT2 : Toxicology	22h30	1h30	-	-	2h30	1	1	x	x
TU discovery teaching unit									
TUD1: Applied hydrobiology	22h30	1h30	-	-	2h30	1	1	X	X
Total Semester 6	**375h00**	**16h30**	**3h00**	**5h30**	**375h00**	**20**	**30**		

III - Detailed programme by matter for semesters

Semester: 1er Semester

TU: Fundamental Teaching Unit

Subject 1: General and Organic Chemistry

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

Recommended prerequisites: The student must master the basic notions of general and organic chemistry, namely the structure of the atom, atomic bonds and redox reactions.

Subject Content:

1. General chemistry

1.1. General

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 reaction

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

1.4.1. Group (Column), Period (Line)

1.4.2. Evolution of physical properties within the periodic table: atomic radius, ionization energy, electronic affinity....

1.5. Chemical bonding

1.5.1. Introduction: strong and weak links

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 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 reaction

Tutorial

Practical work N°1 : Fundamental notions of chemistry (atoms, molecules, gram atoms, moles, calculation of concentrations)

TP N°2 : Stability of the nucleus and radioactivity

TP N°3 : Electronic configuration and periodic classification of elements

TP N°4 : Chemical bonds

TP N°5 : Nomenclature and stereochemistry

TP N°6 : Reaction mechanisms

Practical work

TP N°1 : Principles of experimental chemistry

Objective: To assess the student's knowledge of the equipment used in chemistry experiments and the safety rules to be followed in the laboratory.

TP N°2 : Determination of the quantity of matter

Objective: To determine the quantity of matter (expressed in moles) contained in a sample and to prepare a sample containing a fixed quantity of matter **TP N°3**: Preparation of solutions by dissolution and by 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 diluting a solution of HCl of normality 1N.

TP N°4 : Measurement of the density of some....

Objective: We want to determine the density of a saturated salt water solution and to determine the density of iron.

TP N°5 : Research of functional groups

Objective : Identify the functional groups : Alcohols and carbonyls.

Evaluation method

Continuous assessment and semester exams

References

1. **JacqTUs Maddaluno , VéroniqTU Bellosta , Isabelle Chataigner , Françoi s Couty , et al., 2013.**

Chimie organiqTU. Ed. Dunod, Paris, 576 p.

2. **Jean -François Lambert , Thomas Georgelin , Maguy Jaber , 2014.** Mini manual ofInorganic chemistry. Ed. Dunod, Paris, 272 p.
3. **Elisabeth Bardez , 2014.** Mini ManTUl de Chimie générale : Chimie des Solutions. Ed. Dunod, Paris, 256 pp.
4. **Paula Yurkanis Bruice** , 2012. Organic chemistry. Ed. Pearson, 720 pp.
5. **Jean -Louis Migot , 2014.** Analytical organic chemistry. Ed. Hermann, 180 p.

Semester: 1er Semester

TU : Fundamental Teaching Unit

Subject 2: Cellular Biology

Teaching objectives

The objectives of this course are to introduce students to the living world at the cellular level, to acquire the basic notions of the cell, eukaryotic and prokaryotic, and to study the cellular constitTUnts. These objectives are reinforced by practical sessions in the laboratory.

Recommended Prerequisite Knowledge: The student should have knowledge of General Biology.

Subject Content:

1. **General**
   - 1.1. Classification and relative importance of the kingdoms
   - 1.2. Cell and cell theory
   - 1.3. Origin and evolution
   - 1.4. Cell types (Prokaryote, Eukaryote, Acaryote)
2. **Methods of study of the cell**
   - 2.1. Optical and electron 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. **Cellular 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**
14. **Extracellular matrix**

15. Plant wall

Tutorial / Practical work :

1. Methods of studying cells

1.1. Separation of cellular components

1.2. Observation of cellular constitTUnts

1.3. Identification of cellular constitTUnts

1.4. Plant wall

2. Cell cultures

3. Tests of physiological functions

3.1. Reconstruction of the function from the isolated components

3.2. Anatomical tests: autoradiography, fluorescence labeling, green fluorescentproteins .

3.3. Physiological tests: control of protein expression, mutation, Surexpression.

Evaluation method

Continuous assessment and semester exam

References

1. **B. Albert, A. Johnson, J . Lewis, M. Raff, K. Roberts, and P. Walter, 2011.** Molecular biology of the cell. Ed. Lavoisier, Paris, 1601p.
2. **Abraham L. Kierszenbaum , 2006.** Histology and cell biology: Ed De Boeck, 619p.
3. **Thomas Dean Pollard and William C. Earnshaw, 2004.** Cell Biology. Ed. Elsevier Masson, Paris, 853p.
4. **Marc Maillet , 2006.** Cellular biology. Ed. Elsevier Masson, Paris, 618p.

Semester: 1er Semester

TU : Fundamental Teaching Unit

Subject 3: Mathematics, Statistics

Teaching objectives : This subject allows the student t o integrate the statistical and computer tools in the biological field, and to use numerical analysis, probability and calculation by the computer tool.

Recommended Prerequisite Knowledge: The student should have knowledge of functions, integrals and random variables.

Subject Content:

1. Mathematical analysis

1.1. One-variable function, 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. Probability s

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. Settings 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, flatness,.....etc)

2.4. Distribution function and density function

Evaluation method

Continuous assessment and semester exam

References

1. **Jean Bouyer, 2000.** Statistical methods: medicine-biology. Ed. Estem.

2. **Gilles Stoltzand Vincent Rivoirard , 2012.** Mathematical statistics in action. Ed.Vuibert, Paris, 448p.

3. **Maurice Lethielleux , 2013.** Descriptive statistics. Ed. Dunod, Paris, 160p.

4. **Maurice Lethielleuxand Céline Chevalie r, 2013.** Probabilities: Statisticalestimation. Ed. Dunod, Paris, 160p.

Semester: 1er Semester

TU : Methodological Teaching Unit 1

Subject : Geology

Teaching Objectives: The subject allows students to see the constitTUnts and structure ofthe globe, the interactions between these constitTUnts, external and internal geodynamics.

Recommended prerequisites: No prerequisites

Subject Content:

1. General geology

1.1. Introduction

1.2. The 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. Flexible and brittle tectonics (folds and faults)

3.2. Volcanology

3.2.1. The volcanoes

3.2.2. Magmatic rocks

3.2.3. Study of magmas

3.3. Plate tectonics

Practical work

TP N°1 : Topography

TP N°2 : Geology (Sections)

TP N°3 : Rocks and minerals

Evaluation method

Continuous assessment and semester exam

References

1. **Jean Dercourt , 1999.** Geology: courses and exercises. Ed. Dunod, Paris,
2. **Denis Sorel and Pierre Vergely, 2010.** Initiation aux cartes et aux coupes géologiqTUs. Ed. Dunod, Paris, 115p.
3. **Jean Tricart , 1965.** Principles and methods of geomorphology. Ed. Masson, Paris, 496p.

Semester: 1er Semester

TU : Methodological Teaching Unit

Subject 2: Communication and Expression TechniqTUs 1 (French)

Teaching objectives : The objective of this subject is to understand and write scientific documents in French as well as to use and translate scientific terms.

Recommended prerequisites : No prerequisites

Subject Content:

1. Scientific Terminology
2. Study and comprehension of text
3. Written and oral expression techniqTUs (report, synthesis, use of modern communication means)
4. Expression and communication in a group. Study of proposed texts (observe, analyze,review, written expression)

Tutorial:

Suggested exercises related to the most important language points.

Evaluation method

Continuous assessment and semester exam

References

Scientific articles and dissertations

Semester: 1er Semester

TU : Discovery Teaching Unit

Subject: Working Method and Terminology 1

Teaching Objectives: To help students design methods ofresearch and synthesis ofwork according to scientific rules.

Prerequisite knowledge recommended: The student is expected to have some knowledge of bibliographic research.

Subject Content:

- Introduction to bibliographic research
- Writing of a scientific report
- Introduction to reading and understanding a scientific article

Evaluation method

Continuous assessment and semester exam

References: Books, handouts, websites, etc...

Semester: 1er Semester

TU : Transversal Teaching Unit

Subject: Universal history of biological sciences

Teaching objectives: This program should emphasize the history of biology, and the qTUstion of life across eras and civilizations. It should highlight the role of technical progress in the evolution of biology.

Recommended prerequisites: No prerequisites.

Subject Content:

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, Molecular Biology (DNA) Genetics
7. Twentieth century: gene therapy and cloning

Evaluation method
Semester exam
Reference

1. **Denis Buican, 2008.** Darwin in the history of biological thought. Ed. Ellipses, 232p.
2. **Christophe Ronsin, 2005**. History of molecular biology. Ed. De Boeck, 106p.
3. **Jean Théodoridès, 2000.** History of biology. Ed. Puf, 127p.

