DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

ENGINEER TRAINING OFFER

Establishment	Department
National Higher School of Marin Science and Coastal Development	Environment & Development

Field : **Nature And Life Science (NLS)**
Stream : **Continental and Marine Hydrobiology**

Speciality : **Marine Environment Engineering And Ecosystems Protection**

Academic year : 2022/2023

SUMMARY
2022-2023

I – Training Identity Form

1 – Training Context And goals

This program aims to train senior engineering executives capable of conducting the necessary studies and assessments of the marine environment and its resources through a multidisciplinary approach, within the framework of sustainable development and the protection of marine ecosystems.

Understanding the complexity of marine and coastal environments, along with their varying environmental phenomena and constraints, will enable the preservation and integrated management of marine and coastal spaces and their resources. These executives will be equipped to address these challenges through a multidisciplinary and systemic approach.

2 – Access Terms

- Integrated Preparatory Classes of National Higher School of Marin Science and Coastal Development
- Preparatory Classes in Earth and universe science & Nature and Life Science

3 – Training objectives

Specific skills

- Understand the physical, chemical, and biological processes regulating major ocean biogeochemical cycles.
- Comprehend the mechanisms governing the structure and functioning of marine ecosystems.
- Apply fundamental science and engineering principles to analyze and solve marine and coastal environmental problems within a sustainable development framework.
- Master marine investigation and analysis methodologies.
- Assess the impact of the marine environment on coastal infrastructure.
- Evaluate human impacts on marine and coastal populations and ecosystems.
- Analyze the influence of the marine environment on maritime and coastal activities.
- Ability to conduct environmental audits and marine/coastal environmental impact assessments.
- Ability to manage and lead a marine-related project from conception to completion, addressing technical, economic, human, and financial dimensions.
- Ability to manage and implement marine pollution control measures.
- Ability to perform technical, scientific, and regulatory analyses of environmental constraints and translate them into feasible solutions.

Transversal skills

- Development of a cultural foundation enabling a multidisciplinary approach to the marine environment. This foundation includes tools and a coherent body of specialized knowledge about processes occurring in the ocean system and how human societies have altered - and continue to alter - them. It leads to the ability to analyze and/or model complex situations using appropriate methodologies.
- Ability to conduct multidisciplinary research and gather relevant information.
- Ability to design and implement projects within a multidisciplinary team framework.
- Ability to effectively communicate findings in both French and English.

4 – Targeted job profiles and skills

The sector of environment especially the marine one, the design offices, the management of natural parks, the study, research and analysis laboratories, the environmental services of the local authorities of wilaya, daïra and commune as well as others... are professional destinations for the proceeds of this training. The demand for engineers specialized in the field of the general and marine environment is increased. Given the skills and knowledge acquired during his course, the engineer in marine environment can find its introduction and professional integration in the public or private sector where it can occupy various functions.

In addition, the marine environment also offers great opportunities for engineers and entrepreneurs to develop their ideas and create their own companies that will seek, among other things, the adequacy between the different activities and the preservation of the marine environment and its biodiversity. This will also avoid conflicts use of the coastal areas through the development of economic activities in harmony with the current requirements of sustainable development and biodiversity protection.

5 – Regional and national employability of graduating students

The marine and coastal environment sector in Algeria offers great local, regional and national potential. for absorption of the product of the present training. In Indeed, the various activities of state and private operators in the marine sector require professionals for impact studies, monitoring, follow-up, safeguarding and restoration of the marine and coastal environment according to the required standards, including sustainable development. In Algeria, the sectors in full development and development which offer major opportunities for the integration of new young executives are:

- The sector of the tourism and their quality of the ribs, of the waters and of the beaches
- The sector of aquaculture with research of a balance between profitability of the activity and

protection of the quality of the marine environment and biodiversity, as well well on the coast than in the open sea.

- The communities local of all their seafront Algerian with a demography galloping and high-speed industrialization and enthronization of the coasts.
- The maritime traffic and national cabotage which generate pollution that requires monitoring and continuous monitoring, particularly in ports and marine protected areas.
- The exploitation of the resource's organic marines of which their quality needs to be assured by continuous monitoring.
- The exploitation of the resource's marines No organic (desalination of water, aggregate sailors …) requires a control of the quality of these resources.

6 – Walkways To Others Specialties

The position of the proposed training in relation to the training provided on a national scale is special. In fact, by the specificity of its sound field, ENSSMAL stands out on a national scale (among universities and national higher education institutions) by specializations in the field of marine sciences and especially the coastal marine environment. Consequently, to our knowledge, there is no has no existing similar training at the national level, particularly also multidisciplinary.

7 – Internships and in-company training

1/ Field or sea trips during training (S1 to S5) – 1 daytime (6h)

- Seawater desalination plants (S3)
- Coastal wastewater treatment plants (S3)
- Field trips to collect biota samples (S1 and S2)
- Visit to Marine Protected Area (S5)
- Sea outing: seawater and sediment sampling (S5)

2/ Sea and coastline workshop (S2) – 1 week

During this workshop, several options for multi-disciplinary mini-projects can be envisaged within the school's research laboratories.
It will also be possible to take part in a scuba diving course as part of the P1 certification. Four (04) scuba diving clubs have signed agreements with our school : RECIF, KALYPSO, AQUAMAR, PARADIVE.

3/ Internship professional integration (S4) – 2 weeks

The internship can be carried out in a wide range of public or private institutions:

- Algiers Nuclear Research Center (CRNA)
- National Center for Fisheries and Aquaculture Research and Development (CNRDPA)
- National Coastal Commission (CNL)
- Marine Protected Areas (MPA): Gouraya (Béjaïa); Taza (Jijel); Kala (El Kala); Ile Habibas (Oran)
- Center for the Development of Renewable Energies (CDER)
- National Waste Agency (AND)
- National Climate Change Agency (ANCC)
- Coastal wastewater treatment plants
- Seawater desalination plants
- Economic operators (environmental consultancies; water quality measurement laboratories ....)

4/ Final Project (S6) – 6 month

The final project internship is generally offered as part of the establishment's activities and projects (training through research; patents; startups) or in other organizations.

- Marine and Coastal Ecosystems Laboratory
- Marine Resources Conservation and Development Laboratory
- Algiers Nuclear Research Center (CRNA)
- National Center for Research and Development in Fisheries and Aquaculture (CNRDPA)
- Marine Protected Areas (MPAs): Gouraya (Béjaïa); Taza (Jijel); Kala (El Kala); Ile Habibas (Oran): study of ecosystem status
- Coastal wastewater treatment plants (study of discharges and their impacts)
- Seawater desalination plants (study of discharges and their impacts)
- Economic operators (environmental consultancies; water quality measurement laboratories ....)

8 – Workplace, staff and TIC rooms

The school has a library with large reading rooms, a digital documentary collection, multimedia rooms with a capacity of more than 30 places which form suitable spaces of works staff of students. In addition, four (04) computer laboratories are available for practical work.

II –Semi-annual teachings organization

1- Semester 1

Unit Teaching	VHS	VH weekly (VH Global)				Coefficient	Credits	Fashion devaluation			
	14-16 weeks	C	TD	TP	Others			Continuous		Exam	
EU fundamentals											
UEF 1.1 : Geochemistry of the marine waters and interfaces	75	3 hours	1h30	1h30	75	4	6	50 %	2	50 %	1
UEF 1.2 : Physical oceanography	45	1h30	1h30	0	45	2	4	50 %	2	50 %	1
UEF 1.3 : Structure, Organization and ecological functioning of marine ecosystem	70	3 hours	1h30	1h30	(70) Exit (6h)	3	6	50 %	2	50 %	1
EU methodology											
EMU 1.1 : Environmental metrology	45	1h30	0	1h30	45	2	4	50 %	2	50 %	1
EMU 1.2 : Digital analysis	60	1h30	0	3 hours	60	3	4	50 %	2	50 %	1
EMU 1.3 : GIS and Mapping	60	1h30	0	3 hours	60	2	4	50 %	2	50 %	1
EU transverse											
UET 1.1 : English for Specific Purpose 1	20	1h30	0	0	20	1	2	50 %	2	50 %	1
Total semester 1	**375**	**1:30 p.m.**	**4:30 a.m.**	**10:30 a.m.**	**375**	**17**	**30**				

2- Semester 2

Unit Teaching	VHS	VH weekly (VH Global)				Coeffi cient	Credits	Fashion devaluation			
	14-16 weeks	C	TD	TP	Others			Continuous		Exam	
EU fundamentals											
UEF 2.1: Geochemistry of sediments, atmosphere and biogeochemical cycles	70	3 hours	1h30	1h30	70	3	6	50 %	2	50 %	1
UEF 2.2 : Instrumentation in Oceanography	30	1h30	1h30	0	30	2	3	50 %	2	50 %	1
UEF 2.3 : Ecophysiology And adaptation of marine organisms	60	1h30	1h30	1h30	60 Exit on THE ground (6 h)	3	5	50 %	2	50 %	1
EU methodology											
EMU 2 .1 : Chemical analysis techniques	45	1h30	0	1h30	45	2	3	50 %	2	50 %	1
EMU 2.2 : Treatment And Analysis of Data (TAD)	60	1h30	3:00 a.m.	0	60	2	4	50 %	2	50 %	1
EMU 2.3 : Digital modeling	45	1h30	1h30	0	45	2	4	50 %	2	50 %	1
EU Discovery											
UED 2 .1 : Computer programming science	15	0	0	1h30	15	1	1	100%	2	0%	-
UED 2.2 : Sea & coastline Workshop	30				30	1	2	Report of Mini- Project			
EU transverse											
UET 2.1 : English for Specific Purpose 2	20	1h30	0	0	20	1	2	50 %	2	50 %	1
Total Semester 2	**375**	**12 p.m.**	**9 a.m.**	**6 a.m.**	**375**	**17**	**30**				

3- Semester 3

Unit Teaching	VHS	VH weekly (VH Global)				Coefficient	Credits	Fashion devaluation			
	14-16 weeks	C	TD	TP	Others			Continuous		Exam	
EU fundamentals											
UEF 3.1 : Physical and chemical marine pollution	60	3 hours	0	1h30	(60) / Collection exit waste (6h)	3	5	50 %	2	50 %	1
UEF 3.2 : Management of there marine and coastal pollution	60	3 hours	1h30	0	(60) / Visit Stations treatment of the waters worn (6h)	3	5	50 %	2	50 %	1
UEF 3.3 : Coastal hydrodynamic	45	1h30	1h30	0	45	2	4	50 %	2	50 %	1
UEF 3.4 : Sustainable Development	30	1h30	1h30	0	30	1	2	50 %	2	50 %	1
EU methodology											
UEM 3 .1 : Remote sensing	60	1h30	0	3 hours	60	2	4	50 %	2	50 %	1
EMU 3.2 : Modeling of continuous medium	30	1h30	1h30	0	30	2	3	50 %	2	50 %	1
EMU 3.3 : HSE (Hygiene & Safety & Environment)	45	1h30	1h30	0	45	2	3	50 %	2	50 %	1
EMU 3.4 : Water treatment and desalination Process	25	1h30	0	0	(25)Visit desalination plant (6h)	1	2	50 %	2	50 %	1
EU transverse											
UET 3.1 : English for Specific Purpose 3	20	1h30	0	0	20	1	2	50 %	2	50 %	1
Total semester 3	**375**	**4:30 p.m.**	**7:30 a.m.**	**4:30 a.m.**	**375**	**17**	**30**				

4- Semester 4

Unit Teaching	VHS	VH weekly (VH Global)				Coefficient	Credits	Fashion devaluation			
	14-16 weeks	C	TD	TP	Others			Continuous		Exam	
EU fundamentals											
UEF 4.1 : Biological Pollution and eco-toxicology	75	3 hours	1h30	1h30	75	4	6	50 %	2	50 %	1
UEF 4.2: Isotopic tracers and Oceanographic applications	30	1h30	1h30	0	30	1	3	50 %	2	50 %	1
UEF 4.3 : Law of the sea	30	3 hours	0	0	30	1	3	50 %	2	50 %	1
EU methodology											
EMU 4.1 : Spatial Oceanography	45	1h30	0	1h30	45	2	3	50 %	2	50 %	1
EMU 4.2 : Life-cycle analysis	30	1h30	0	1h30	30	2	3	50 %	2	50 %	1
EMU 4.3 : Artificial Intelligence	45	1h30	0	1h30	45	2	3	50 %	2	50 %	1
UEM 4.4 : Professional internship	60				60	2	4	Report of internship			
EU Discovery											
UED 4.1 : Biodiversity and enthronization	20	1h30	0	0	20	1	2	50 %	2	50 %	1
EU transverse											
UET 4.1 : Methodology of documentary research	20	1h30	0	0	20	1	1	50 %	2	50 %	1
UET 4.2 : English for specific purpose 4	20	1h30	0	0	20	1	2	50 %	2	50 %	1
Total Semester 4	**375**	**4:30 p.m.**	**3 hours**	**6 a.m.**	**375**	**17**	**30**				

5- Semester 5

Unit Teaching	VHS	VH weekly (VH Global)				Coefficient	Credits	Fashion devaluation			
	14-16 weeks	C	TD	TP	Others			Continuous		Exam	
EU fundamentals											
UEF 5.1 : Climate Change: Observations, Assessment	**60**	3 hours	1h30	0	60	3	5	50 %	2	50 %	1
UEF 5.2 : Action of the sea on coastal infrastructure	**45**	1h30	0	1 hour 30	45	2	4	50 %	2	50 %	1
UEF 5.3: Environmental Assessment	**45**	1h30	1h30	0	45	2	4	50 %	2	50 %	1
UEF 5.4 : National and international law of the environment	**30**	1h30	1h30	0	30	2	3	50 %	2	50 %	1
EU Methodology											
EMU 5.1 : Monitoring And strategy of monitoring of marine ecosystems	**60**	1h30	1h30	1h30	(48) + 2 exits (sea and MPA)	3	5	50 %	2	50 %	1
EU Discovery											
UED 5.1 : Marine ecosystem monitoring and surveillance strategy	**45**	1h30	1h30	0	45	2	3	50 %	2	50 %	1
UED 5.2 : Navigation	**15**	1h30	0	0	15	1	1	50 %	2	50 %	1
EU transverse											
UET 5.1 : Economy of the environment	**45**	1h30	1h30	0	45	1	3	50 %	2	50 %	1
UET 5.2 : Management of projects	**30**	1h30	1h30	0	30	1	2	50 %	2	50 %	1
Total semester 5	**375**	**3 p.m.**	**10:30 a.m.**	**3 hours**	**375**	**17**	**30**				

6- Semester 6

Field : Nature And Life Science (NLS)

Stream : Continental and Marine Hydrobiology

Speciality : Marine Environment Engineering And Ecosystems Protection

Internship of PFE assessed by a memory and a defense.