Semester: 2ème Semester

TU : Fundamental Teaching Unit

Subject 1: Thermodynamics and chemistry of mineral solutions

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

Recommended Prerequisites: The student should have some knowledge of redox reactions.

Subject Content:

1. **Chemical equilibrium**
   - **1.1. Acid-base balance**
     - 1.1.1. Definition according to : Arrhenius ; Bronsted ; lewis
     - 1.1.2. Equilibrium constant: of water dissociation, acidity and basicity

1.2.3. The pH: of water, of a strong monoacid, of a strong monobase, ...

1.2. Redox balance

1.2.1. Redox reaction: electron transfer

1.2.2. Oxidation number

1.2.3. Writing redox reactions

1.2.4. Electrochemical batteries

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 speed

2.3. Expression of the law of speed and order of a reaction

2.4. Factors inflTUncing the reaction rate

Thermodynamics

2.5. Systems and quantities thermodynamics Functions and thermodynamictransformations

2.6. First principle of thermodynamics

2.6.1. Expression of work and heat

2.6.2. Expression of internal energy and enthalpy

2.7. Second principle of thermodynamics

2.7.1. Expression of entropy

2.7.2. Expression of free energy and free enthalpy

2.8. Thermochemistry

2.8.1. Heat of reactions

2.8.2. Enthalpy of reactions

2.8.3. Calculation of the internal energy of a reaction

3.4.5. Kincgoff's law

3.4.6. Hess's law

2.9. Predicting the direction of reactions

2.9.1. Isolated systems

2.9.2. Calculation of the reaction entropies

2.9.3. Reactions at constant temperature

2.9.4. Calculation of the free enthalpy and free energy of a system.

3. Inorganic chemistry
Tutorial:

TP N°1 : Chemical kinetics

TP N°2 : Acid-base equilibrium and precipitation equilibrium

TP N°3 : Oxidation-reduction equilibrium

TP N°4 : Thermodynamics and thermochemistry

TP N°5 : Organic chemistry (Reaction mechanisms)

Practical work

TP N°1 : Chemical kinetics

Part 1: Experimental determination of the order of the reaction

Purpose: Determination of the order of the reaction with respect to sodium thiosulfate($Na_2S_2O_3$) using the initial rate method.

Part 2: InflTUnce of temperature on the reaction rate

Objective: Determination of reaction rates for the same concentration of reagents but for different temperatures.

TP N°2 : Titrimetric analysis method in acid-base. The acid-base neutralization-base

Part 1: Determination by colorimetry

Objective:

- Determination of a strong acid solution (HCl) by a strong base (NaOH).
- Determination of the concentration of a weak acid solution (CH_3COOH) by a strong base solution (NaOH).

Part 2: Determination by pH metry

Objective: Determination of a weak acid solution (CH_3COOH) by a strong base (NaOH).

TP N°3 : Titration by redox method. Manganimetric determination of Fe^{2+}

Objective:

- Determination of the normality of a given solution of $KMnO_4$
- Determination of the concentration of Fe^{2+} contained in a $FeSO_4$ solution.

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

Objective:

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

Evaluation method

Continuous assessment and semester exam

References

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.

Semester: 2ème Semester

TU : Fundamental Teaching Unit

Subject 2: General plant biology

Teaching Objectives: The objective of this subject is to teach students the fundamentalprinciples of plant tissTU organization and development.

Recommended Prerequisites: **T h e** student should have some knowledge of the differentparts of a plant**.**

Subject Content:

1. **Introduction to plant biology**
2. **Different types of fabrics**

2.1. Primary meristem (root and cell)

2.1.1. Primary tissTUs

2.1.2. Protective tissTUs (epidermis)

2.1.3. Filling tissTU (parenchyma)

2.1.4. Supporting tissTUs (collenchyma and sclerenchyma)

2.1.5. Conductive tissTUs (primary xylem, primary phloem)

2.1.6. Secretory tissTUs

2.2. Secondary (lateral) meristems (the cambium and the phellogen)

2.2.1. Secondary tissTUs

2.2.2. Conductive tissTUs (secondary xylem and secondary phloem)

2.2.3. Protective fabrics (suber or cork, phelloderm)

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 between mono- and dicotyledons

4. **Morphology of higher plants and adaptation**

4.1. Roots

4.2. Sheets

4.3. Stems

4.4. Flowers

4.5. Seeds

4.6. Fruits

5. Gametogenesis

5.1. Pollen grain

5.2. Ovum and embryo sac

6. Fertilization

6.1. Egg and embryo

6.2. Concept of development cycle

Practical work :

Practical exercise N°1 : Morphological study of Angiosperms (roots-stems-leaves-flowers) **Practical exercise N°2 :** Morphological study of Gymnosperms (roots- stems-leaves-flowers) **Practical exercise N°3 :** Primary meristems (root and stem)

TPN°4 : Covering tissTUs : epidermis - piliferous base - suberous base - suberoid

TP N°5 : Parenchyma (chlorophyll-reserve-air-aquiferous)

TP N°6 : Supporting tissTUs (collenchyma-sclerenchyma)

TP N°7 : Secretory tissTUs (hairs-glands-tannin cells-laticifers)

TP N°8 : Primary conductive tissTUs (phloem-xylem)

Evaluation method

Continuous assessment and semester exam

Reference

1. **Alain RaveneaT Ut al. 2014**. Plant biology. Ed. De Boeck, 733p.
2. **Jean François Morot -Gaudry et al. 2012.** Plant biology. Ed. Dunod, Paris, 213p.

Semester: 2ème Semester

TU : Fundamental Teaching Unit

Subject 3: General Animal Biology

Teaching aim : This module consists in making the students discover the particularities of the developmental biology of some animal species.

Recommended Prerequisites: No prerequisites.

Subject Content:

Part 1: Embryology

1. Introduction
2. Gametogenesis
3. Fertilization
4. Segmentation
5. Gastrulation

6. Neurulation: fate of the leaflets
7. Boundary: Bird Annexes
8. Particularities of human embryology (Cycle, nidation, evolution of appendages, placenta)

Part Two: Histology

1. Coating epithelia
2. Glandular epithelia
3. Connective tissTUs
4. Blood tissTUs
5. Cartilaginous tissTUs
6. Bone tissTU
7. Muscle tissTUs
8. Nerve tissTU

Titles TP -TD

N°1 : Gametogenesis

N°2 : Fertilization segmentation in sea urchins

N°3 : Gastrulation amphibians birds

N°4 : Exercises on gastrulation and neurulation

N°5 : Neurulation appendices birds

N°6 : Human embryology

Evaluation method

Continuous assessment and semester exam

References

Paul Richard W. Functional Histology

Semester: 2ème Semester

TU: Methodological Teaching Unit

Subject 1: Physics

Teaching Objectives: The objective of this teaching is to enable students to acquire knowledge related to the basic notions of physics that can be exploited in the SNV field.

Recommended prerequisites: Students should have a basic understanding of mathematicsand mechanics.

Subject Content:

1. Mathematical reminder

1.1. Physical quantities and dimensional analysis

1.2. Calculation of errors (different types of errors, calculation of uncertainties and significant figures).

2. Op tics

2.1.1. Introduction (objective of the optics)

2.1.2. Nature of light (spectrum of electromagnetic waves, photons, waves...)

2.2. Geometric optics

2.2.1. Principles of geometrical optics and light propagation.

2.2.2. Refraction (Snell-Descarte's laws, limit angle and total reflection)

2.2.2.1. Planar 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 (convergent, divergent), conjugation formula, magnification, association of two thin lenses and geometric construction (image construction).

2.2.3. Reflection

2.2.3.1. Flat mirror (image construction)

2.2.3.2 Spherical mirror (image construction, conjugation formula)

2.2.4. Optical instruments

2.2.4.1. The Eye

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 o f hydrostatics, b u o y a n c y , float)

3.3. Hydrodynamics (eddy, continuity equation, Bernoulli's theorem)

4. Notion of crystallography

5. Notions of spectral analysis:

TD N°1. Exercises o n dimensional analysis and error calculation. **TD N° 2.** Exercises on light propagation, plane diopters and prism **TD N° 3.** Exercises on spherical diopters and thin lenses.
TD N° 4. Exercises on plane and spherical mirrors and the reduced eye. **TD N° 5.** Exercises on Pascal's law and Archimedes' thrust (Hydrostatics) **TD N° 6.** Exercises on Bernoulli's law (hydrodynamics)

Evaluation method

Continuous assessment (presentation + test) and semester exam.

References

1. **Christophe Texier, 2015.** Quantum mechanics. Ed. Dunod, Paris.
2. **Eugene Hecht, 1998.** Physics. De Boeck, 1304p.
3. **Michel Blay, 2015.** OptiqTU. Ed. Dunod, Paris, 452p.

Semester: 2ème Semester

TU : Methodological Teaching Unit

Subject 2: Communication and Expression TechniqTUs 2 (English)

Objectives of teaching: This subject completes the learning of this subject completes the learningof understanding and writing scientific documents in English.