	VHS	Coefficient	Credits
Work Staff	375	-	30
Internship in business	375	-	-
Seminars	-	-	-
Other (to specify)	-	-	-
Total Semester 6	**750**	**17**	**30**

7- Summary overall the training

EU / VH	UEF	EMU	UED	UET	PFE	Total
Course	442	282	57.5	137.5	-	**919**
TD	250.5	37.5	22.5	37.5	-	**348**
TP	139.5	317.5	15	-	-	**472**
Work staff	860	655	125	175	375	**2190**
Other (exit in sea, on ground And visit of sewage treatment plants)	24	78	30	-	375	507
Total	1716	1370	250	350	750	**4436**
Credits	75	54	9	12	30	**180**
% in credits for each EU	41.67	30.00	5.00	6.67	16.66	**100**

III - Detailed program by teaching unit

Semester 1

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 1

UEF 1.1 : GEOCHEMISTRY OF THE WATERS AND INTERFACES

Credits : 6

Coefficients : 4

Matter 1: Geochemistry general

Teaching objectives: To perfect and deepen the knowledge acquired by students in the 1st and 2nd years in of the discipline's fundamentals. This unit fundamental will allow to students to access knowledge of the ocean: its physicochemical composition and exobiological, its functioning and its interactions with THE different geospheres.
The specific objective of this subject is an introduction to general geochemistry with the positioning of the ocean as a geochemical reservoir in relation to planet Earth and knowing its interaction with other geospheres.

Knowledge prerequisites recommended:

For power pursue THE teachings of this unit, the student must to have followed THE teachings exempted In THE classes preparatory has known : oceanography general, there chemistry of the waters natural, there geology navy, there physical navy, there biology and ecology marines.

Contents of there matter

Course masterful (9 a.m.)

Chapter 1 Goals of their geochemistry
Chapter 2 Tanks geochemical on Earth and their interfaces
Chapter 3 Continental geochemistry
1- Composition of their crust terrestrial (continental and navy)
2- Classifications of the element's geochemical terrestrial

Matter 2 : Geochemistry of waters marines

Goals of teaching : The objective of this matter East a introduction has awareness of there composition physical chemistry of the ocean And her functioning.

Recommended prior knowledge : to be able to continue the lessons of this unit, the student must to have followed THE teachings exempted In THE classes preparatory namely : oceanography general, there chemistry general, there chemistry of the waters natural And there physical navy.

Contents of there matter

Course masterful : 18 h

Chapter 1. Composition chemical And properties of water of sea

1.1. Cycle of water. Sources of salts has the ocean
1.2. Time of residence of the salts In the ocean
1.3. Composition chemical water of the sea (ions majors, minors And traces)
1.4. Temperature, salinity And density of water of sea : distributions vertical and horizontal
1.5. Movement of the waters ; Masses of waters types, diagrams θ/S

Chapter 2. pH and Alkalinity total of water of sea

2.1. Law of Nernst. Scales of pH
2.2. Power buffer of water of sea : carbonates And borates
2.3. Alkalinity total: definition practical And distributions vertical And horizontal

Chapter 3. THE gas dissolved In water of sea

3.1 Dissolution of the gas in the water of sea. Units And representations of there saturation.
3.2 Oxygen dissolved O_2 and use related of oxygen
3.3 THE dioxide of carbon CO2 And system of the carbonates

Chapter 4. The elements nutritious In water of sea

4.1. Salts nitrogen, of phosphorus, of Silicon
4.2. Production and destruction of organic matter in sea water: reports elementary (oxic, hypoxic, anoxic systems)
4.3. Production primary oceanic And fertility oceans

Chapter 5. Materials in suspension And matter organic of water of sea

- There diversity of the compounds organic at sea
- Reactivity And notion of sharing
- Transformation chemical And degradation
- Transformation chemical by photochemistry

Chapter 6. THE elements traces metallic (ETM) In water of sea

6.1 Properties of the ETM (Origins, transportation, becoming, trapping And remobilization ..) / Sources and sinks of metals: transfer processes in the ocean (scavenging, etc.)
6.2. Profiles types of the metals In the ocean
6.3. ETM and fertility of the oceans And seas

Chapter 7. THE radionuclides natural In water of sea

7.1. Law of radioactive decay
7.2. Radionuclides primordial (families of Uranium And Thorium)
7.3. Radionuclides cosmogenic (case of carbon -14)

Works directed (9 a.m.) :

TD No. 1 : Composition water of sea, salinity and chlorinity. Determination of the mass volumetric from the international equation of state of seawater. Study of typical waters of the Mediterranean and the Atlantic. Diagram (T/S). (computer lab) (3h)

TD No. 2: pH of seawater, buffering capacity of seawater. Determination of the parameters of the carbonate system. Seasonal variations of $O2_{\text{and } CO2}$ in seawater. Acidification and saturation in $_{CaCO3}$ (computer lab) (3h)

TD No. 3: Speciation of nutrients in seawater. Calculation of new and regenerated production from nutrient data. Degradation of organic matter. and Elementary Reports. Metals and Production (HNLC areas) (3h)

Works Practices (9 p.m.) :

TP No. 1 : Measure of Salinity (conductivity) And Preparation of a water of sea synthetic (3h)

TP No. 2 : Dosage of O2 dissolved of water of sea (Method of Winkler) (comparison results with those of the oximeter)

TP No. 3 : Measure of pH and of alkalinity total of water of sea (potentiometry)

TP No. 4: Determination of nitrites and nitrates by UV-visible spectrophotometry

TP No. 5: Determination of Orthophosphates in seawater by UV-visible spectrophotometry TP

No. 6 : Dosage of there silica (acid orthosilicic) In water of sea by spectrophotometry UV-visible

TP No. 7: Dosage of there Chlorophyll (has) by spectro fluorescence

Subject 3: Process geochemical liquid- solid interfaces

Goals of teaching : the objective of this matter East of to know THE process geochemical of interaction to interfaces liquids-solids At breast of the ocean And his borders.

Knowledge prerequisites recommended: For power pursue THE teachings of this unit, the student must to have followed THE teachings exempted In THE classes preparatory has know: general chemistry and the chemistry of natural waters.

Contents of there matter

Course masterful (9 a.m.)

Chapter 1 : Process electrochemical in sea

1- Potential redox potential hydrogen And strength ionic of water of sea
2- Speciation metals in the water of sea
   - 2.1 Shapes dissolved And ions majors
   - 2.2 In presence of ligand organic (chelation)
   - 2.3 In presence of MES

Chapter 2 : Process to interfaces sediment / water of sea 1-

Physical process

- **a.** Sedimentation : flow of particles in the column of water
- **b.** Phenomena of broadcast sediment / water of

Wed 2- Sediment-chemical substance chemical process

- a. THE forces intermolecular to interfaces liquid- solid
- b. Reactions chemicals between THE sediment And THE waters interstitial
  - i. THE exchanges ionic In THE sediment
  - ii. Complexation
  - iii. Precipitation / Dissolution
  - iv. Reaction redox In THE sediment

3- Process physicochemical sediment water of sea

- a. Adsorption / desorption
- b. Isotherms adsorption
- c. Adsorptions of the metals on THE sediment marine
- d. Adsorption of the compounds organic on THE sediment

sailor 4- Biological processes: bioturbation of the sediment surface

Works directed (6h)

TD No. 1 : Speciation of the metals in marine environment (diagrams of Pourbaix) TD No. 2: Adsorption isotherms, case studies in the marine environment

Works Practices (6h)

TP No. 1 : Matter in suspension Ŕ turbidity of water of sea
TP No. 2 : Adsorption of the metals in surface of a sediment

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester : 1

UEF 1.2 : OCEANOGRAPHY PHYSICAL

Credits : 4

Coefficients : 2

Matter 1 : Ocean circulation, waves of gravity of surface and instrumentation

Teaching objectives : This course aims to teach students the main foundations of physical oceanography; description of the dynamics and functioning of the ocean Thus that the study of role complex that he plays In THE system climate And THE forecasts
weather marines

Knowledge prerequisites recommended: For power pursue THE teachings of this unit, the student must have followed THE teachings exempted in the classes preparatory namely: general oceanography and marine physics

Contents of there matter

Course lectures (28h30)

Chapter 1 : Introduction has there physical of the atmosphere (9:00 a.m.)

1 Stratification vertical in pressure And temperature (3h00)

1.1 Stratification And composition of the atmosphere
1.2 Thermodynamics of the air dry
1.3 Law hydrostatic And stratification
1.4 Distribution vertical And meridian of there temperature on earth

2 THE transformations of a plot of air In the atmosphere (3h00)

2.1 THE transformations **without** change of phase : liquid- vapor
2.1.1 Transfer adiabatic
2.1.2 There temperature potential
2.1.3 Ancestry And subsidences adiabatic
2.2 THE transformations **with** change of phase : liquid- vapor
2.2.1 Process evaporation And of condensation atmospheric

3 Humidity atmospheric (1h30)

3.1 There pressure partial of there steam of water
3.1.1 Tension of steam (law of the gas perfect)
3.1.2 There You of Delton
3.2 Humidity specific
3.3 The report of mixture
3.4 Humidity relative
3.5 There temperature of point of dew

4 The emagram (1h30)

Chapter 2: Dynamic oceanic (7:30 p.m.)

1 Equations of base in oceanographic physical (3h00)

1.1 The equation of continuity (conservation of the mass)
1.2 THE equations of movement in oceanographic (^{2nd} law of Newton, Scaling, …)

2 Currents without friction, fluent geostrophic (3h00)

2.1 The balance hydrostatic
2.2 THE fluent of inertia
2.3 Geopotential
2.4 There speed of fluent geostrophic

3 Currents frictional (4h30)

3.1 THE equations of the movement including THE forces of friction
3.2 There solution of Ekman (traffic induced by THE wind)
3.3 THE transportation of Ekman in the surface layer
3.4 THE upwellings And downwellings far of the borders (convergences And divergences)
3.5 Friction in water little deep
3.6 Limitation of there theory of Ekman
3.7 Solution of Sverdrup (traffic induced by THE wind)
3.8 Transportation mass total (transportation below of there surface layer)
3.9 Solutions of Stommel And of Munk

4 Vorticity (1h30)

4.1 There vorticity relative: ζ
4.2 There vorticity planetary : f
4.3 There vorticity absolute : $(\zeta + f)$
4.4 There vorticity potential : $(\zeta + f) / D$

5 There traffic thermohaline (3h00)

5.1 There traffic deep
5.2 THE equations of T And S, laws of conservation of there heat and of salt

6 There dynamic of the waves linear (4h30)

6.1 THE waves internal I (waves has the interface of a ocean has two layers)
6.2 THE waves internal II (effect of there rotation)
6.2.1 Waves of Poincaré (inertia / gravity)
6.2.2 Waves of Kelvin (borders lateral vertical)
6.2.3 Waves planetary or waves Rossby (variation of the Coriolis parameter, β-effect)
6.2.4 Waves topographical from Rossby

II . ***<u>Works directed (4:30 p.m.)</u>***
TD-1 : The equation of balance hydrostatic In the atmosphere (1h30)
TD-2 : The equation hypsometric (ladder of height) (1h30)
TD-3 : Emagram : diagram meteorological allowing of represent A survey (1h30)
TD-4 : Demonstration of the equation of continuity (1h30)

TD-5 : THE equations of movement in oceanography : establish THE equations (1h30)
TD-6 : Currents without friction (1h30)
TD-7 : Geostrophic current (1h30) **TD-8** : Frictional currents (1h30)
TD-9 : There vorticity (1h30)
TD-10 : There traffic thermohaline (1h30)
TD-11 : There dynamic of the waves linear (1h30)

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester : 1

UEF 1.3 : STRUCTURE, ORGANIZATION AND ECOLOGICAL FUNCTIONING OF THE MARINE ECOSYTEM

Credits : 6

Coefficients : 3

Matter 1 : Structure, Organization And functioning ecological of the ecosystem marine

Goals of teaching :

This matter will allow to students to access has there awareness And there understanding of the different
shapes of structuring And organizational of the marine biodiversity and oceanic, with a focus on Mediterranean biodiversity and that of the Algerian coast.