Recommended Prerequisites: No prerequisites.

Subject Content:

1. Scientific Terminology
2. Study and comprehension of text
3. Written and oral expression t e c h n i q T Us (report, synthesis, use of modern communication means)
4. Expression and communication in a group. Study of proposed texts (observe, analyze,review, written expression)

Tutorial :

Suggested exercises related to the most important language points.

Evaluation method

Continuous assessment and semester exam

References

Scientific articles

Semester: 2ème Semester

TU : Discovery Teaching Unit

Subject: Life Sciences and Socio-Economic Impacts

Teaching Objectives: To help students conceive of occupations directly or indirectly relatedto the various specialties of the natural and life sciences.

Recommended Prerequisites: No prerequisites.

Subject Content:

1. Animal and plant production (breeding, processing, production...)
2. Toxicology and environmental health (effect of pollutants on plant and animal life andon human health)
3. Biology and health (talk about the interest of biology in the diagnosis of animal andplant diseases),
4. Biotechnology and molecules of interest (Pharmaceutical and food industry),
5. Biology and Forensics
6. Terrestrial and marine ecosystems (park management, etc.)
7. Technical-commercial biology (e.g. sales representative).

Evaluation method

Continuous assessment and semester exam

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

Semester: 2er Semester

TU: Transversal Teaching Unit

Subject: Working methods and terminology 2

Teaching Objectives: To help students design methods ofresearch and synthesis ofwork according to scientific rules.

Prerequisite knowledge recommended: The student is expected to have someknowledge of bibliographic research.

Subject Content:

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

Evaluation method

Semi-annual review

References

Scientific articles

Semester: Three

TU: Fundamental Teaching Unit 1

Subject 1: Zoology

Teaching objectives

Know the main groups of living organisms on the plans: General Architecture, Characteristics (Systematics, Morphology, Anatomy, Reproduction, Ecology), Constraints, Adaptations, and Evolution. Particular importance will be given to updating the classification and to zoological groups with an agricultural, medical, veterinary, fisheries or environmental interest.

Prior knowledge recommended

The student must have an idea about the different classes of the animal kingdom.

Content of the subject

1. Presentation of the animal kingdom

1.1. Basics of classification
1.2. Zoological nomenclature
1.3. Evolution and phylogeny
1.4. Numerical importance of the Animal Kingdom

Subkingdom Protozoa

1.5. General information on protozoa.
1.6. Classification
    1.6.1. Phylum Sarcomastigophora
    1.6.2. Phylum Ciliophora
    1.6.3. Phylum Apicomplexa
    1.6.4. Phylum Cnidosproridia

Subkingdom Metazoa

1.7. Phylum sponges
1.8. Phylum Cnidaria
3.3. Ctenary phylum
3.4. Phylum Platyhelminthes
3.5. Phylum Nemathelminths
3.6. Phylum Annelids
3.7. Phylum Molluscs
3.8. Phylum Arthropoda
3.9. Phylum Echinodermata
3.10. Phylum Chordates

Practical work (PW)

PW N°1: Study of some typical species of Protozoa: *Trypanosomarhodesiense, Leishmania major, Leishmania infantum, Trypanosoma gambiense, Entamoeba histolytica, Paramecium sp.*

PW N°2: Study of some typical flatworm species: *Moniezia expansa, Taenia hydatigena, Taenia pisiformis, Fasciola hepatica.*

PW N°3: Study of some typical Annelid species: *Lumbricus terrestris , Hirudo officinalis.*

PW N°4: Study of some typical species of Arthropods: Crustaceans (Royal shrimp, Squill, morphology and biramous appendages), Chelicerates (Scorpion), Insects (Cricket, Bee).

PW N°5: Study of the mouthparts of insects: The different mouthparts and adaptation to diets, mouthparts of the crusher type (Orthoptera, Locust).

PW N°6: Study of some typical species of Echinoderms: Echinids (Sea urchin), Asterids (Starfish).

PW N°7: Study of some typical species of Vertebrates: Fish (Carp), Birds

(Pigeon), Mammals (Rat, Mouse)

References

1. ARAB A., CHERBI M., KHERBOUCHE-ABROUS O., Amine F., BIDI AKLI S., HADDOU SANOUN G., 2013: Zoology Volume 1. Polycopie , Works and University Publications. Algeria. 152p.

2. ARAB A., CHERBI M., KHERBOUCHE-ABROUS O., Amine F., BIDI AKLI S., HADDOU SANOUN G., 2013: Zoology Volume 2: Practical work. Handout, Works and University Publications. Algeria. 224p.

3. DJEZZAR M., 2013 : Les protistes. Polycopie de cours, Université Djilali Bounaama de Khemis- Miliana, Algérie. 37 P. https://p7.storage.canalblog.com/73/62/919911/125547999.pdf

4. Milne-Edwards, H. (1851). *Introduction à la zoologie générale, ou, Considérations sur les tendances de la nature dans la constitution du règne animal: Première partie*. Masson.

Semester: Three
TU: Fundamental Teaching Unit 1
Subject 2: Limnology

Teaching objectives
The aim of the course is to present the biophysical environment of continental waters by describing the physical and biological elements of aquatic ecosystems and by defining the interactions between the different components of these ecosystems, the processes that control the development of communities.

Prior knowledge recommended.

No prerequisites

Content of the subject

I. INTRODUCTION

1.1. The lakes and their basin

1.2. Typology of hydrosystems

1.3. Origin of lakes

II. PHYSICAL AND CHEMICAL LIMNOLOGY

2.1. Physical limnology

- Climatic factors
- Currentology
- large bodies of water

2.2. Chemical limnology

- chemical nature of water
- Abiotic factors (O_2, pH,..)

III. BIOLOGICAL LIMNOLOGY

3.1. The main microbial groups (prokaryotes – fungi, etc.)

3.2. The main floristic groups (macrophytes - microphytes - Role of coastal macrophytes in the functioning of lake ecosystems)

3.3. The main faunal groups (Invertebrates (Zooplankton, zoobenthos) – Vertebrates (reptiles, birds and amphibians)

IV. NOTIONS OF PALEO LIMNOLOGY

V. POPULATION GROWTH AND DYNAMICS

5.1. Growth and dynamics of algal populations

5.2. Growth and population dynamics of planktonic invertebrates

5.3. Benthic invertebrate population growth and dynamics

5.4. Growth and population dynamics of fish populations

Method of evaluation.

Semester review

References .

1. R. POURRIOT AND M. MEYBECK. 1995. General Limnology. Ecology Collection 25. *Masson. Paris, Milan, Barcelona.* 956p.
2. LIMNOL OGY. Lake and River Ecosystems. 2001. RG WETZEL. Academic Press. *Third edition* .
3. E. ANGELIER. 2000. Running water ecology. TechniqTUs and documentation.
4. C. BRÖNMARK AND LA. HANSSON. 2001. The biology of lakes and ponds. Biology of habitats. *Oxford University Press.*
5. W. LAMPERT AND U. SOMMER. 1997. Limnoecology. The ecology of lakes and streams. *Oxford University Press* .
6. J. KALFF. 2002. Limnology. Prentice Hall.
7. S. BOURGET. 2011. Limnology and phosphorus load of a drinking water reservoir subject to cyanobacterial blooms: lake saint-charles, qTUbec. Thesis in SC. *University Laval QTUbec* .159p.

Semester: Three
TU: Fundamental Teaching Unit 2
Subject 1: Biochemistry

Teaching objectives
This subject consists of teaching the fundamental bases of biochemistry and the notions of enzymology, and familiarizing students with biochemical techniqTUs.
Recommended prior knowledge (brief description of the knowledge required to be able 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 links
1.2. Weak bonds
2. Structure and physico-chemical properties of carbohydrates
2.1. simpledares
2.2. Oligosides
2.3. Polysaccharides, heterosides.
3. Structure and physico-chemical properties of lipids
3.1. Simple lipids
3.2. Complexlipids
4. Structure and physico-chemical properties of amino acids, peptides and proteins
4.1. Aminoacids, peptides, proteins
4.2. Structure (primary and secondary, tertiary and quaternary)
4.3. Properties and effect of treatments (solubility, electrophoretic behavior, denaturation.)
4.4. Protein separation
5. Notions of enzymology
5.1. Definition, classification
5.2. Mechanisms of action
5.3. Active website
5.4. Enzyme kinetics and types of representation
5.5. Enzymatic inhibition
5.6. Allosteryphenomenon
6. Notions of bioenergetics
6.1. Types of chemical reaction
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)
7.2. Anabolism (gluconeogenesis and glycogenesis)
7.3. Regu
8. Lipid metabolism
8.1. Catabolism of fatty acids (Beta-oxidation)
8.2. Sterol catabolism
8.3. Biosyntheses 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 carboxylic groups
9.3. Side chain catabolism
9.4. Glucoforming and ketogenic acids
9.5. Biosynthesis of essential amino acids
9.6. Nitrogen removal, 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

Continuous control and semi-annual review

Semester : Three
TU: Fundamental Teaching Unit 2
Subject 2: Genetics

Teaching objectives

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

Prior knowledge recommended.

The student must 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. Chromosome organization
2. **Transmission of genetic traits in eukaryotes**
3. **Haploid Genetics**
   - 3.1. independent genes
   - 3.2. Related genes
   - 3.3. Establishment of genetic maps
4. **Genetics of diploids**
   - 4.1. independent genes
   - 4.2. Related genes
   - 4.3. Establishment of genetic maps
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. **Gene 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. **Concept of population genetics**

Tutorials:
Tutorial N°1: Genetic material
Tutorial N°2: Transmission of characters
Tutorial N°3: Mono and di hybridism (Special cases)
Tutorial N°3: Linked genes
Tutorial N°4: Genetic maps
Tutorial N°5: Synthesis of proteins (Genetic code)
Tutorial N°6: Fine structure of the gene (intragenic recombination)
Tutorial N°7: Conjugation and factorial map
Tutorial N°8: Population genetics
Tutorial N°9: DNA extraction
Tutorial N°10: DNA assay
Tutorial N°11: BARR corpuscle

Assessment method
Continuous control and semi-annual review

References
1- Pasternak JJ, 2003- Human Molecular Genetics. Ed. De Boek, 522 p.
2- Harry M., 2008- Molecular and evolutionary genetics. Ed. Maloine.
3- Watson J., Baker T., Bell S., Gann A., Levine M. and Losick R., 2010 - Molecular biology of the gene. Ed. Pearson.
5. **Henry JP and Gouyon PH,** 2003- Summary of Population Genetics. Ed. Dunod.

Semester : Three
TU: Methodological Teaching Unit 1
Subject: Communication and Expression TechniqTUs.

Teaching objectives .
Learn and apply research methods and the collection of useful and essential information for the synthesis and the written form (report, oral, defense).
Application of English grammar in a scientific context.

Prior knowledge recommended.

Certain notions of terminology and research methodology acquired in B1.

Content of the subject

1. Study of proposed texts (observe, analyze, take stock, written expression)
2. Terminology
3. Bibliographic research methodology.
4. Methods of writing scientific reports.

Assessment method

Continuous control and semi-annual review

References.
Research article.

.

Semester: Three
TU: Methodological Teaching Unit 2
Subject: Biophysics
Teaching objectives
The general objective of the teaching of the biophysics course is to allow SNV students to acquire the basics in physics.

Prior knowledge recommended.

Content of the subject
I. The states of matter
I.1. Gases: elements of kinetic theory, equation of state of ideal 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, deformable polymers
General information on aqTUous solutions
I.5. Study of solutions: classification of solutions
I.6. Concentrations: molar fraction, molarity, molality, concentration by weight, osmolarity, equivalent concentration.

I.7. Solubility
I.8. Electrolyte solutions: electrical conductivity, physical and chemical properties of electrolytes

II. Surface phenomenon

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

III. Diffusion phenomenon

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

IV. Viscosity study

IV.1. Laminar and turbulent flow
IV.2. Viscous resistance and viscosity measurements
IV.3. Sedimentation

V. Sound and ultrasonic waves

V.1. The sound wave and its properties: production, nature and classification of sound waves.
V.2. The Doppler effect: definition, measurements and biological applications. VI.3. Ultrasound: definition, measurements and biological applications.

Practical work:

Practical work N°1: Surface tension
Practical work N°2: Conductometric Practical work N°3: Titration by pH
Practical work N°4: Viscosity
Practical work N°5: Spectrophotometer
Practical work N°6: Refractometer

Assessment method

Continuous checks (presentation + test) and Semester examination.

References.

- F. Grémy and J. Perin. Elements of Biophysics. Volume 1 and 2. Flammarion. Paris.
- C. Bénézech and J. Llory. Physics and Biophysics. Mason and Co. Paris, 1973.
- Y.THOMAS, 2000, Biophysics for the use of students in biological sciences, Bréal, Paris.
- A. Bertrand, D. Ducassou and JC. Healy. Biophysics. Medical use of radiation – Vision – Hearing.

Semester: Three
TU: Discovery Teaching Unit
Subject: Environment and sustainable development

Teaching objectives
This teaching aims to make students aware of the issTUs, content and actions of sustainable development. It is a qTUstion of making 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 his university education, whatever his specialty and his ambition for his future professional orientations, the student will have the opportunity to learn and experience his knowledge of sustainable development.
Sustainable development is currently one of the responses that is emerging worldwide, to face the current conjunction of the world's major ecological, economic and societal challenges.

Prior knowledge recommended.
No prerequisites

Content of the subject.
Definitions: Environment, components of an environment, Sustainable development.
Meaning of development?
1.1. The main dimensions of the environmental crisis: human demography, global warming, fossil fTUls (non-renewable), depletion of natural resources, drinking water, biodiversity and agriculture
1.2. Durable development, why?
1.3. The Concept of Sustainable Development
1.4. The domains of sustainable development
1.5. SD principles and their origins: precaution, prevention, responsibility, solidarity, equity, polluter pays
1.6. Some indicators of sustainable development **:** ecological footprint and biocapacity, impact on the environment, environmental performance index, human development index, GDP: gross inferior product (economic) and enrollment rate boys / girls (societal), accessibility to care (societal).
1.7. Environmental education, Awareness and nature animation, environmental communication,

Program for personal work
1- Find examples in the press (international and national) illustrating the principles 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- Illustrate the polluter pays principle by taking an example of a polluting company in Algeria taking into account national legislation.
5- Give examples of the implementation of preservation, conservation or restoration of environments

Assessment method
Continuous control and semi-annual review

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

Semester: Three
TU: Transversal Teaching Unit
Subject: Ethics and University Deontology

Teaching objectives
The general objective of this course is to enable SNV students to acquire the resources of deontology and professional ethics.

Prior knowledge recommended.

Content of the subject
1. INTRODUCTION: Contexts of the Algerian university
2. CONCEPTS
2.1 Moral
2.2 Ethics
2.3 Deontology
2.4 Right
2.5 Professional valTUs
2.6 Learning and teaching
2.7 Didactics and pedagogy
3. THE CHARTER OF ETHICS AND UNIVERSITY DEONTOLOGY
3.1 Fundamental principles
3.2 Rights
3.3 Obligations and duties
4. APPLICATIONS
4.1 Teaching: courses, evaluation of knowledge and behavior
4.2 Scientific research: research methodology, plagiarism, copyright, scientific writing
Assessment method
Semester review

References

- Bergadaà, M., Dell'Ambrogio, P., FalqTUt, G., Mc Adam, D., Peraya, D., & Scariati, R. (2008). The ethics-plagiarism relationship in the realization of personal work by students.
- Charter of ethics and university deontology, Algiers, May 2010 www.mesrs.dz
- Gilbert Tsafak , Ethics and deontology of education *Collection Sciences de education* University Press of Africa, 1998
- Gohier, C., & Jeffrey, D. (2005). *Teaching and training in ethics* . Laval University Press.
- Jaunait, A. (2010). Ethics, morals and deontology. *Pocket-Space Ethics* , 107-120.

Semester : 4th
TU: Fundamental Teaching Unit 1
Subject: Oceanology

Teaching objectives
Students will have acquired sufficient knowledge of the marine environment, its resources, techniqTUs for studying and exploiting this environment, pollution problems, as well as appropriate intervention methods.

Prior knowledge recommended. *No prerequisites*

Content of the subject

- INTRODUCTION TO KNOWLEDGE OF THE OCEAN

1.1 Geography of the oceans

- The Atlantic
- The pacific
- The Indian Ocean

1.2 Nature and geodynamic elements of the seabed

- Distribution of ocean floors (shelf, slope, abyssal plains)
- Mid-ocean ridges
- Underwater eruptions
- The relative movements of the continents (Wegener)

1.3 marine waters

- Distribution of water on the planet
  - In the oceans
  - In the ice (Greenland, Antarctica)
  - In the continents (aquifers, lakes, rivers
  - In the air
- The composition of sea water
- The circulation of sea water

1.4 The resources of the ocean

- living resources
- Non-living resources

2 - THE MEDITERRANEAN SEA

- Geographical framework: dimensions, configuration, basins,...
- Geological elements and main tectonic effects - Closed sea
  - Reduced watersheds
  - Relative depth of the Mediterranean basin
  - Island aspects
  - Volcanic and seismic activities
  - Damping of tidal regimes
  - Specific wind regime (mistral, sirocco)
  - Water balance
- Human pressure and economic activities
  - Population growth and distribution
  - Economic activities and coastal development (industry, agriculture, tourism, maritime traffic, etc. - Impacts on the environment and resources

3 - THE ALGERIAN COAST

- Coastal regional morphology
- The major watersheds
- The waters of the Algerian basin (Atlantic inflTUnce)
- The distribution of the coastal population

Tutorials :

Tutorial N°1: Exercises on the physical aspect of seawater.