Knowledge prerequisites recommended : For power follow THE lessons from this unit, the student must to have follow up THE teachings exempted In THE classes preparatory has know : oceanography general, there biology And marine ecology .

Contents of there matter

Course masterful (28h)

CHAPTER 1- Definition and concepts of base

Settings abiotic And biotics,
biodiversity,
THE ecosystems And habitats

CHAPTER 2- Factors Ecological

Interaction inter And intra specific in medium marine

CHAPTER 3- Pelagic ecosystem

i) Categories ecological And classification of the species pelagic
ii) THE adaptations has there pelagic life

THE phytoplankton

iii) Composition taxonomic And dynamic phytoplankton
iv) Biology And ecology of phytoplankton

THE zooplankton

Composition taxonomic And dynamic zooplankton ,
v) Biology And ecology of zooplankton

THE Nekton

vi) Big groups nektonic, mobility And adaptation morphological
vii) Behavior And migrations

Ecosystem benthic

viii) Notion of biocenosis, of communities and of facies
ix) THE different types of substrate And floors stands

Phytobenthos

x) Algae And marine phanerogams

xi) Biology And ecology of phytobenthos

Microbenthos And meiobenthos

xii) Organization taxonomic
xiii) Shapes larval and juveniles In meiobenthos

Macrobenthos And megalobenthos

xiv) Composition taxonomic
xv) Dynamic of the communities And of the stands
xvi) Biology And ecology of macrobenthos And of megalobenthos

Works practical work (12 hours)

1. Acknowledgement of the species phytoplankton
2. Acknowledgement of the species zooplankton
3. Acknowledgement of the species phytobenthic
4. Acknowledgement of the species zoobenthic

Works directed (30h)

1. Methods of study of the ecosystems pelagic And benthic
2. Analysis of a population phytoplankton
3. Analysis of a population zooplankton
4. Analysis of a population phytobenthic
5. Analysis of a population zoobenthic
6. Strategies And methods of studies applied has the ecosystem pelagic And benthic
7. Protocols of follow up of the habitats benthic : Case of the herbarium Posidonia 1
8. Protocols of follow up of the habitats benthic : Case of the ecosystem coralligenous
9. Treatment of the data in ecology benthic
10. Modeling ecological

A has Two exits on THE ground are planned For there collection of the samples (6 at 12 p.m.)

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 1

UEM 1.1 : METROLOGY ENVIRONMENTAL

Credits : 4

Coefficients : 2

Matter 1: THE instruments of measures And of sea sampling

Teaching objectives : Metrology applied to the marine environment consists of carrying out all operations of measurement from sampling to results through collection , packaging, THE different steps of treatment And the analysis having For goal of know components of this environment And his developments

Recommended prior knowledge : to be able to follow the lessons of this unit, the student must to have followed THE teachings exempted In THE classes preparatory has know : Chemistry general, biochemistry And mathematical

Contents of there matter

Course masterful (24h)

Chapter 1 Introduction has there metrology.
- importance of a measure : scientist and socio-economic And policy
- concepts of measure, of measurement And of measurand

Chapter 2 THE errors In the analysis
2.1 Exactness And there precision of a result
- Notion of replicability, repeatability, reproducibility
2.2 Errors systematic
- Errors instrumental, errors due has there method, errors personal
- Identification of the errors instrumentals And personal
2.3. Random errors
- Distribution of the data experimental ;
- Treatment statistical of the error random,
- Sample And population (difference between sample statistical And analytical sample , mean, standard deviation)
- variance
2.4. Modes of presentation of the results calculated
2.5. Application of there statistical At treatment And assessment of data.
- Boundaries of trust
- Interval of trust

Chapter 3 Methods validation
3.1 Vocabulary methods validation
3.2 White of method analytical, Duplicate, Sample fortified, Standard similar,
3.3 Material of reference, Material of reference certified (MRC)
3.4 Boundaries of detection of a method
3.5 Method of calculation of the ratio of conformity
3.6 Limit of quantification of a method
3.7 Limit of linearity
3.8 Loyalty
3.9 Methods of calculation of there replicability, of there repeatability And of reproducibility)

3.10 Accuracy And methods of calculation
3.11 Sensitivity And methods of calculation
3.12 Notion of traceability.

Chapter 4. Plans sampling And measure in situ
4.1 Different sample In the environment marine
4.2 Site sampling (area of interest)
4.3 Approach statistical sampling
4.4 Measure in situ

Chapter 5 Methods of sampling
5.1 THE techniques of samples of the waters
5.2 THE techniques of samples of the sediments
5.3 THE techniques of samples of the biota

Chapter 6 Methods of treatment of the sample
6.1 Filtration
6.2 Extraction (liquid-liquid), liquid-solid, SPE, microwave, supercritical
6.3 Purification,
6.4 Freeze-drying And drying
6.5 Conservation

Works directed And works practices (9 p.m.)
TD1 Introduction has there metrology : units And equations to TD2
dimensionsError calculation
TD3 Validation of a analytical method
TP No. 1 : THE errors In the use of there glassware
chemical TP No. 2: THE features of a instrument of
measure
TP No. 3 : Validation of a method analytical: dosage of blue of methylene by spectroscopy UV-Visible
TPN° 4 Extraction liquid-liquid TP
N°5 Liquid-solid extraction

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 1

EMU 1.2 : ANALYSIS DIGITAL

Credits : 4

Coefficients : 3

Matter 1: Analysis digital

Goals of teaching : Perfect THE knowledge of the students acquired in 1st And 2nd year in giving of the aspects applied and practices on the study of the environment marine and of the analysis, there valuation And the exploitation of one-dimensional data.

Recommended prior knowledge : to be able to follow the lessons of this unit, the student must to have follow up THE teachings exempted In THE classes preparatory has know : Statistics, Mathematics And Computer science.

Goals of teaching :

Knowledge prerequisites recommended :

Contents of there matter

Course masterful (33 h)

1. Elements matrix analysis
    - 1.1. Matrices
    - 1.2. Operations on THE matrices
    - 1.3. Trace and determinant of a matrix
    - 1.4. Matrices particular
    - 1.5. Values clean And eigenvectors
    - 1.6. Products scalars vectors And vector standards
2. Methods direct For there resolution of the systems linear
    - 2.1. Resolution of a system linear by the method of pivot of Gauss
    - 2.2. Resolution of a system linear by there method of Gauss- Jordan
    - 2.3. Resolution of a system linear by there method of Cramer
3. Resolution of the equations And of the systems No linear
    - 3.1. Packaging of a equation
    - 3.2. A approach geometric of there determination of the roots
    - 3.3. Method of dichotomy, the methods of there rope, of there false position And Newton 's
    - 3.4. Iterations of point fixed For THE nonlinear equations
    - 3.5. Roots of the equations algebraic
    - 3.6. Criteria stop

3.7. Techniques of post-processing For THE methods iterative

3.8. Resolution of the systems of equations No linear

3.9. There method of Newton And its variants

3.10. Methods of point fixed

4. Interpolation polynomial

4.1. Interpolation polynomial

4.2. Shape of Newton of polynomial interpolation

4.3. Interpolation of Lagrange by pieces

4.4. Splines

5. Integration digital

5.1. Rectangle method

5.2. Method of trapeze

5.3. Method of Simpson

6. Resolution digital of the equations differentials ordinary

6.1. Introduction to differential equations

6.2. Method Euler's

6.3. Method Euler's explicit

6.4. Method Euler's implicit

6.5. Method(s) of Runge Kutta

Program of the works directed (27h)

TD No. 1 Ŕ Introduction At software Matlab

TD No. 2 Ŕ Analysis matrix on Matlab

TD No. 3 Ŕ Resolution of the systems linear with Matlab

TD No. 4 Ŕ Resolution of the equations No linear with Matlab

TD No. 5 – Polynomial interpolation with Matlab

TD No. 6 Ŕ Integration digital with Matlab

TD No. 7 Ŕ Resolution digital of the equations differentials ordinary with Matlab

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 1

EMU 1.3 : GIS & MAPPING

Credits : 4

Coefficients : 2

Matter 1 : GIS and Cartography

Goals of teaching : Describe there data geospatial, explain his characteristics, know the different spatial models that can represent it, identify its sources and master the different techniques for its integration into a Geographic Information System (GIS); Give of the examples of data geospatial In THE context " Environment Marine » and select the most appropriate spatial model to represent them;

Recognize And compare THE models spatial THE more widespread (raster And vector), list their advantages and disadvantages and know the techniques for switching from one model to another; Understand This what is A GIS And his features, notably, the acquisition, the analysis And there production of information geographical Or of there data has value useful addition For scientists and decision-makers;

Know how to design a GIS according to its objectives (management, decision-making, research);

Master the use of a software of GIS, of integration of the data has there production cartographic through modeling, editing and the rich range of analysis methods.

Knowledge prerequisites recommended: Of the concepts in mathematics (examples, theory of the sets, Boolean algebra , geometry, analysis, etc.) are desirable; Mastery of the Windows environment

Content of there matter

Part Course (21 h) :

Chapter I : There Data Geospatial (DG)(1h30)

1.1 Definition
1.2 Examples of data geospatial In the Marine Environment
1.3 Interest scientist, economic And strategic of there data geospatial

Chapter II : THE systems of reference spatial (1h30) * 2)

2.1 Surfaces of reference (Local/Global, horizontal/vertical, Ellipsoid/Geoid)
2.2 Systems of contact details of reference (SCR) (Different terminologies, Local/Global, Geographic/Plane)
2.3 Projections cartographic (Conforms/Equivalent, Old/New mapping)
2.4 Transformations between systems of reference And settings of passage
2.5 SCR adapted to studies in Environment marine

Chapter III : Acquisition and techniques integration of the data geospatial (1h30) * 2)

3.1 Survey direct (remote sensing, survey air, survey ground continent/marine, base of data, crowdsourcing)
3.2 Survey indirect (Georeferencing/Digitization manual, semi-automatic, automatic, edition, restitution photogrammetric/Image satellites, spatialization, transformations between models such as scanning and interpolation)

Chapter IV : Models spatial (1h30 * 2)

4.1 What Models of representation of there DG on computer ?
4.2 Concepts of Topology/variability temporal
4.3 Criteria of selection of model of representation
4.4 Components of there data geospatial according to THE model spatial (geometry/semantics/metadata)
4.5 Concepts of scale, of precision, of quality And of property
4.6 Concepts of formats (raster/vector)

Chapter V : Systems Information Geographic (1h30) * 2)
5.1 Historical
5.2 Domains application of the GIS
5.3 Definition of a System Information (IF)
5.4 Definition of a System Information Geographical (GIS)
5.5 Features
5.6 Architecture general of a GIS
5.7 Systems of Management of the Basics of data (DBMS)
5.8 Different configurations of a solution GIS
5.9 Steps of there bet in artwork of a GIS
5.10 Software GIS

Chapter VI : Abstraction (1h30)
6.1 Preparation of a Plan Conceptual of data geospatial (example : experimentation of the MERISE method)
6.2 Implementation

Chapter VII : Analysis(2 * 1h30)
7.1 Analysis spatial on of the data vector: Measures geometric (distances, surfaces, positions, perimeters, etc.), geoprocessing and spatial queries.
7.2 Raster Analysis: Raster measurements, MapAlgebra (logical, arithmetic, conditional operations, etc.), operations local (reclassification Or thresholding), neighborhood (filtering) and global (ACP)
7.3 Analysis of surface

Chapter VIII : Mapping(2 * 1h30)
8.1 Definition
8.2 Types of maps
8.3 Components of a map
8.4 Steps of there design of a map

Works practices (42 h) :

TP No. 1 : Facilities And socket in hand of a GIS software **(3 hours)**

- Facility of a software GIS ArcGIS/Qgis Or others ;
- Presentation of the environment of the software and features of base, setting preferences, etc.

TP No. 2 : Access to data geospatial **(3h00) TP n°3:** DG I Integration Techniques **(6h00**
Spatialization of a coordinate file;

- Georeferencing of a map (with all THE information on THE SEO spatial,

with a few information, without none information).

TP No. 4 : Techniques Integration of the DG II **(6:00 a.m.)**

- Digitalization (map/image satellite) ;
- Edition ;
- Access to BDD ;
- Projection/transformation of data geospatial (raster/vector)

TP No. 5: Techniques Integration of the DG III **(3h00)**

- Creation/modification of a structure of table of the attributes (fields alphanumeric)

TP No. 6 : Creation and implementation of a conceptual diagram of data **(3h00)**

TP n° 7: Vector analysis **(3h00)**

Lab No. 8: Raster Analysis I

(3h00) Lab No. 9 : Analysis Raster II **(3h00)**

TP No. 10: Preparation of a map area study **(3 hours)**

Practical work no. 11: Creation of a raster results map

(3 hours) Practical work No. 12 : Development of a map result vector **(3h00)**

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 1

UET-1.1 : ENGLISH for SPECIFIC PURPOSE I

Credits : 2

Coefficients : 1

Matter 1: English for Specific Purpose I

Goals of teaching : the student must acquire the basic notions of the English language, expressing himself on the dimensions and the quantities to describe the different ones objects according to the height, there width, and the surface Or THE weight, volume, and rate. These These concepts will be supplemented by a series of exercises to put them into practice. the application of
rules which govern the interrogative form, in this case the structuring of questions and answers in English, while respecting the tense (Present simple, present perfect or Past)

Knowledge prerequisites recommended: U E English

Contents of there matter

Course (8 p.m.)

Unit 1 : Describing the dimensions of year object :
- Height, Width, Weight, depth, missed ……
- Exercises
-Lexicon
Evaluation

Unit 2 : Speaking about quantity
-Countable nouns : a/an, tea, many, few, a few
-Uncountable nouns : much, little, has little
- Exercises : How much …. ? How many…… ? How far…. ?
- Video : How to talk about measurements ?
- Lexicon
Evaluation

Unit 3 : To say how often something does happen ?
- Usually, often, rarely, sometimes, ounce , twice…..
- Review of Present Simple tense.
- Exercises
- Lexicon
Evaluation

Unit 4 : Asking questions in Here simple tense
- How does …… ?
- Is it .....?
- Exercises
- Lexicon
Evaluation

Semester 2

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 2

UEF 2.1 : GEOCHEMISTRY OF THE SEDIMENTS, OF THE ATMOSPHERE AND BIOGEOCHEMICAL CYCLES

Credits : 6

Coefficients : 3

Matter 1: Geochemistry of the marine sediments

Goals of teaching : Perfect And to deepen THE knowledge of the students acquired in semester 5 in the fundamental disciplines. This fundamental unit will allow students to deepen their knowledge and of himself specialize in oceanography geochemistry, oceanography physical and in eco-biology marine. The objective of this subject is an introduction to the knowledge of the geochemistry of marine sediments and their evolution.

Recommended prior knowledge: to be able to continue the courses in this unit, the student must have followed the courses provided in the preparatory classes and the half 5, has know : there geology navy, there geochemistry of the marine waters And THE process of interaction geochemical liquid - solid .

Contents of there matter

Lectures (3 p.m.) :

1) **Preview on THE sediments sailors :**
   - 1.1) THE sediments of the margins continental
   - 1.2) THE sediments of the abyssal plains
2) **There diagenesis of the sediments of the margins continental :**
   - 2.1) There digenesis, its factors And his steps
   - 2.2) There area oxidation (area of bioturbation) :
     - 2.2.1) oxidation of the matter organic
     - 2.2.2) others process oxidation
   - 2.3) There area of reduction (area without bioturbation) :
     - 2.3.1) There diagenesis suboxic :
       - reduction of the nitrates
       - Reduction of manganese
       - Reduction of iron
     - 2.3.2) Diagenesis anoxic :
       - Reduction of the sulfates
       - Digenesis of the phosphates
       - Methanogens
     - 2.3.3) Diagenesis and training of minerals typically sailors
     - 2.3.4) Comparison with there diagenesis of the sediments lake And training of typically non-marine minerals.

3) **There diagenesis of the sediments of the plains abyssal :**
   - 3.1) THE carbonate sediments
     - 3.1.1) Dissolution of the carbonates
     - 3.1.2) Diagenesis And burial
   - 3.2) THE sediments siliceous (opal)
     - 3.2.1) Dissolution of the silica
     - 3.2.2) Diagenesis And transformation of the phases silicates
   - 3.3) There diagenesis suboxic of the matter organic

3.4) Training nodules polymetallic.

4) THE sediments of the ecosystems wealthy individuals in materials organic :

5.1) Preview on THE ecosystems particularly rich in materials organic: mangroves, fjords, estuaries…
5.2) Composition of the materials organic : humus, humins …
5.3) THE reports elementary And the origin of the matter organic,
5.4) There diagenesis, the catagenesis there metagenesis And evolution thermal sedimentary organic matter.

Works Practices And directed : 15 h

TP No. 1 : Study of there distribution vertical of the settings chemicals THE long of a carrot of deep sediment by the data to be collected from the literature:

- Distribution of carbonate of calcium (% of $CaCO_3$);
- Distribution of there matter organic
- Distribution of Fe, of Mn And others metals
- Determination of the limit between there area of bioturbation (layer oxidation) and the area without bioturbation (reduction layer) by the appropriate parameters.

P No. 2 : Levy And characterization of sediment : Collection of a deep sediment and study of the distribution of parameters:

- Presentation of there method of levy of a sediment marine deep by corer gravity research.
- Presentation of the method of cutting the carrot into samples and their conservation in petrie dishes for analysis.
- Description And study of there composition mineralogical of sediment has there binocular loupe .

TP No. 3 : Composition chemical of sediment :

- Determination of there concentration in matter organic by incineration

- Determination of there concentration of the carbonates of calcium by calcimetry

TP No. 4 : Composition chemical of sediment :

- Determination of trace metals in sediment, particularly iron and Mn at different depths of the sediment.

TP No. 5 : Composition chemical of sediment :

- Dosage of nitrogen organic In THE sediment.

Matter 2 : Geochemistry of the atmosphere
Goals of teaching : Perfect And to deepen THE knowledge of the students acquired in half 5 in fundamental disciplines. This matter will allow to students to access has there awareness of there geochemistry of the atmosphere And THE functioning

of this one .

Knowledge prerequisites recommended : For power pursue THE teachings of this subject, the student must to have followed the teachings exempted In THE half 5, has know : marine water geochemistry and marine physics (thermodynamics of the atmosphere).

Contents of there matter

Course masterful (3 p.m.)

1) Introduction :
- 1.1) Stratification of the atmosphere terrestrial.
- 1.2) Process has the interface air-sea :
  - 1.2.1) Interface air-sea And exchange of gas
  - 1.2.2) layer limit atmospheric

2) Elements of kinetics and of photochemistry,
- 2.1) Reactions in chains Ŕ process radicals
- 2.2) Reactions elementary and reactions global
- 2.3) Time of life
- 2.4) Photolysis
- 2.5) notion of ability oxidizing
- 2.6) Pollution urban/atmospheric

3) Composition chemical of the atmosphere
- 3.1) THE compounds carbon
- 3.2) THE compounds of nitrogen
- 3.3) Oxygen And hydrogen
- 3.4) THE compounds sulfur
- 3.5) Ozone And there layer ozone
- 3.6) THE gas rare
- 3.7) Introduction to phases condensed atmospheric :
  - 3.7.1) features of the aerosols atmospheric,
  - 3.7.2) balance of water,
  - 3.7.3) reactions heterogeneous,
  - 3.7.4) physical And chemistry of the systems cloudy
- 3.8) Introduction to rains acids :
  - 3.8.1) Definition of the rains acids
  - 3.8.2) Origins of the rains acids
  - 3.8.3) Consequences of the rains acids on THE natural environment

4) Composition of the atmosphere And the effect of tight
- 4.1) the effect of tight : the effect of tight natural And anthropogenic
- 4.2) THE gas has effect of tight And notion PRG
- 4.3) protocol of Kyoto (1997)
- 4.4) consequences of the effect of tight on there planet earth

5) Regulation Algerian relative has there pollution atmospheric

Matter 3: THE cycles oceanic biogeochemicals

Goals of teaching : Perfect And to deepen THE knowledge of the students acquired in semester 5 in fundamental disciplines.
This matter will allow to students to access knowledge of the flow of there matter And of the biogeochemical cycles in the ocean.

Knowledge prerequisites recommended : For to be able to follow the teachings of this subject, the student must have followed the courses provided in the half 5 and the half 6, namely: the geochemistry marine waters, there physical navy, there geochemistry of the sediments and of the atmosphere..

Contents of there matter

Course masterful (12h)

1. Introduction has there notion of cycle biogeochemical
2. THE Cycle biogeochemical of nitrogen
3. THE Cycle biogeochemical phosphorus
4. THE Cycle biogeochemical silicon
5. THE Cycle biogeochemical carbon
6. THE cycle biogeochemical metals traces
7. There sea Mediterranean : preview on there production primary And THE cycles biogeochemical

Works practices : (6h)

- Treatment And analysis of data oceanographic by ODV.
- Visualization And exploitation of the data oceanographic by ODV :
  - · Establishment of vertical profiles of the settings oceanographic,
  - · Study of there distribution of the settings by of the maps horizontal and vertical sections .

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 2

UEF 2.2 : INSTRUMENTATION OCEANOGRAPHIC

Credits : 3

Coefficients : 2

Matter 1 : Oceanographic instrumentation

Teaching objectives : Instrumentation in oceanography deals with the means used in oceanography to know THE physical properties of the ocean (offshore and inshore) by *in-situ* measurements . After a definition measured quantities and quantities which are deduced by calculation, this module details the operation of the sensors and instruments used to evaluate the parameters useful to oceanographers and describe the means employed For THE measures in sea Thus that THE techniques in course of development.

Knowledge prerequisites recommended : For power follow THE teachings of this matter, the student must to have follow up the teachings of physical general, physical navy, oceanography physics and mathematics .

Contents of there matter

I. Course masterful (9:00 p.m.)

Chapter 1 : Sensors And instrumentation out acoustic And optical (4h30)

Features of the sensors : Sensitivity, linearity, domain of use, extent of measure, …. Sensors for measuring: pressure, temperature, conductivity, dissolved oxygen
Measure Eulerian of fluent And measure of the swell

Chapter-2: Sensors And instrumentation using optics (3h00)

THE radiation electromagnetic (features of the waves electromagnetic, ...) Absorption and diffusion of light
Optics underwater
Optical properties of water Sea
Sensors optics (Fluorimetry, …)

Chapter-3: THE system Argos (3h00)

THE subsystems of system Argos
THE floats oceanic : features, sensors partners, …Float VS
Archimedes' principle
THE cycle And there derivative of a float

Chapter-4: Sensors And instrumentation using acoustics underwater (10:30)

Generalities on acoustic waves Characteristics of
- the waves mechanical acoustic pressure and intensity
- THE level sound, THE decibel
- Doppler effect
- Effect piezoelectric

Spread of the waves acoustics in the medium marine

Impedance acoustic, reflectivity
Loss of spread of the waves acoustics by divergences geometric And depreciation

2.3. Main applications in oceanography physical
General information on the pollsters And sonars (principle of functioning, ...) Side-scanning sonars
THE multibeam sonars
THE pollsters profilers of sediments (geology ADCP (acoustic current profiler)
Acoustic tomography The positioning acoustic
Instrument used by A diver For there mapping of habitats (Aquameter)

II. <u>Works directed (9:00 a.m.)</u>

TD-1: Exercises on the features of the sensors (calculated of the errors, sensitivity, etc.) (1h30)
TD-2 : Calculation of the depth, of there temperature, of the salinity, of there density has leave of the measurements given by the sensors (1h30)
TD-3 : THE lengths of waves and the frequencies used by the sensors optics underwater (1h30)
TD-4 : Exercises of applications on the shift, there gone up, there descent And speed of the Argos system floats (1h30)
TD-5 : Exercises on there spread of the waves acoustics underwater (1h30)
TD-6 : Treatment of the data issues of measures acoustics (1h30)

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 2

UEF 2.3: ECOPHYSIOLOGY AND ADAPTATION OF THE ORGANIZATIONS SAILORS

Credits : 5

Coefficients: 3

Matter 1 : **Ecophysiology And adaptation of the marine organisms**

Teaching objectives : This subject will first examine the main physiological functions of marine organisms, including thermoregulation, water and osmotic balance, gas exchange and acid-base balance. Secondly, it will focus on the adaptations of species to the different stresses encountered in the marine environment: salinity, hypoxia, pressure. hydrostatic, acidification of the oceans, stress thermal And light. Of the examples will be drawn
of a wide fan of habitats sailors, notably estuarine, coastal, benthic, intertidal rocky, and pelagic

Knowledge prerequisites recommended : For to be able to follow the teachings of this subject, the student must have followed the courses relating to marine biology and ecology provided In THE half 1. Thus that the modules of biology, zoology And botanical of preparatory classes

Contents of there matter

Course masterful (30h)

Course (30h) Introduction
1.1. Definition of Ecophysiology
1.2. Themes central of there physiology
1.3. Reminders of the constraints environmental specific in the middle marine

Part 1. Main functions physiological

1.1. Balance water And osmotic
1.1.1 .General information Ŕ Terminology
1.1.2. Mechanisms osmoregulation at the house of THE invertebrates And vertebrates sailors And organs involved

1.2. Thermoregulation
1.2.1. General information introductory Ŕ Terminology
1.2.2. Ectothermy : Tolerance
1.2.3. Ectothermy : Thermoregulation
1.2.4. Endotherm : Thermoregulation

1.3. Exchanges gaseous and balance acid- base
1.3.1. Considerations general
1.3.2. Oxygen And dioxide of carbon blood
2.3.3. Balance acid-base And regulation of pH

Part 2. Adaptations physiological
2.1. Adaptations has there hydrostatic pressure

2.1.1 Effects of high pressures
2.1.2. Perception of the variations of there pressure hydrostatic

2.2. Adaptation to variations of temperature
2.2.1. Answers physiological At stress thermal
2.2.2. Effects of there temperature on THE process ecological

2.3. Adaptations to variations of pH
2.3.1. Answers physiological to acidification of the oceans
2.3.2. Effects ecological of acidification of the oceans

2.4. Adaptations to variations of salinity
2.4.1. Answers physiological At stress thermal
2.4.2. Effects of there temperature on THE process ecological

2.5. Adaptation to variations of the light
2.5.1. Answers physiological to variations of there light
2.5.2. Effects And impact ecological of light

Works Directed (9 p.m.)
Work by function based on publications on selected models allowing for a better understanding of the complexity of integrated operation of the marine organisms in link with their environment. Making presentations.