Tutorial N°2: Slide projection session (the geography of the oceans, and the distribution of water on the planet).

Assessment method

Continuous control and semi-annual review

References.

-Serge Lepage. 2014. Discovering the Oceans. *Multiworlds* . 156p
-Michel Olagnon, Janette Kerr. 2015. Curious Anatomy of RogTU Waves. *Quae*. 176p
-Philippe Clabaut, Claude Augris. 2014. The coastal seabed of Corsica. Biomorphose dimentary mapping. *Quae*.
-Patrick Geistdoerfer. 2002. General Oceanography. *InfoMer*.

Semester: 4th Semester
TU : Fundamental Teaching Unit 2
Subject 1: Microbiology

Teaching objective

The student must acquire the notions of the microbial world, the techniqTUs used to observe microorganisms, bacterial growth and classification.

Recommended prior knowledge. The student must have a global notion of pathogens.

Content of the subject

1. The Microbial World

- 1.1. Historical
- 1.2. Place of microorganisms in the living world
- 1.3. General characteristics of the prokaryotic cell
- 2. The Bacterial Cell
- 2.1. Bacterial Cell Observation TechniqTUs
- 2.2. Cell morphology

2.3. Wall

- 2.3.1. chemical composition
- 2.3.2. Molecular structure
- 2.3.3. Functions
- 2.3.4. Gram-stain

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. Reserve substances

2.6. The chromosome

- 2.6.1. Morphology
- 2.6.2. Composition
- 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. highlighting
- 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. Sprouting3.

3. Bacterial classification

- 3.1. Phenetic classification
- 3.2. Phylogenic classification
- 3.3. Bergey 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. Growth measurement
- 5.2. Growth Parameters
- 5.3. Growth curve (batch culture)
- 5.4. Bacterial culture
- 5.5. Antimicrobial agents.

6. Notions of mycology and virology

- 6.1. Mycology (yeast and mold)
- 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 viruses

- **Practical work :**

Practical work N°1: Introduction to the microbiology laboratory
Practical work N°2: Method for studying micro-organisms and the different sterilization processes
Practical work N°3: Sowing methods;

- Practical work N°4: Microscopic study of bacteria, simple staining
- Practical work N°5: Morphological study of the different bacterial colonies on culture medium

- Practical work N°6: Coloring of gram
- Practical work N°7: Culture media
- Practical work N°8: Study of bacterial growth
- Practical work N°9: Criteria for the biochemical identification of bacteria
- Practical work N°10: Yeasts and cyanobacteria
- Practical work N°11: Growth inhibitors, antibiogram
- Practical work N°12: Isolation of the total and specific flora of certain products (water, milk, etc.).
-
- **Evaluation method**
- Continuous control and semi-annual review

Semester : 4th
TU: Fundamental Teaching Unit 2
Material 2: BOTANICAL

Educational objectives of the course
This subject aims to initiate the classification and anatomical characterization of the major groups of the plant kingdom. The teaching provided also attempts to provide students with the means of reproduction.

Prior knowledge recommended
The student must have knowledge of plant biology (morphology, anatomy, physiology).

Content of the subject
Introduction to Botany
- Definitions, notions and classification criteria. Systematics of the major groups of the "plant" kingdom

FIRST PART: Algae and Fungi
1. The seaweeds
1.1. Prokaryotic Algae (Cyanophytes / Cyanobacteria)
1.2. Eukaryotic Algae
1.2.1. Morphology
1.2.2. Cytology
1.2.3. Reproduction (concept of gamy, development cycle)
1.3. Systematics and particularities of the main groups
1.3.1. Glaucophyta
1.3.2. The Rhodophyta
1.3.3. Chlorophya and Streptophyta
1.3.4. The Haptophyta, Ochrophyta, Dinophyta, Euglenozoa, Crytophyta, Cercozoa
2. fungi and lichens

2.1. Problems posed by the classification of fungi
2.2. Structure of the thalli (mycelia, stroma, sclerotia)
2.3. Reproduction
2.4. Systematics and peculiarities of the main groups of fungi
2.4.1. Myxomycota
2.4.2. The Oomycota
2.4.3. Eumycota (Chrytridiomycota, Zygomycota, Glomeromycota, Ascomycota, Basidiomycota)
2.5. A particular algae-fungus association: lichens
2.5.1. Morphology
2.5.2. Anatomy
2.5.3. Reproduction

PART TWO: The Embryophytes

1. Bryophytes: Morphology and reproduction of the different branches
- **1.1.** Marchantiophytes
- **1.2.** Hookworms
- **1.3.** Bryophytes *s. str.*

2. Pteridophytes: Morphology and reproduction of the different branches
- **2.1.** Lycophytes
- **2.2.** Sphenophytes (= equisetinated)
- **2.3.** Filicophytes

3. Gymnosperms sensu lato
- **3.1.** The Cycadophytes: concept of ovule
- **3.2.** Ginkgophytes
- **3.3.** Coniferophytes: concept of flower, inflorescence and seed
- **3.4.** The Gnetophytes: hinge group

4. Angiosperms
- **4.1.** Vegetative apparatus and concept 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.** Notion of modern systematics, cladogenesis and main taxa. Presentation of classifications (Engler 1924, APG II)

Practical work (3 weekly):

PW N° 1. Algae (Phycophytes)
Morphology and reproduction of some species like *Ulva lactuca* and *Cystoseirameditерranea.*

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 No. 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: Monocotyledonous and Eudicotyledonous Angiosperms .

Illustration of the concept of trimery and pentamery, the concept of actinomorphy and zygomorphy; dialypetaly, gamopetally, hypogynous flower, epigynous flower... .

PW N°8. Floral morphology of Monocotyledonous Angiosperms on examples such as *Asphodelus* (or *Allium)*

PW N°9. Floral morphology of **Eudicotyledonous Angiosperms** on examples such as *Lathyrus* or *Vicia*

PW N°10. Sexual reproduction in angiosperms

Pollen grain, pollination and fertilization in angiosperms Fruit types and seed types.

Assessment method

Continuous control and semi-annual review

References.

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.
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. and Le Guyader H. 2001. Phylogenetic classification of living organisms. Ed. Belin.
4. Reviers de B. 2002 **.** Biology and Phylogeny of Algae. Volume 1 and 2. Ed. Belin.
5. Meyer S, Reeb C and Bosdeveix R 2004 **.** Botany: Plant Biology and Physiology. Ed. Maloine.
6. Dupont F., Guignard JL 2012. Botany Plant families. Ed. Elsevier-Masson.

Semester: 4th
TU: Methodological Teaching Unit 1
Subject: Plant Physiology

Teaching objectives
This subject allows students to have general notions on plant systematics (interest of classification in botany, notions of species and identification, evolution and classification of the plant kingdom), and to sharpen the sense of observation: one of the essential bases of the biologist's approach.

Prior knowledge recommended.

The student must master concepts in Botany and Plant Physiology.

Content of the subject

Part 1 Nutrition

1. Reminder of the basic concepts
1.1. Organization of a plant
1.2. Organization of a plant cell
2. Water nutrition (mechanism of water absorption and transit)
3. Perspiration and water balance
3.1. Highlighting
3.2. Location and measurement
3.3. Change in perspiration
3.3.1. inflTUnce of plant morphology
3.3.2. inflTUnce of environmental factors
3.4. Physiological determinism of perspiration
3.5. The water balance of plants
3.6. Interest of transpiration for plants
4. Mineral nutrition (macro and trace elements) 5. Nitrogen nutrition (nitrogen cycle, transport and assimilation of nitrates) 6. Carbon nutrition (Photosynthesis)

Part 2: Development

Seed formation- Germination –Growth- Bloom -Fruiting

Practical work

Water nutrition
Practical work N°1: Osmolarity (spectrophotometry)
PW N°2: Sweating
PW N°3: Stomata
Mineral nutrition
PW N°4: Growth of broad bean seedlings in different nutrient solutions
Nitrogen nutrition
PW N°5: Electrophoresis of total proteins
PW N°6: Breathing
Practical work N°7: Separation of pigments by chromatography
Growth
PW N°8: Growth of seedlings in different solutions
PW N°9: Tropisms

PW N°10: Seed germination

Assessment method
Continuous control and semi-annual review

References
Béraud J., 2001- The biological analysis technician. Theoretical and practical guide. Ed. Tec and Doc, Paris, 208p.
Dupont G., Zonszain F. and Audigié C., 1999- Principles of biochemical analysis methods. Ed. Doin, Paris, 207p.
Burgot G., Burgot JL, 2002- Instrumental methods of chemical analysis and applications: Chromatographic methods, electrophoresis and spectral methods. Ed. Tec and Doc, Paris, 306p. **4- Heller R., Esnault R. and Lance C., 2005-** Plant Physiology: Volume 1, Nutrition. Ed. Dunod,
Paris, 209p.
5- Morot-Gaudry JF, Moreau F. and Prat R., 2009- Plant biology: Nutrition and metabolism.
Ed. Dunod, Paris, 224p.