Works practices (9 a.m.)

1. Exit on there area intertidal
2. Realization of a post on THE adaptations anatomical-physiological of the organizations from the intertidal zone to hard substrates

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 2

EMU 2.1 : TECHNICAL OF ANALYSIS CHEMICAL

Credits : 3

Coefficients : 2

Matter 1: Techniques chemical analysis

Goals of teaching : This part aim there mastery of the methods physical, chemicals and biochemical separation and analysis, namely: chromatography, spectrometric methods

Knowledge prerequisites recommended : For to be able to follow the teachings of this subject, the student must have followed the fundamental and methodological courses: Environmental metrology, chemistry, physics, mathematics

Contents of there matter

Course Magistral : (10:30 p.m.)

Chapter 1 THE spectrochemical methods

1.1. Concepts of interactions radiation- matter
1.2. THE devices of spectrometry optical
1.3. Spectroscopy molecular

- Spectroscopy UV Visible
- Spectroscopy IR
- Spectroscopy fluorescence

1.4. Spectroscopy absorption atomic
1.5. Spectroscopy resignation

Chapter 2The methods of separation

2.1 Chromatography of sharing
2.2 Chromatography in phase carbonated
2.3 Liquid chromatography has high performance
2.4 Chromatography ionic
2.5 Chromatography coupled has there spectrometry of mass

Chapter 3 Methods electro phoretic

3.1. Electrophoresis native
3.2. Electrophoresis denaturing

Chapter 4 Electrochemical methods

4.1. Potentiometry
4.2. Polarography

Chapter 6 Analysis of the isotopes in geochemistry

6.1. Isotopes stable And spectrometry of mass
6.2. Measures of the isotopes unstable (alpha spectro and gamma …)

Works directed And works practices : (10:30 p.m.)

TD No. 1 Spectrophotometry UV- Visible
TP No. 1 Analysis by spectroscopy atomic
TP N°2 Analysis in IR spectroscopy
TP No. 3 Analysis by spectroscopy of fluorescence
TP N°4: Chromatographic analysis by HPLC TP
N° 5 Analysis by ion chromatography
TP No. 6 Analysis chromatographic GC
TP No. 7 Analysis chromatographic on freeze (exclusion-diffusion)
TPN°8 Denaturing gradient gel electrophoresis

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 2

UEM 2.2 : TREATMENT AND ANALYSIS OF DATA

Credits : 4

Coefficients : 2

Matter 1: Treatment and Analysis of Data (TAD)

Goals of teaching : Perfect THE knowledge of the students acquired in 1st year And 2nd year in providing applied and practical aspects on the processing and exploitation of the various data acquired.

Recommended prior knowledge: to be able to continue the teachings of this matter, the student must to have followed the teachings exempted In the cycle of the classes preparatory (mathematics, statistics) and semester 1 (numerical analysis).

Contents of there matter

Course masterful (24 h)

Chapter 1- Analysis of the series mono- variable

I. Statistical descriptive
   a. Individual table / Variables
   b. Variables
   c. Paintings distributions
   d. Variable qualitative (Paintings, Graphs)
   e. Variable quantitative discreet (Tables, Graphs)
   f. Variable quantitative continue (Tables, Graphs)

II. Laws of probability
   a. Law Normal
   b. Law of Student
   c. Law of Chi -square

III. Estimate
   a. Average
   b. Frequency
   c. Variance

Chapter 2- Analysis of the series bi- varied

1. Tests of comparison
   1.1 Comparison of the averages (THE four case)
   1.2 Comparison proportions
   1.3 Comparison variances
   1.4 Test of khi two
2. Regression Linear
   2.1 Covariance
   2.2 Right of regression
   2.3 THE squares of regression
   2.4 Regression And causality
3. Series temporal
   3.1 Definition
   3.2 Equation of the trend
   3.3 Adjustment line

4. Analysis of variance
   4.1 REGRESSION LINEAR MULTIPLE
   4.2 Painting of ANOVA
   4.3 Linear model
   4.4 Tests partner has ANOVA

Chapter 3- Multidimensional analysis

1. Analysis in Main Components
   1.1. Matrices
   1.2. Algorithm ACP
   1.3. Projections
   1.4. Inertia
   1.5. Interpretation of ACP
   1.6. Regression multiple
2. Analysis Factorial
   2.1. Paintings cross dynamic
   2.2. Algorithm of AFC
   2.3. Interpretation of AFC
   2.4. Bi- plot
3. Classification Hierarchical CAH
   3.1. Development of the method
   3.2. Algorithm of the CAH
   3.3. Distances
   3.4. Dendrogram
   3.5. Interpretation
4. Analysis of the correspondences multiples
   4.1. Data
   4.2. Studies of terms and conditions
   4.3. Aids has the interpretation
   4.4. Bet in artwork

Program of the works directed (36h)

TD1- Distribution of a series discreet And of a series continue TD2- Calculation of the statistical summary
TD3- probability laws
TD4- Tests of TD5
compliance - Statistical
tests
TD6- Analysis of regression linear
TD7- Chi-square test
TD8- Analysis of variance
TD9- Principal Component Analysis TD10- Analysis Factorial of the TD11- Classification correspondences Ascending Hierarchical

- Use Excel And Excel STAT
- Application software STATISTICA

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 2

EMU 2.3 : MODELING DIGITAL

Credits : 4

Coefficients : 2

Matter 1: Modeling digital

Goals of teaching : This matter has For aim to deepen THE knowledge learners on THE models used in oceanography (notably chemical/geochemical, physical …), And has develop their skills in there personal achievement of numerical and environmental assessment models.

Knowledge prerequisites recommended : Analysis digital, processing and analysis of data ; physical oceanography; mathematics

Contents of there matter

Course masterful : 22.5 h

1 – Reminders of the concepts mathematics And of mechanical of the environments continuous

1.1. Derivatives, derivative partial And material derivative
1.2. Fields advection
1.3. Hypotheses general
1.4. Laws of behavior
1.5. Deformations And constraints

2- Concepts on THE equations to derivatives partial

2.1. Equations hyperbolic
2.2. Equations parabolic
2.3. Equations ellipticals

3- Modeling mathematical of the phenomena of transportation

4.1. Equation of conservation of there mass
4.2. Equation of quantity of movement
4.3. Equation of energy
4.4. Equation of conservation of chemical species
4.5. Models of Turbulence

4- Methods digital of discretization

4.1. Method of the Finite differences
4.2. Methods of the Finished volumes
4.3. Method of the Elements finished

5- Numerical modeling 5-1.
Discretization And mesh 5-2.
Numerical diagrams
5-3. Construction of system numerical
5-4. Boundary conditions
5-5. Display And post- processing

5-6. Convergence, consistency And stability

6- Resolution digital

6-1. Methods of resolution digital 6-2.
Convergence and validity tests
6-3. Applications : Transport Equation, Diffusion Equation, Convection-Diffusion-Dissipation Equation, Wave Equation, Nonlinear Parabolic Equation, Nonlinear Hyperbolic Equation

Program of the works directed: 10.5 p.m.

1- Equations to partial derivatives
2- Modeling mathematical
3- Discretization And mesh
4- Diagrams digital
5- Terms initials and conditions to boundaries
6- Programming and resolution digital
7- Convergence And stability
8- Treatment And Resolution digital on computer

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 2

UED 2.1: COMPUTER PROGRAMMING

Credits : 1

Coefficients : 1

Matter 1: computer programming

Goals of teaching : The objective of this education East of prepare the learner has intelligence artificial in him lavishing THE elements keys of there computer programming

Knowledge prerequisites recommended : analysis digital, computer science of the classes preparatory

Contents of there matter

Volume hourly total : 15 h

- Programming Python
- Programming R

THE teachings are organized below shape of works practices with direct applications

Work staff : Realization of programs in Python and R on miscellaneous examples oceanographic applications

Fashion devaluation : programs realized by THE students are noted

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 2

UED 2.2 : WORKSHOP SEA & COASTLINE

Credits : 2

Coefficients : 1

Subject 1 : Workshop Sea & Coastline

Goals of teaching : See on THE ground THE knowledge theoretical And practices acquired At course of course.

Knowledge Recommended prerequisites: The teachings of S1 And S2 of the specialty

Contents of there matter

Volume hourly total : 30 h

A week blocked will be consecrated has :
Option 1 : A internship of diving underwater in view of obtaining of level 1. The learner will have to address the following points:

- Concepts theoretical of base : (there physical, THE accidents of diving, there regulations, etc.)
- Swimming with And without diving suit (PMT : palms, mask And tuba).
- Learn has rig And unrigger THE diving suit Thus that at adjust THE vest stabilization
- Realization of at least ten dives framed at the end of which the student must know how to stabilize at any depth (control of the vest); monitor their air consumption (use of the pressure gauge); react to common situations (air shortage of a teammate, pain in the ears or to the sinus, cold, loss of the dive, etc.); exercises mask emptying ; control of ascent speed with good stabilization at the decompression stop.
- Report of internship on THE knowledge acquired and on This Who has summer observed in diving

Option 2 : A multidisciplinary mini-project accomplished At breast of the laboratories of research of ENSSMAL.

- A report of the whole of the multidisciplinary activities will have to be accomplished

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 2

UET-2.1 : ENGLISH FOR SPECIFIC PURPOSE 2

Credits : 2

Coefficients: 1

Matter 1 : English-2 : Techniques oral expression

Teaching objectives : the student must know how to compare between two entities in using the structures of comparison, either " comparative adjectives: exp ….bigger than » Or THE "superlative adjective: exp …..the biggest " or even the similarity : ….as big as ……The modification rules will allow the student to enrich there structure of there sentence, in adding of the information Before THE name, by THE process of
" pre-modification » or after the name by " post-modification ".
To understand scientific terminology, knowledge of the laws of affixation is necessary to dissect THE terms techniques. THE program plans the explanation of the graphs And there reading of the Numbers
that contain statistics. These concepts will be supplemented by a series of exercises to verify the acquisition of skills

Knowledge recommended prerequisites: the UET of the half 1.

Contents of there matter

Course (8 p.m.)

Unit 1 : Comparison
- Comparative adjectives : ……is bigger than……
- Superlative Adjectives : Tea biggest, tea best, ……
- Similarity : …..as big ace ……..
- Exercises
- Lexicon
- Assessment

Unit 2 : Modification
- Pre-modification : Determiners, adjectives
- Postmodification : Relative clauses introduced by Who, which, that…….
- Exercises
- Lexicon

Unit 3 : Scientific affixation (Prefixes) and suffixes)
- Suffixes
- Prefixes
- Exercises
-lexicon
Evaluation

Unit 4 : Figures, charts, graphs
- Reading figures
- Explaining Graphs and charts
- Exercises
-lexicon
Evaluation

Semester 3

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 3

UEF 3.1: POLLUTION NAVY PHYSICAL AND CHEMICAL

Credits : 5

Coefficients : 3

Matter 1: Physical and chemical

Goals of teaching : the objective of the course East of know the different types of the physical pollution, understand its origin and master the methods of its evaluation and remediation.

Recommended prior knowledge: to be able to continue teaching this subject, the student must have followed the teaching provided in the preparatory classes cycle (general chemistry, chemistry waters natural), the half 1 (UEF1.1 And UEF1.2) and the half 2 (UEF2.1 and UEF2.2).

Contents of there matter

Course Magistral : (39h)

Chapter 1 : General information on there pollution
marine Introduction to pollution of seas and oceans
General information on marine and coastal pollution
Types of pollution navy (physical, chemical and organic)
Sources of pollution in medium marine (emissions, transfer pathways) And receiving environments: seawater, suspended solids and sediments, biota)

Chapter 2 : Indicators of there pollution navy
1. There request in oxygen (BOD, COD)
2. THE potential hydrogen
3. There turbidity
4. THE materials in suspension
5. There matter organic And mineral
6. There concentration ammonium

Chapter 3 : Physical Pollution (mechanical and waves)
1/ Abrasion of the funds and modification of turbidity (trawling, dredging, reefs artificial, extraction of aggregates on the coast…)
2/ Effect of there turbidity on the quality of the waters, the wildlife And flora marines 3/ Noise disturbances (maritime works, sonar, etc.)
Studies case: sediments dredging …

Chapter 4 : Macro-waste and micro- plastics
1/ THE different types of macro -waste
2/ Mechanisms of passage of macro has microplastic
3/ Effects on marine flora and fauna
Study of case : THE 6th continent

Chapter 5 : Pollution by radioelements

Reminders on there radioactivity And THE radiation radioactive
Natural and artificial sources of irradiation
Routes and transfer of radioactive pollution
Impact of radiation on there matter biological
Study of case : Accidents of Chernobyl, of Fukushima

Chapter 6: Modification of the temperatures And salinities
Modification of the temperatures by THE warming climate and the thermal power plants
Modification of salinities by discharges from desalination plants
Study of case : impacts of the stations of desalination / power plants thermal

Chapter 7 : **Eutrophication, deoxygenation And acidification of the waters marines**

1. Excess of the salts nutritious And of materials organic, consequences on THE marine ecosystems
2. Events hypoxic benthic, proliferations algae (blooms)
3. Acidification of the waters And acidification additional by eutrophication

Chapter 8 : THE hydrocarbons
1/ Reminders of the properties of the Hydrocarbon Aromatic Polycyclic (HAP): (Solubility, Octanol/water partition coefficient Kow, Diffusion coefficient, Density and viscosity)
2/ Behavior And become of the hydrocarbons (persistence, volatilization, biodegradability)
3/ Evaluation of the toxic effects of hydrocarbons

3.1.1. Splitting of the hydrocarbons And thresholds of toxicity
3.1.2. System of Equivalence Toxic (TEF & TEQ) 4/

Methods for measuring hydrocarbons in the marine environment
Studies of case of pollution to hydrocarbons in medium coastal And marine (Pollutions massive by oil tanker accident, Gulf of Mexico spill, etc.)

Chapter 9: THE products organic persistent (POPs)
1/ THE organochlorines, the toxins, TBT, …
2/ Concepts of bioaccumulation, bioconcentration And biomagnification 3/ Properties and behavior of POPs in seawater

- Water solubilitySw liposolubility (coefficient octanol/water)
- Pressure of saturated steam P
- Speed of volatilization Ki
- Coefficient absorption Koc

4/ Methods of measure of the organochlorines in marine environment

Chapter 10 : THE elements Traces Metallic (ETM)
1/ THE sources natural and anthropogenic of the metals Sources minerals and hydrothermal
2/Behavior of ETMs in waters and sediments

2.1. Mobility, bioavailability And bioaccumulation
2.2. Transfer And broadcast between compartments 3/ Analysis of metal pollution

3.1. Noise of bottom geochemical And concentrations of reference
3.2 Reminders methods analysis ETMs

Studies of case of pollution to metals in medium coastal and marine (Accident of Minamata, …)

Workshop on there regulations, the standards and the thresholds of imposed tolerance For there protection of the marine environment in Algeria and the world

Works practices (9 p.m.) + 2 field trips

TP 1 Measure of there turbidity and effect on the penetration of the light In water of the sea. TP 2 Identification and quantification of micro and macro waste (field trips)
TP 3 Effect of there pollution thermal on the marine environment (exit on ground : central coastal electric to see the effects of the discharge of hot water from the power plant cooling circuit) TP 4 pollution indicators 1 (pH, conductivity, dissolved O2, etc.).
TP 5 Indicators of pollution 2 (DCO And BOD5).
TP 6 Extraction, purification and concentration of the hydrocarbons In water and the sediment TP 7 Analysis of total HPA in water and sediment by fluorescence.
TP 8 Extraction of the elements traces metallic of the sediment by digestion.
TP 9 Analysis of trace metal elements by AAS.

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 3

UEF 3.2: MANAGEMENT OF THERE POLLUTION NAVY AND COASTAL

Credits : 5
Coefficients : 3

Matter 1: Management of there marine pollution And coastal

Goals of teaching : the objective East of provide to students engineering And THE tools of sizing of systems and stations of treatment and purification of the waters worn out Thus as well as fundamental knowledge relating to the treatment of different types of pollution.

Recommended prior knowledge: to be able to continue teaching this subject, the student must have followed the teaching provided in the preparatory classes cycle (chemistry general, water chemistry natural), the half 1 (UEF1.1 And UEF1.2) And THE half 2 (UEF2.1 and UEF2.2).

Contents of there matter

Course masterful (39)

Chapter 1 : treatment and purification of waters worn out

1.1) Pretreatment (treatment physical) : Screening, Sieving, Sand removal And Deoiling

1.2) Treatments primary (treatment physicochemical)

1.2.1. Coagulation-Flocculation

1.2.2. Decantation-Flotation

1.2.3. Adsorption

1.3) Treatment secondary organic

1.3.1. Crops free : sludge activated

1.3.2. Lagooning

1.3.3. Crops fixed (bed bacterial And biofilter)

1.3.4. Treatments mixed (Bioreactors has membrane)

1.4) Treatment And valuation sludge And of the waste solids

Chapter 2: struggles against THE massive pollution

2.1) THE spill of oil in sea

2.1.1) THE accidents of the oil tankers

2.1.2) THE breakups of pipelines

2.1.3) THE plates shapes offshore

2.1.4) THE continental sources

2.2) Struggle against THE pollution oil companies

2.2.1) There prevention

2.2.2) There fight in sea

2.2.3) There struggle in medium coastline

Chapter 3: management of the sediments of dredging

3.1. Case of the sediments No polluted

3.2. Case of the sediments polluted

Titled of the TD (VH 9 p.m.)

TD n°1: Physical treatment TD
No. 2 : Coagulation-Flocculation
TD n°3: Decantation-Flotation
TD n°4: Adsorption
TD No. 5: Estimates of TD flow
rates No. 6 : Treatment organic

Exit on Ground : Visit of station of treatment of Waters Worn out (6h)

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 3

UEF 3.3: HYDRODYNAMIC COASTAL AND COASTLINE

Credits : 4

Coefficients : 2

Matter 1: Hydrodynamic coastal and coastal

Teaching Objectives : The objective of this course is the study of dynamic processes specific to coastal and littoral regions. It aims to give students expertise on the complexity of real processes and a critical mind on their modeling. This course is divided into
in two parts which deal respectively with the hydraulics of phenomena linked to waves and coastal sedimentary dynamics.

Recommended prior knowledge: to be able to follow the courses in this subject, the student must have followed the courses provided in the preparatory classes cycle (marine physics), semester 1 (oceanographic physics).

Contents of there matter

Course masterful (24 h)

1. Characterization of the states of the sea

1.1. Classification states of sea
- Ladder Beaufort
- Ladder of Douglas

1.2. Characterization of the states of sea by geographic area

1.3. Measure states of sea

1.4. Treatment statistical of the results

2. Swell real

2.1. Classification of the swell

2.2. Different models of swell

2.3. Settings of description of there swell

3. Analysis statistical of the swell real

3.1.1. Decomposition of a swell real in swells simple

3.1.2. Analysis wave by wave

3.1.3. Distribution of the heights of waves

3.1.4. Determination of the amplitude significant

3.1.5. Determination of there period significant

3.1.6. Swells of project

4. Representation spectral of the states of sea

4.1. Description spectral of states of the sea

4.2. THE different types of specters

5. Wave mechanics

5.1. Wave Fundamentals and Classification of Waves

5.2. Elementary Progressive Wave Theory (Small-Amplitude Wave Theory)

- Wave Speed, Length, and Period

- Tea Sinusoidal Wave Profile
- Local fluid velocities and acceleration
- Water particals displacements
- Surface pressure
- Velocity of has Wave Group
- Wave Energy and Power .
- Higher Order Wave Theories

5.3. Higher Order Wave Theories
5.4. Stokes' Progressive, Second-Order Wave Theory
- Wave Celerity, Length, and Surface Profile
- Water Particle Velocities and Displacements
- Mass Transportation Velocity
- Subsurface Pressure
- Maximum Steepness of Progressive Waves
- Comparison of the First- and Second-Order Theories

5.5. Cnoidal Waves
5.6. Solitary Wave Theory

6. The evolution of there swell in out of there sea of wind

6.1. Spread of there swell
6.2. Schooling of the swell
6.3. Refraction of there swell
- Refraction by there bathymetry

6.4. Diffraction of the swell
- Calculation of diffraction
- Diffraction of the swell on THE breakwater
- Diffraction of the swell on THE piers of a port
- Combined refraction- diffraction

6.5. Reflection of the swell
- Reflection of there swell on THE structures waterproofs, walls vertical (Linear theory)
- Reflection In A basin farm
- Reflection of there swell on a slope plane, beaches, THE coatings And THE breakwater
- Reflection of the swell on variable bathymetry
- Refraction waves thoughtful

6.6. THE cuttlefish
6.7. THE tsunamis

7. THE Surge of the waves

7.1. Systems of currents related At surge
7.2. Different types of surge
- Sliding surge
- Plunging surge
- Frontal surge
- Surge has collapse

7.3. Analysis of surge
7.4. Terms of surge
7.5. Height of swell In there area of surge

8. Currents generated by the swell

8.1. General outline of the ocean currents

8.2. Transportation of mass
8.3. Fluent coastline due to there swell
- Currents longitudinal
- Currents transverse

8.4. Currents coastlines And THE sediment transport

Program of the works directed (9 p.m.)

TD1- Classification And measure of the states of sea
TD2- Classification, prediction , observation And measure of there swell
TD3 - Analysis statistical of there swell real
TD4- Representation spectral of the states of sea And Treatment of signal of the waves
TD5 - Calculation THE settings of there swell (there length wave, there height, the speed of phase, group velocity, horizontal and vertical velocity of water particles, acceleration of particles of water, energy of the swell….)
TD6- Refraction of there swell
TD7- diffraction And reflection of there swell
TD8 - Modeling digital of the spread of the swell from the open sea to there side by the SWAN model, swach\
TD9- Modeling of the currents sailors

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 3

UEF 3.4 : DEVELOPMENT SUSTAINABLE

Credits : 2

Coefficients : 1

Matter 1 : Development Sustainable

Teaching Objectives : This course aims to enable students to gain a global vision and understand the different social, economic, environmental and cultural dimensions and components of development as well as to grasp their complexity. Students will acquire knowledge about the concept of sustainable development, its evolution, and its implementation at different scales. The analysis and monitoring and evaluation tools will be also addressed

Recommended prior knowledge : to be able to continue teaching this subject, the student must have followed the teaching provided in the first semesters of speciality

Contents of there matter

Course masterful (3 p.m.)

I. Introduction

- THE models of development current And their limits.

II. History And definitions

- Birth of concept of development sustainable And her evolution
- Definitions of development sustainable

Perception of sustainable development

THE development sustainable of the marine areas And coastal

Effects, benefits And benefits of a approach based on THE development sustainable development and resilience

THE big programs of development sustainable

III. Main instruments legal international of sustainable development

Convention Ŕ biodiversity CDB And his protocols

Convention - Change climate Ŕ UNFCCC And Agreement of Paris on THE Climate

Convention - Desertification

IV. Foundations And principles

- THE foundations of development sustainable
- Presentation of the principles of development sustainable

V. Evolution of concept of development sustainable

- Dates And key conferences

VI. Actors And tools of development sustainable

VII. THE Goals of Development Sustainable (ODD)

- Context And features

- THE 17 SDGs
- THE contributions SDGs
- Actors of the SDGs And their contribution
- State of progress of the bet in artwork

VIII. Measure THE development sustainable

- The indicators
- The imprint ecological
carbon footprint
- THE GDP Green
- The Index of development human (IDH)
Ecological accounting

IX. The companies And THE development sustainable

- Historical
- The commitment of the companies In THE development sustainable
(benefits, methodology and application)
- THE challenges of development sustainable In THE companies
- There responsibility social And environmental of the companies (RSEE)

B. Works directed (3 p.m.)

Calculation of the indicators (example : Biodiversity, change climate, water, energy)
Calculation of the ecological footprint
Calculation of the imprint carbon
Realization of a investigation on THE development sustainable

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 3

EMU 3.1 : REMOTE SENSING

Credits : 4

Coefficients : 2

EMU 3.1 : Marine remote sensing - 1

Goals of teaching :

Describe THE plan acquisition of a picture satellite has leave of a sensor passive And to understand the different interactions that impact the measurement;

Differentiate between THE sizes measured And estimated Thus that THE features geometric and radiometric of the measurement;

Explain image formation satellite and its spatial, spectral and radiometric characteristics; **Know** the different missions observation spatial old, current and future, there nomenclature levels of distribution of the data satellites And **know how to select** those Who are suitable THE better to each problem;

To understand the techniques of there photo-interpretation And THE methods of treatment satellite images And

Master their execution on A software of treatment of images (ENVI, SeaDAS, SNAP Or others).