Semester : 4th
TU: Methodological Teaching Unit 2
Subject: Bio Statistics

Teaching objective

The objective of this teaching is to provide certain methodological tools classically used to describe and test biological phenomena.

Prior knowledge recommended.

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. Position parameters
        - 1.1.2. Dispersion Parameters
        - 1.1.3. Shape Parameters
2. **Reminders of the main distribution laws:** laws: normal and log normal, Student, Pearson, Fischer-Snedecor…
3. **Statistical Inference: Hypothesis Testing**
    - 3.1. Compliance testing
    - 3.2. Comparison test
    - 3.3. Independence test
4. **Correlation study and Regression**
    - 4.1. Correlation coefficient
    - 4.2. Correlation significance test
    - 4.3. Simple linear regression
        - 4.3.1. Regression line (least squares method)
        - 4.3.2. Confidence interval of regression estimate
        - 4.3.3. Significance test of the regression coefficients

5. One-way and two-way analysis of variance

The use of software such as Statistica or SAS as practical work for each chapter which will be covered in detail in the third year.

Tutorials :

Series of exercises on each chapter of the course

Assessment method

Continuous control and semi-annual review

References .

1. BENZEON JP, 1984- Data analysis. Ed. Bordas, Volumes I and II.
2. HTUT S., JOLIVET E. and MESSEON A., 1992- Nonlinear regression: methods and applications in biology. Ed. INRA.
3. TROUDE C., LENOUR R. and PASSOUANT M., 1993- Statistical methods under Lisa - multivariate statistics. CIRAD-SAR, Paris, PP: 69-160.

Semester : 4th
TU: Discovery Teaching Unit
Subject: General Ecology

Teaching objective

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

Prior knowledge recommended.

No prerequisites

Content of Matter

Chapter I

1.1. Definition of the ecosystem and its constitTUnts (Notions of biocenosis and ecological factor.)
1.2. Areas of intervention

Chapter II: Environmental Factors

2.1. Abiotic factors
2.1. Climatic
2.2. Edaphic
2.3. Waterborne
2.2. Biotic factors
2.2.1. Competitions
2.2.2. Pests and Predators
2.2.3. Cooperation and symbiosis interaction
2.2.4. Parasitism
2.3. Interaction of environments and living beings
2.3.1. Role of ecological factors in population regulation
2.3.2. Concept of ecological optimum
2.3.3. Ecological Valencia
2.3.4. Ecological niche.

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. The consumers (Heterotrophs) who are linked to the producers and finally the decomposers who ensure the recycling and the mineralization of the organic matter.

Chapter IV: Functioning of ecosystems

4.1. Energy flow at the biosphere level:
4.2. Notions of ecological pyramids, bioenergy production, productivity and yield
4.3. Circulation of matter in ecosystems and main bio-geochemical cycles 4.4. InflTUnce of human activities on biological balances and particularly on the disruption of bio-geochemical cycles (conseqTUnces of pollution of aquatic environments and atmospheric pollution (eutrophication, greenhouse effect, ozone, acid rain).

Chapter V: Summary description of the main ecosystems

5.1. Forest, grassland, surface water, ocean
5.2. Evolution of ecosystems and notion of climax

Tutorials :

The tutorials concern the methods applied for the study of the environment.

Assessment method

Continuous control and semi-annual review

References.

1. DAJET P. and GORDAN M., 1982- FreqTUncy analysis of the ecology of the species in the communities. Ed. Masson.
2. RAMADE F., 1984- Elements of ecology: Fundamental ecology. Ed. McGraw-Hill.

Semester : 4th Semester
TU: Transversal Teaching Unit
Subject: Computer tools

Teaching objective

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

Prior knowledge recommended.

Content of Matter

I. Discovery of the operating system

- Definition of an OS
- Different existing OS: Windows, Linux and Mac OS.

II. Discovery of the office suite

- Design documents on WORD.
- Design tables with EXCEL.
- Design of a presentation with Powerpoint.
- Introduction to Latex.

III. software and algorithms

- Definition of software.
- Definition of algorithmic.
- use of algorithms in biology.

Assessment method:

Semester review

Semester 5
Core Curriculum Unit (CCU 3.1.1): Aquatic Environment

Matter 1: Ecology of marine and continental environments
Credits.....:6
Coefficient : 3
Course..... : 45h
PRACTICAL WORK..... : 22h30
Personal work: 82h30

Teaching objectives
The lessons will concern the different subdivisions of aquatic environments and their ecological factors.

Recommended prior knowledge
The student must have previous knowledge of general ecology and general biology.

Content of the matter :
1. Introduction
1.1 Subdivisions and stages
1.2 Selection criteria
A-pelagic domain
B-benthic area

2. Ecological factors of the aquatic environment
2.1. Abiotic factors
A-hydrological factors
B-edaphic factors
2.2. Biotic factors
2.3 Human factors
A-degradation factors
B-technological impacts
C-pollution problems
2.4. Time factors

3. Pelagic domain
3.1 General knowledge
3.2 Methods of approach
3.3 Classification of planktonic organisms
3.4. Adaptations to pelagic life
A- size and coloration
B- suspension, buoyancy, mobility and morphological adaptations
3.5. Composition of plankton
A- phytoplankton
B- zooplankton

4. Necton
4.1. Definition and composition

4.2 Mobility and morphological adaptations
4.3. Gregarious behaviour
4.4 Migration

5. Benthic domain
5.1. Definitions
5.2. Systematics and composition
5.3. The substrate as a structuring factor
A - varieties of substrates
B- hard bottom communities
C- soft-bottom populations
D- feeding requirements and methods
E- aspects of reproduction

Evaluation method :
Continuous assessment (qTUstionnaires, reports) and semester exam

Bibliographical references

Semester 5
Core Curriculum Unit (CCU 3.1.1): Aquatic Environment

Matter 2: Hydrogeology and aquatic environments
Credits : 4
Coefficient : 2
Course..... : 22h30
PRACTICAL WORK..... : 22h30
Personal work: 55h00

Teaching objectives
In this module, the physico-chemical and geological properties as well as the hydrodynamics and the management of aquatic systems are addressed.

Recommended prior knowledge
The student must have previous knowledge of hydrology, chemistry, physics and geology.

Content of the matter :
1. Introduction to limnology
2. Physical chemistry of natural waters
3. Hydrodynamics
4. Climatic factors and their impact on ecosystems
5. Geology of marine and continental environments
6. Development of aquatic systems

Mode of assessment :
Assessment method:
Continuous assessment (qTUstionnaires, reports) and semester examination

Bibliographical references

Semester 5

Fundamental teaching unit (TUF 3.1.2) : Biology and Physiology of Aquatic Organisms

Matter 1: Physiology of aquatic organisms
Credits : 6
Coefficient : 3
Course..... : 45h
PRACTICAL WORK..... : 22h30
Personal work: 82h30

Teaching objectives
The teaching of this module allows to know the systematics of aquatic invertebrates and vertebrates, their way of life (distribution, habitat, feeding, reproduction, ...) and the study of their main functions and the systematics of aquatic plants (algae and phanerogams), their growth and development.

Recommended prior knowledge
The student must have previous knowledge of zoology, botany and general biology.

Content of the course :
Part I: Physiology of aquatic plants
1. General information
1.1 Basic knowledge of plants
1.2 Classification and general characters
1.3. Vegetative apparatus of plants
2. Algae
2.1. Nutrition (organic, mineral, nitrogen)
2.2 Germination
2.3 Reproduction
2.4. Development and growth

Part II: Physiology of aquatic animals
1. Biology and physiology of invertebrates
1.1 Classification and general characters of crustaceans
1.2 Classification and general characteristics of molluscs
1.3. Physiology of major functions
- Circulation
- Respiration
- Excretion, osmoregulation,
- Digestion, nutrition and metabolism,
- Reproduction, development and growth.
2. Biology and physiology of vertebrates

2.1. Classification and general characteristics of vertebrates (bony and cartilaginous fish) cartilaginous fish)
2.2. Physiology of major functions
- Circulation
- Respiration
- Excretion, osmoregulation,
- Digestion, nutrition and metabolism,
-Reproduction, development and growth

Assessment method :
Continuous assessment (qTUstionnaires, reports) and semester exam

Bibliographical references

Semester 5

Fundamental teaching unit (TUF 3.1.2) : Biology and Physiology of Aquatic Organisms

Matter 2: Biodiversity
Credits : 2
Coefficient: 1
Course..... : 22h30
Personal work : 27h30

Teaching objectives
The teaching of this module allows to know the history of biodiversity, its distribution, and its factors of balance.