Recommended prior knowledge : Notions in physics (electromagnetic field, optics, etc.) and in mathematics (theory of the sets, algebra Boolean, geometry, analysis data, etc.) are desirable; Mastery of the Windows environment.

Contents of there matter

Course Magistral (9 p.m.)

Chapter I :Introduction (1h30 * 2 **)**

1.1. Definition of there remote sensing

1.2. Historical of observation of there earth : missions old, current And futures

1.3. THE applications of there remote sensing in Environment marine

1.4. THE settings oceanic measures by remote sensing (color of water, temperature of surface, altimetry, etc.)

1.5. Systems observation permanent And emergence of oceanography operational

1.6. Interest scientist, economic and strategic of there remote sensing

Chapter II : Orbits, Satellites And Sensors (1h30)

2.1. Types of orbits

2.2. Types of satellites

2.3. Sensor types (Heliosynchronous/Geostationary, Panchromatic/Multispectral/Hyperspectral, Optical/Passive/Radar/Lidar, Imager/No imager)

Chapter III : Basics physical of there remote sensing optical (2* 1h30)

3.1 Plan classic acquisition

3.2 THE radiation electromagnetic And his properties

3.3. THE spectrum electromagnetic And her interest in remote sensing

3.4 Energy of a wave electromagnetic And sizes physical (Irradiance, luminance, radiance, reflectance)
3.5. Interaction radiation And atmosphere
3.6 Windows atmospheric
3.7. Interaction radiation And matter (Case of a target land/sea)
3.8 Spectral signature

Chapter IV: Image satellite (2 * 1h30)
4.1 Training of the image
4.2 Features
4.2.1 Resolution spatial (weak, average, high, very high)
4.2.2 Resolution spectral
4.2.3 Resolution temporal
4.2.4 Resolution radiometric
4.3 Improvement/Degradation of the features
4.4 Levels of distribution (Signal analog/ digital image)

Chapter V : Corrections of images (Pretreatments) (2 * 1h30)
5.1 Corrections atmospheric (THAT)
5.1.1 For what ?
5.1.2 Approaches (empirical, modeling)
5.2 Corrections geometric (CG)
5.2.1 For what ? When and How ?
5.2.2 Approaches (empirical, modeling)

Chapter VI : Photo-interpretation (PI) (1h30)
6.1 Definition
6.2. Tool help has there PI (Composition colorful, etc.)

Chapter VII : Image processing (TI) (2 * 1h30)
7.1 Origin of the Methods of IT
7.2 Transformations local, of neighborhood and global
7.2.1 Improvement of contrast
7.2.2 Classification (supervised/unsupervised supervised, assessment of the precision)
7.2.3 Filtering
7.2.4 Calculation of clues
7.2.5 Analysis in Components Main

Chapter VIII : Post-processing (2 * 1h30)
8.1 Statistics on the image
8.2 Mosaicing
8.3 Mapping

Works practices (42 h) :

TP No. 1 : Facility and presentation of the software packages of image processing satellites general ENVI, QGIS and dedicated to oceanography (SEADAS, SNAP, etc.) **(3h00)** .
TP No. 2 : Registration to bases of data satellites and procedures of download (USGS/NASA OceanColor/Eumetsat/Copernicus hub/CMEMS) **(3h00)**
TP No. 3 : Initiation has there handling of images satellites I (Reading of different formats, Display, metadata, import, export, tools vector, king, extraction spatial, spectral, etc.) **(3h00)**

TP No. 4 : Initiation has there handling of images satellites II **(3h00)**
TP No. 5 : Corrections atmospheric by model/empirical of a interface terrestrial **(3h00) TP n°6:** Atmospheric corrections by model/empirical of a marine interface **(3h00) TP n°7** : Geometric corrections (different cases) **(3h00)**
TP No. 8 : Photo-interpretation of images & techniques **(3h00) TP n°9** : Filtering **(3h00)**
TP No. 10 : Classification supervised Ŕ No supervised **(2 * 3h00) Practical work No. 11** : Assessment of there precision of a classification (3h00) **Practical work no. 12** : ACP and index calculation **(3h00)**
TP No. 13 : Post-processing of a result of treatment of images **(3h00)**

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 3

EMU 3.2 : MODELING OF ONE MEDIUM CONTINUOUS

Credits : 3

Coefficients: 2

Matter 1 : Modeling of a continuous medium

Goals of teaching : This matter has For aim to deepen THE knowledge learners on THE models digital used in oceanography For solve THE problems And there understanding of the phenomena has small And medium scale.

Knowledge prerequisites recommended : Modeling 1, Analysis digital, treatment And analysis of data, geochemistry of the waters marines, of the sediments sailors, of the atmosphere and marine physics.

Contents of there matter

Course Magistral (15 h)

Chapter 1 - Modeling digital of a medium continuous : Ocean and Sea

1- Fundamentals of numerical modeling
   - 1.1- The equations primitives
   - 1.2- The approximation of Boussinesq
   - 1.3- The equations in waters little deep
   - 1.4- Equations of conservation of there heat and the salt 1.5- The " density "
   - 1.6- The ≪ closure ≫ of there turbulence 1.7- Boundary conditions

2- THE digital grids
   - 2.1- THE methods explicit And implicit
   - 2.2- Off-center grids
   - 2.3- THE CFL criterion
   - 2.4- Contact details horizontal And transformation of the grids horizontal 2.5- Coordinates and vertical grids
   - 2.6- The diagrams advection

3- THE initial conditions And to borders open
   - 3.1- Classification of the equations to derivatives partial 3.2- Models with open borders
   - 3.3- THE methods practices of calculation of the terms initials
   - 3.4- Terms to borders open For THE models solving the equations primitives 4- Basic techniques for discretizing primitive equations
   - 4.1- Differences finished
   - 4.2- Elements finished
   - 4.3- Expansion of Fourier

5- Study of the answer of the diagrams of discretization
   - 5.1- Conservation of there mass, of there variance and of energy 5.2- Monotonicity

Works Practices : 3 p.m.

TP 1- Presentation general of Model 3D ROMS (Or All other model existing in open source of the same type: code structure, compilation tests and data preparation) (3h)

TP 2- Simulation on 3D ROMS on a area of the side Algerian (3h) TP 3- Preparation of the grid (3h) TP 4- Forcing and conditions to borders, Simulations (3h) TP 5- Exploitation chart of the results And diagnosis (3h)
Work staff : Design of small programs computers specific has of the case studies (at the student's choice) within the framework of modeling digital.

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 3

EMU 3.3 : HSE (HYGIENE – SAFETY – ENVIRONMENT)

Credits : 3

Coefficients : 2

Matter 1 : Hygiene - Security - Environment

Teaching objectives : Training in health, safety and environment allows students to acquire a set of scientific, technical and managerial knowledge which will serve of base For there mastery of the risks during of their works practices And of research.
This to them also serves in the protection of the environment. She also allows to engineers easy integration into the professional environment and adaptation within companies.

Recommended prior knowledge: To follow this training and achieve the set objectives, it is important that students have the following skills: Mastery of IT tools; Analytical and synthesis skills; Language skills

Contents of there matter

Course masterful (9 p.m.) And Activities – TD (24h)

Chapter 1 : Organization, functioning And management of the activity HSE

1. Introduction has training HSE
   1.1. Vision global on there training And her progress
2. Regulation and HSE Standards
   2.1. Regulation And standards Who manage the activity HSE
   2.2. Roles, responsibilities And authorities At breast of the companies

Chapter 2 : Prevention, intervention And mastery operational HSE

1. Organization of the prevention
   1.1. Principles And organs of prevention (INPRP, CNAS, Medicine of work, CPHS, labor inspection, OPREBAPTH, etc.)
2. Identification of the dangers, assessment of the risks And mastery operational
   2.1. Identification, assessment And mastery of the risks professionals (risk chemical, biological, mechanical, electrical…)
   2.2. Identification, assessment And mastery of the risks technological (fire, explosion, etc.)
   2.3. Identification, assessment And mastery of the risks environmental (spill, pollution, etc.)
3. Facilities classified For there protection of the environment (ICPE)
   3.1. Classification of the ICPE
   3.2. Management of the ICPE
4. Study of hazard
   4.1. Frame legal
   4.2. Preparation And bet in artwork of the study of hazard
5. Study impact on the environment
   5.1. Frame legal
   5.2. Preparation And bet in artwork of the study impact on the environment
6. Communication HSE
   6.1. Importance of there communication HSE in the company

6.2. Techniques And means of training, information And awareness HSE At breast companies

7. Organization of the intervention
   7.1. Vision global on the organization of the intervention
   7.2. Bet in artwork plans intervention
   7.3. Use of the means of first rescue.

Chapter 3: Management of there health, of there security At work And of the environment

1. Management SSTE
   1.1. Introduction At management of there health, the security At work And of the environment
   1.2. Importance of management SSTE In there performance of the companies
2. System of management of the environment according to there standard ISO 14001 v 2015
   2.1. Bet in place of a system of management of the environment (SME)
3. System of management of there health and the security At work according to there standard ISO 45001 v 2018
   3.1. Bet in place of a system of management of there health And there security At work (SMSST)
4. Visit on site of an installation classified For there protection of the environment (Station desalination, laboratory, water treatment plant, etc.)
   4.1. Choice and visit of an installation classified For there protection of the environment, to acquire know-how and put into practice what has been learned.

Others Activities : Of the workshops and exercises on case practices are included In THE course for better student learning.

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 3

UEM 3.4 : PROCESSES OF TREATMENT AND DESALINATION WATER

Credits : 2

Coefficients : 1

Matter 1: Processes of treatment and water desalination

Teaching objectives : this subject will enable students to become familiar with sea/brackish water desalination technologies, to understand the impacts of the different processes used on the environment and to learn about the practices

Recommended prior knowledge: to follow the lessons in this unit, the student must have followed THE course exempted in classes preparatory ; has know: the chemistry general, chemistry of natural waters, general oceanography

Contents of there matter

Volume hourly overall (25 h)

Chapter 1. Introduction

Reminder on THE :

- Features of the waters natural (groundwater, surface water, water of the sea And brackish waters);
- Uses of water And standards of quality ;
- Needs in water And challenges of desalination ;
- Situation of desalination In THE world And in Algeria.

Chapter 2. Main technologies of desalination of waters

2.1. Thermal processes

1.1.1. Distillation has simple effect

1.1.2. Distillation multiflash

1.1.3. Distillation has multiple effects

1.1.4. Compression mechanical of steam

2.2. Processes membranes

1.2.1. Electrodialysis

1.2.2. Reverse osmosis

2.3. Processes powered by renewable energies

2.4. Problems techniques encountered

1.4.1. Sealing

1.4.2. Corrosion

1.4.3. Scaling.

Chapter 3. Fashion of functioning of a facility desalination

3.1. Elements constituents of a unit desalination

3.1.1. Socket of water of sea

3.1.2. Job of pre -treatment

3.1.3. Desalination process

3.1.4. Job of post- processing

3.2. Studies of case (station monobloc Ŕ mega-station Ŕ station in cycle combined)

Chapter 4. Impacts environmental of desalination And measures attenuation

4.1. Impacts environmental

1.1.1. Emissions atmospheric

1.1.2. Alteration from the middle receiver

4.2. Methods preventive And management rejections

4.3. Legislation

Exit on ground : Visit of station of desalination of water of sea (6h)

Work staff : Reports of exit

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 3

UET 3.1: ENGLISH FOR SPECIFIC PURPOSE III

Credits : 2

Coefficients: 1

Matter 1: English for specific purpose 3

Goals of teaching : There progression of the student must himself TO DO in reinforcing his skills to describe the different shapes: one-dimensional, two-dimensional or three-dimensional.
THE future engineers will be to call has apply the different ones procedures " processes ", such that there function And there ability, there relationship between there cause And the effect, the sequence logic of the sequences, And the method which differs from one process to another.

Knowledge prerequisites recommended : UET- 2

Contents of there matter

Volume hourly : 8 p.m.

Unit 1 : Shapes

- One dimensional shapes
- Two dimensional shapes
- Three dimensional shapes
- Exercises
-lexicon

Evaluation

Unit 2 : Process 1 Functions and ability

- Function of devices
- Instruments
- Ability and capacity
- Exercises
-lexicon

Evaluation

Unit 3 : Process 2 Cause and effect

- Actions and results
- Changes of state
- Causing, allowing and preventing
- Exercises
-lexicon

Evaluation

Unit 4 : Process 3 Purpose and Method

- How things should be done
- How things may be done
- Describing experiments
- Exercises
- lexicon
- Assessment

Semester 4

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 4

UEF 4.1: BIOLOGICAL POLLUTION AND ECO- TOXICOLOGY

Credits : 6

Coefficients : 4

Matter 1 : Pollution biological

Goals of teaching : the objective of course is of know the different types biological pollution, understand its origin and master the methods of its evaluation.