Recommended prior knowledge
The student must have previous knowledge of ecology and general biology.

Content of the Matter :
1. Definitions.
2. Origin of life and evolution of the cell and metabolism.
3. History of biodiversity.
A. Paleo biocenosis.
B. Mass extinctions and adaptive radiation.
4. Biogeography and phytogeography.
A. Definition of biogeographic regions.
B. B. Biodiversity of the Mediterranean basin (fauna and flora).
5. Dynamics of biogeography.
A. Functioning, structure and assembly of biocenoses.
6. Eco-diversity (example of an ecosystem).
7. Population genetics.
A. Definition.
B. Hardy Weinberg's law of equilibrium and calculation of gene freqTUncies.
C. Factors that may affect Hardy Weinberg's law of equilibrium (evolutionary factors).
C. Scope of application.

Assessment method :
Continuous assessment (Quizzes, reports) and Semester examination

Bibliographical references

Semester 5
Teaching Unit: Methodology
Matter (TUM 1): Hydraulics
Credits: 4
Coefficient: 2
Lecture Hours: 22.5
Tutorial Hours: 22.5
Personal Work: 55.0
Teaching Objectives
To understand the water circulation system used in fish farming and the different pumps and drainage systems in fish facilities.
Recommended Prior Knowledge
Knowledge of fluid mechanics and hydrology.
Matter Content:

- Hydrostatics
- Fundamental equation of fluid statics
- Pressure forces
- Fluid hydrodynamics
- Fundamental equation of perfect fluid in motion
- Fundamental equation of real fluid in motion
- Aquaculture farms and ponds (structures and functioning)
- Fishery
- Drainage systems
- Water intake structures
- Pumping stations and hydraulic networks

Evaluation method: Continuous assessment (quizzes, reports) and semester exam
References.

Semester 5

Teaching unit Methodology

Matter t (EMU 2) : Hydrology
Credits : 5
Coefficient : 3
Course..... : 22h30
TD .....: 22h30
TP..... : 15h00
Personal work: 55h00

Objectives of the course
The course presents the fundamental notions of hydrology that allow students to master and understand the different functions of hydrological processes in a watershed.

Recommended prior knowledge
Knowledge in geology, fluid mechanics, probability and statistics
Content of the Matter :
-Precipitation
-The different natural waters
-Water cycles

Assessment method: (type of assessment and weighting) : Continuous assessment (qTUstionnaires, reports) and semester examination

Bibliographical references
1. ANDRE MUSY et CHRISTOPHE HIGY, 2004- Hydrologie une science de la nature. Presse PolytechniqTU et universitaires ROMANDES, 314p
2. LABORDE J.P., 2000- Elément d'hydrologie de surface. Université de Nice, 191p

Semester 5
Transversal teaching unit
Matter (TUT 1): Water treatment
Credits: 1
Coefficient: 1
Course: 22h30
Personal work: 2h30
Teaching Objectives
The course presents the fundamental basics that allow students to master and understand the different water treatment techniqTUs.
Recommended prior knowledge
Knowledge in microbiology, chemistry, and physics.
Matter Content:

- Polluted water (natural and industrial)
- Analysis of water (physical, chemical, and biological)
- Treatment of polluted surface water

- Disinfection of polluted surface water

Evaluation method: (type of evaluation and weighting) Continuous assessment (Interrogations, reports) and semester examination

References.

Semester 5

Transversal Teaching Unit
Matter (TUT 2) :Fish endocrinology
Credits : 1
Coefficient : 1
Course..... : 22h30
Personal work : 2h30
Objectives of the course

The course presents the fundamental bases which allow the students to master and understand the various techniqTUs of water treatment

Recommended prior knowledge

Knowledge in microbiology, chemistry and physics

Content of the Matter :

I. Introduction to endocrine physiology
I.1 Endocrine system/ Nervous system
I.2 Components of the endocrine system
I.3. The different types of hormones and their modes of action
I.4. Particularities of the endocrine system (Notion of hormonal hierarchy)
II. The hypothalamus-pituitary axis
II.1 The Hypothalamus
II.2 Neurons of the hypothalamus and neurosecretion
II.3 Organisation of the hypothalamic-pituitary axis
II.4 Hypothalamic hormones and innervation of secretory neurons
II.5. The pituitary gland and pituitary hormones
III. Case studies

Evaluation method: (type of evaluation and weighting) Continuous control (Interrogations, reports) and Semester exam

Bibliographical references

Semester 5

Discovery Teaching Unit
Matter (TUD) :Selection and Genetic Improvement
Credits : 1
Coefficient: 1
Course..... : 22h30
Personal work: 2h30

Objectives of the course

The course presents the fundamental bases which allow the students to master and understand the various techniqTUs of water treatment

Recommended prior knowledge
Knowledge in microbiology, chemistry and physics
Content of the Matter :
I. Reproductive function
- Sex determination and differentiation in fish
- Neuroendocrinology
- Ovogenesis
- Spermatogenesis

II. Growth function
- Muscle differentiation, development and growth
- Endocrine control of growth

III. Genetics and Biotechnology
- Genetic markers
- Microsatellite markers

Evaluation method: (type of evaluation and weighting) Continuous control (Interrogations, reports) and Semester exam

Bibliographical references

3 rd year
Natural and Life Sciences" field
Marine and Continental Hydrobiology" field of study

Semester 6
Core Curriculum Unit (CCU 3.2.1): Aquaculture

Matter 1: General Aquaculture
Credits : 6
Coefficient : 3
Course..... : 45h
PRACTICAL WORK..... : 22h30
Personal work: 82h30

Teaching objectives
The types of aquaculture (repopulation, aquarium, production, etc.), the organisms raised (fish farming, shellfish farming, carcinoculture, algoculture), the grow-out methods (extensive, semi-intensive, intensive) are studied.

Recommended prior knowledge
The student must have previous knowledge of ichthyology, aquatic ecology, aquatic biology and business management (economics).

Content of the Matter
1. General

1.1 History of aquaculture
1.2 General definitions
1.3. Aims of aquaculture
1.4. Prospects for the development of aquaculture in the world and in Algeria
1.5. Various species exploited in aquaculture.

2. TechniqTUs and study methods
2.1. Principles and conditions
2.2. Main steps required to conduct a farm.
2.3. Different methods of grow-out
- Extensive rearing
- Semi-extensive rearing
- Intensive rearing

3. Breeding of animals belonging to various zoological groups
3.1 Breeding of molluscs
3.2 Echinoderm farming
3.3 Cultivation of sponges
3.4. Farming of crustaceans
3.5. Freshwater fish farming
3.6. Marine fish farming
3.7. Seaweed culture

4. Diseases of species
5. Feeding and growth
6. InflTUnce of the rearing environment on reproduction
7. Management principles, construction of pens
8. Aquaculture and sanitary hygiene
9. Ancillary farms
9.1) phytoplankton culture
9.2) culture of a rotifer brachionus plicatilis
9.3) culture of artemia salina

Assessment method :
Continuous assessment (Quizzes, reports) and Semester examination

Bibliographical references

Semester 6

Core Curriculum Unit (CCU 3.2.1): Aquaculture

Matter 2: Fish farming
Credits : 4
Coefficient : 2
Course..... : 22h30
TP..... : 22h30
Personal work: 55h00

Teaching objectives
The lessons will concern the functions of the hatcheries as well as all the stages relating to the growth of fish.

Recommended prior knowledge
The student must have previous knowledge of the biology of aquatic environments.

Content of the course :
Chapter 1: General
1.1. General description of the different fish farming systems
1.2 Geographical conditions
1.3 Criteria for site selection
Chapter II. Fingerlings
2.1 Hatchery production
2.1.1. Spawning techniqTUs
2.1.2 Incubation of eggs
Chapter III. Rearing (grow-out)
3.1 Extensive rearing
3.2 Semi-intensive rearing
3.3 Intensive rearing

Mode of evaluation :
Continuous assessment (qTUstionnaires, reports) and semester exam

Bibliographical references

Semester 6

Core Curriculum Unit (CCU 3.2.1): Aquaculture

Matter 3: Processing techniqTUs for fishery products
Credits : 2
Coefficient : 1
Course..... : 22h30
Personal work : 27h30

Teaching objectives
In this teaching unit or module, the raw material (fish flesh) is described (physical structure and chemical composition). The processing techniqTUs (dehydration, smoking, marinating, ...), the physical processes of conservation (cold), the conditioning and the packaging are approached

Recommended prior knowledge
The student must have previous knowledge of animal biology, biochemistry and microbiology.

Content of the course :
Chapter 1: Raw material
1.1 Structure and chemical composition of fish flesh

Chapter 2: Post-mortem processing of fish.
2.1. Assessment of fish flesh after death
2.2. Processing of fresh fish: drying and salting, smoking, acidification and canning

Chapter 3: Waste treatment

Chapter 4: Packaging of fishery and aquaculture products
4.1. Materials used
4.2. Presentation and labelling

Assessment method :
Continuous assessment (Quizzes, reports) and Semester examination

Bibliographical references

Semester 6
Fundamental teaching unit 2 (TUF 3.2.2) : Aquaculture Engineering and Pathology of Aquatic Organisms

Matter 1: Aquaculture Engineering
Credits : 2
Coefficient: 1
Course..... : 22h30
Personal work : 27h30

Teaching objectives
In this teaching unit, a natural site and/or aquaculture farm, a hatchery is presented. The layout and construction of the rearing structures are explained. A field trip program will be established to introduce students to the internship.

Recommended prior knowledge
The student should have previous knowledge in civil engineering.

Content of the subject :
1. Management of natural environments
1.1. Ponds
1.2. Lakes
1.3. Lagoons

2. Creation of artificial environments
2.1. Technical conditions for creation
2.2. Construction costs
2.3. Equipment and mechanisation of production

3. Hatchery design
3.1. Different types of hatchery
3.2. Technical conditions for setting up a hatchery

3.3. Construction costs
3.4. Equipment for starting up a hatchery

4. Rearing structures
4.1. The different types of structures
4.2. Technical conditions for setting up structures
4.3. Accompanying equipment

Evaluation method :
Continuous assessment (qTUstionnaires, reports) and semester examination

Bibliographical references

Semester 6
Basic teaching unit (TUF 3.2.2) : Aquaculture Engineering and Pathology of Aquatic Organisms

Matter 2: Pathology of aquatic organisms
Credits : 4
Coefficient: 2
Course..... : 22h30
PRACTICAL WORK..... : 22h30
Personal work: 55h00

Teaching objectives
The etiological and epidemiological aspect, the pathological fields, the diagnoses, the preventions and medication of the aquatic organisms are approached.

Recommended prior knowledge
The student must have previous knowledge of zoology and biology.

Content of the Matter :
1. Infectious pathology
1.1. Viral pathology
1.2. Bacterial pathology
1.3 Mycosis
1.4. Parasitic pathology

2. Non-infectious pathology
2.1. Water quality
2.2. Trauma
2.3. Food pathology
2.4. Congenital pathology

3. Diagnostic process

4. Preventive and curative treatments

Assessment method :
Continuous assessment (Quizzes, reports) and Semester examination

Bibliographical references

Semester 6

Teaching unit Methodology

Matter (EMU 1): **fisheries science**
Credits : 5
Coefficient: 3
Course..... : 22h30
TD .....: 22h30
TP.....: 15h00
Personal work : 65h00
Teaching objectives
After this course the student will learn the basic notions of fish biology and identify and differentiate between different fishing gears and boats.
Recommended prior knowledge
To be able to follow this course, the student should have knowledge of animal biology and general physics and chemistry.
Content of the matter :
-Biology of species
- Different fishing gears (gillnets, traps, electrofishing, etc.)
- Trapping and harvesting
- Criteria for the choice of fishing gear
- Fishing techniqTUs
- Choice of fishing sites
- Boat
- Detection equipment
- Seamanship
- Transport and storage
- Fishing.
Assessment method: (type of assessment and weighting) Continuous assessment (qTUstioning, reporting) and semester examination
Bibliographical references
Rapports techniqTU de la FAO
Fiche d'identification des espèces exploitées
www.fao.org

Semester 6

Teaching unit Methodology

Matter (EMU 2) : Agro-fertilisation and pond management
Credits : 4
Coefficient : 2

Course..... : 22h30
TD .....: 22h30
Personal work: 55h00

Objectives of the course
At the end of this module, the student should be able to study and analyse the effect of fertilisers of different crops on aquaculture ponds
Recommended prior knowledge
To be able to follow this module, knowledge of chemistry and biology is necessary
Content of the Matter :
General agronomy :
-Soil preparation
-The course is designed to provide students with the opportunity to learn about the different types of agriculture and their effects on the environment.

* Special agriculture :
-Cereal growing
-Fodder and market gardening in aquaculture farms
- Dredging, mowing and dredging
- Plant protection

* Pond preparation :
-Fertilisation and amendment
- Watering of ponds
- Rotifer cultivation
- Selective cultivation and monitoring of introduced fish species
- Fishing
- Stock management.

Assessment method: (type of assessment and weighting) Continuous assessment (qTUstionnaires, reports) and semester examination

Bibliographical references :

Coche, A.G. et H. van der Wal, 1983. Pisciculture continentale: l'eau, dans: collection FAO: formation no 4, méthodes simples pour l'aquaculture. FAO, Rome, 111 p. FAO, 1984. La pisciculture en eau douce: comment débuter. Série FAO: apprentissage agricole no 27. FAO, Rome, 43 p. FAO, 1984. L'eau: d'où vient l'eau. Série FAO: apprentissage agricole no 28. FAO, Rome, 31 p. FAO, 2004. La pisciculture en eau douce: l'étang. Série FAO: apprentissage agricole no 29. FAO, Rome, 44 p. http://cedepa.wordpress.com/

Semester 6

Transversal Teaching Unit
Matter (TUT 1) :Nutrition and food biotechnology
Credits : 1
Coefficient : 1
Course..... : 22h30

Personal work : 2h30
Teaching objectives
To give the essential bases of the nutrition of captive aquatic species, in order to allow a better understanding of the production processes.
Recommended prior knowledge
Biology, biochemistry
Content of the Matter:
-Physiological bases of nutrition
-Anabolism and catabolism
- Importance of macro, micro, trace elements and vitamins
- Energy requirements.
- Dietary deficiencies.
-Assessment of nutritional status.
-Food technology. (Intensive system - extensive system and super intensive system).
-Ad libitum feeding techniqTUs - Artificial feeds.
- Extrudation.
- Use of micro particles
- Anabolic agents.
- Interest in homogenising fish farms through feeding (use of methyl testosterone)
- Interest in the use of hormones in feed.

Assessment method: (type of assessment and weighting) Continuous assessment (qTUstioning, reporting) and Semester examination
Bibliographical references

J.GUILLAUME**,** S.KAUSHIK**,** P.BERGOT**,** R.MÉTAILLER**,** (1999) : Nutrition et alimentation des poissons et crustacés, INRA / IFREMER**,** 490p.
J-P.PROTEAU, O.SCHLUMBERGER, P.ÉLIE, (2008) : Le silure glane Biologie, écologie, élevage, QUAE, 221p.
Horvath M., (1999) : ManTUl de pisciculture – Cyprinidés, Percidés, Siluridés- Sarvach, 240p. Christiane FERRA, (2008) : Aquaculture, VUIBERT, 1264p. J.LAZARD**,** B.JALABERT**,** T.DOUDET**,** (1990) : L'aquaculture des tilapias du développement à la recherche, CIRAD, 122p.

Semestre 6

Transversal Teaching Unit Subject (TUT 2): Toxicology
Credits: 1
Coefficient: 1
Class hours: 22h30
Personal work: 2h30
Teaching Objectives
During and after studying toxicology, students will master the basic concepts of toxicology. Recommended prerequisite knowledge to enable students to follow this course, it is recommended that they have knowledge of ecology, biochemistry, and chemistry.
Subject Content:
- Definitions
- Sources of contamination and modalities (Pesticides - heavy metals)
- Toxic food products (BlTU-green algae and mushrooms)

- Chemical products.
- Decomposition of organic matter.
- Oxygen.
- Nitrates
- Nitrites and Ammonia
- ResidTU analysis.
- Prevention and treatment.

Evaluation method: (type of evaluation and weighting) Continuous assessment (Interrogations, reports) and Semester Exam

Bibliographical References

Ramade F. (2007) Introduction to Ecotoxicology. Tec ETDOC Publishing. Forbes V.E. (1997) Ecotoxicology: Theory & Application. INRA Publisher, 256p.
Ramade F. (2007) Ecotoxicology: Foundations and Applications. Tec ETDOC Publishing, 200p.
Ramade F. (2007) Introduction à l'Ecotoxicologie. Edt. Tec ETDOC. Forbes V.E. (1997) Ecotoxicologie : Théorie & application. Editeur INRA, 256p Ramade F.(2007) Ecotoxicologie : Fondements et applications. Edt. Tec ETDOC. 200p.

Semester 6

Discovery Teaching Unit
Matter (TUD) :Applied hydrobiology
Credits : 1
Coefficient: 1
Course..... : 22h30
Personal work : 2h30

Objectives of the course
To understand the different physicochemical characteristics of surface waters, as well as the aquatic fauna and flora.
Recommended prior knowledge
Animal biology - Plant biology - Chemistry - Physics
Content of the Matter :
Physico-chemical character of water
-Lacustrine zonations
-Planktonology
-Benthology
-Ichthyology
- Microbiology of water
- Aquatic plants.

Assessment method: (type of assessment and weighting) Continuous assessment (qTUstionnaires, reports) and semester examination

Bibliographical references