Knowledge prerequisites recommended :

Contents of there matter

Course masterful (20)

1- Definition And kind of there biological pollution
2- THE main sources of there microbiological pollution
3- Become of the microorganisms In water of sea
4- Diagnosis And measures of there pollution
microbial 4-1- Suspended matter
4-2- There charge of pollution (there
BOD5) 5- Bacterial identification
5-1- THE samples (means techniques, rhythms And terms of levy, nature samples collected)
5-2- Exploitation bacteriological
5-2-1- THE goals
5-2-2 - The methods of enumeration bacterial.
5-2-3- THE germs indicators of there fecal pollution
5-2-4- Search for pathogenic bacteria in polluted marine waters 6-
Identification of the virus pathogens For the man and bacteriophages
6-1- Techniques of research and of study of the human viruses In THE waters And THE fruits of sea
6-2- Techniques of study And of research of the indicator bacteriophages of contamination fecal
7 Ŕ Monitoring parasitological of the environment maritime
8 - monitoring of the phytoplanktons toxic (HAB) and phycotoxins
9 - THE standards of sanitation of the waters of bathing And of the areas
shellfish 10- Self-purification of water

Works Directed : (8h)

Analysis of articles Or exposed on around the two themes :

- THE news techniques devaluation of there pollution fecal
- Of the studies of case on the research of some virus And parasites found in medium marine

Works practices : (5 p.m.)

TP1 : Enumeration of flora total (1h30)
TP2 : Counting of indicators of contamination fecal by method of the NPP: total coliforms, fecal, E.coli and Enterococcus (6h)
TP3 : Counting of indicators of contamination fecal by the method of filtration (2h) TP4: Counting spores of sulfite-reducing Clostridium (1h30)
TP5 : Research of some germs pathogens : Salmonella, Staphylococcus aureus, Vibrio,

Pseudomonas aeruginosa. (3h)
TP/TD6 : Protocols of Detection And of dosage of the toxins (DSP, PSP, ASP..) (3h)

Matter 2 : Ecotoxicology element

Goals of teaching : is of to know THE concepts general of ecotoxicology and the processes of toxicokinetics. It aims to understand the mechanisms of transport, bioavailability and actions of the xenobiotics Thus that at the distinction THE different toxicity and exposure assessment strategies.

Knowledge prerequisites recommended : Chemistry general And UEF 3.1 (pollution chemical And physical).

Contents of there matter

Course masterful (20)

Concepts of base in toxicology of environment 2 -
types of toxicity (acute, subacute, chronic)
3- Reminders on THE pollution marines, and THE large classes of xenobiotics
3-1- kind And features of the pollutants
3-2- measurement of accumulation
4- Path And become of the substances toxic In the environment
5- Mechanism of action of the contaminants (Bioavailability, bioaccumulation, ways entry into organisms, excretion-immobilization..)
6- Impact biocenotic of the pollutants
6-1- impact on THE ecosystems sailors.
6-2- Effects organic on THE organizations, populations And
communities. 6-2-1- Trophic transfer of contaminants
6-2-2- The influence of the properties physicochemical of the compounds contaminants on the speed and the importance of absorption
6-2-3- kinetic of contamination And of decontamination
6-2-4- Metabolization of chemical compounds
- Biotransformation of the HAP by THE marine animals
- Process of bioamplification (example of the DDD, of PCB And of DDT)
- There carcinogenesis among the organizations sailors
7- There monitoring of the pollutants And assessment of there toxicity
7-1- There monitoring chemical Or THE dosage of the pollutants In there matter alive *in located*
7-2- There monitoring biological Or there forecast of the
effects 7-2-1-Ecotoxicity tests
7-2-2- There research of biomarkers (physiological, biochemical, genetic)

7-2-2-1 -Non-specific physiological and biochemical markers (Growth, Activity energetic, The activity endocrine, There answer immune, There function detoxification (Phase II), The response to oxidation, The constituent proteins and enzymes (stress proteins), blood chemistry).
7-2-2-2-The markers biochemical specific (THE system enzymatic of MFO detoxification, Acetylcholinesterase, Metallothioneins, etc.).
7-2-2-3 THE markers of genotoxicity (THE aberrations chromosomal, THE adducts has DNA, Inhibition of the methylation of DNA, THE mutations).

8- analysis of risk, epidemiology, models . **Practical**

work (10 a.m.):

Sessions application of the concepts of course below shape of exercises, problems, exposed Or article analysis .

- Exercise on there determination of the settings toxicological: DL50, CL50, TL50
- Problems on THE phenomena eco-toxicology (study of case)
- Studies of case on biomarkers
- Analyses of articles on THE problems eco toxicology

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 4

UEF 4.2: TRACERS ISOTOPICS AND OCEANOGRAPHIC APPLICATIONS

Credits : 3

Coefficients : 1

Matter 1 : Tracers isotopic

Goals of teaching : This material has for objective to develop learners' skills in using isotopes to understand and quantify processes geochemical And climatic playing A role important In THE cycles global biogeochemicals of the main elements .

Knowledge Recommended prerequisites: Chemistry general (Thermodynamics) S2 (1st cycle) ; Geochemistry of marine waters S1 (2nd cycle); Geochemistry of sediments S2 (2nd cycle); Ocean dynamics S2 (2nd cycle).

Contents of there matter

Course masterful (3 p.m.)

Chapter 1 – Elements of isotopic geochemistry

1- Abundance of the isotopes ; composition isotopic ; standards And splitting isotopic
2- Process of isotopic fractionation
   2.1. Changes of state
   2.2. Balance isotopic
   2.3. Process kinetics
   2.4. Measure of the isotopes

stable 3- General information on
radioisotopes
3.1 Law of radioactive decay
3.2 Balance secular
3.3 Principle of measure of there radioactivity

Chapter 2 – Stable isotopes

1- System $^{18}O/^{16}O$ And D/H : applications climatic
2- System $^{13}C/^{12}C$ And $^{15}N/^{14}N$: process organic And anthropogenic

Chapter 3 – Unstable isotopes

1- Dating of the waters marines by THE radionuclides (couple Tea ; $^{14}C/^{12}C$)
2- Vertical mixing In the ocean traffic general And dating of the waters deep by ($^{14}C/^{12}C$)
3- Study of marine geochemical processes using primordial radionuclides (scavenging; diffusion)

Practical work : 15 h

TD No. 1 Ŕ Calculation of the abundances; of the compositions And of the splits isotopic For various processes (evaporation/precipitation; diffusion; photosynthesis); radioactive decay law

TD No. 2 Ŕ Study of balance isotopic Calcite /Water ; $^{13}C/^{12}C$ tracer of the emissions anthropogenic carbon and water circulation. Paleotemperature reconstruction (ice and sediments)

TD No. 3 Ŕ Mixtures conservatives and their applications to isotopes: (tracers of pollution, of

mixtures of masses of waters in area coastal ; of diet eating …)

TD No. 4 Ŕ Tracers radioactive In the ocean and process geochemical (broadcast ; scavenging; …)

TD No. 5 Ŕ Dating of the waters marines : Tea and method to CFC in Mediterranean; determination of the flow vertical of mixture In A ocean has two boxes and evaluation organic export of carbon by its isotopes.

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Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 4

UEF 4.3 : RIGHT OF THERE SEA

Credits : 3

Coefficients : 1

Matter 1: Right of the sea

Goals of teaching : it is to learn to learners THE spaces maritime, the study and research in these maritime areas and the instruments which allow pollution prevention and preservation of the marine environment.

Knowledge prerequisites recommended : none

Contents of there matter

Course masterful (30)

THE SPACES MARITIMES

1.1 - THE SPACES GENERAL MARITIMES

1.1.1 THE waters interiors
1.1.2 There sea territorial
1.1.3 There area contiguous
1.1.4 There area economic exclusive
1.1.5 THE plateau continental
1.1.6 There high sea
1.1.6 THE funds sailors

2 – THERE RESEARCH SCIENTIST NAVY

2.1 Diet of the research scientist In the territorial sea
2.2 Diet scientific research in the exclusive economic zone And the continental shelf

3 – THERE PRESERVATION OF MEDIUM MARINE

3.1 THERE PREVENTION OF POLLUTION

3.1.1 There pollution voluntary
3.1.2 There pollution accidental

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 4

EMU 4.1 : OCEANOGRAPHY SPACE

Credits : 3

Coefficients : 2

Matter 1: Oceanography spatial

Teaching objectives : This unit aims to teach students how to master the application of sea and coastal observation techniques to marine and coastal sciences. For measurement, study and analysis of some parameters and phenomena oceanic/marine and coastal.

Recommended prior knowledge : remote sensing 1, numerical analysis, data processing and analysis, modeling I, ocean dynamics, geochemistry of marine waters, sediments and the atmosphere, ecobiology, UEF3.1 and UEF4.1.

Contents of there matter

Course Magistral (3 p.m.) :

Chapter I : Remote sensing Radar (2 * 1h30)

1. Historical And Definition
2. Benefits And disadvantages vs. Remote sensing passive
3. Principle of there measure And geometry of the acquisition
4. Sizes measured And sizes estimated (phase/amplitude)
5. Settings Radar (length wave Or frequency, polarization, corner incidence) and measurement parameters
6. Interaction signal radar/target
7. Distortions geometric And radiometric of the image Radar
8. Treatment of the speckle : filtering
9. Missions Radar, current And futures
10. Domains of applications of Radar
11. Software of treatment of the data Radar

Chapter II : Remote sensing Lidar(2 * 1h30)

1. Historical And Definition
2. Principle of measure and geometry acquisition
3. Sizes measured And sizes estimated (Distance satellite-Target, Altitude of satellite, surface height)
4. Pre-treatments And treatments of the data altimetric
5. Missions Lidar old, current And futures
6. Domains of Applications of Lidar
7. Software of treatment of the data Lidar

Chapter III : Remote sensing of there color of the ocean (CO) (2*1h30)

1. Historical And Definition
2. Principle of there color of the ocean And plan acquisition
3. Sizes measured And sizes estimated (AOPs and IOPs)
4. Interaction of there light with the atmosphere - with there column of water
5. Classification bio-optics of the waters marines

6. Algorithms extraction of there chlorophyll- has (empirical, Models)
7. Missions of there CO old, current And futures
8. Domains application of there CO (Dynamic of phytoplankton, taxa of phytoplankton, etc.)
9. Software of treatment of the data of there CO

Chapter IV : Remote sensing of there Sea Surface Temperature (SST) (1h30)

1. Historical
2. THE five definitions of the SST
3. Principle of there measure of there SST (with of the radiometers infrared thermal And microwave)
4. Pretreatment and treatment of the measure of there SST
5. Benefits And disadvantages (SST infrared thermal And microwave)
6. Missions spatial of there Old and current SSTs and future
7. Domains application of there SST
8. Software of treatment of the data of there SST

Chapter V : Measures of there salinity of surface of water of sea (SSS) Since space (1h30)

1. Historical
2. Definition
3. Principle of the measure of there SSS
4. Pretreatment and treatment of the measure of there SSS
5. Missions spatial of there Old and current SSTs and future
6. Domains application of there SSS
7. Software of treatment of the data of there SSS

Chapter VI : Remote sensing of the change (2 * 1h30)

1. Definition
2. Domains application
3. Methods of detection of change : Qualitative (photo-interpretation), Quantitative (pre-classification, spectral indices, etc.)
4. Assessment of there precision

Works practices (30 h) :

TP No. 1 : Initiation has there handling images radar **(3h00)**
TP No. 2 : Mapping of the tablecloths hydrocarbon by use of imaging radar (Sentinel 1) **(3h00)**
TP No. 3 : Exploitation of the Lidar data terrestrial (Generation of a MNE)
(3h00) TP n°4: Exploitation of oceanographic Lidar data (Sentinel 3) **(3h00) TP n°5:** Analysis of ocean color data **(3h00)**
TP No. 6 : Application of a few algorithms empirical of the color of the ocean **(3h00) TP n°7:** Analysis of SST data **(3h00)**
TP No. 8 : Analysis of the data of the LST **(3h00)**
TP No. 9 : Detection of change by calculation of the index spectral
(3h00) TP n°10: Change detection by image classification **(3h00)**

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 4

EMU 4.2 : ANALYSIS OF THE CYCLE OF LIFE

Credits : 3

Coefficients : 2

Matter 1 : Analysis of Cycle of Life

Teaching objectives : The part theoretical of This program aims the acquisition of the frame conceptual basis of LCA as well as knowledge of LCA databases, calculation methods and models for analyzing environmental impacts at the intermediate level of the causal chain (Eutrophication, Ecotoxicity terrestrial and aquatic, global warming...), Thus than damage to the final targets (Human Health, Ecosystem Quality, Climate Change and Resource Depletion).

The practical part of the program is devoted to the application of LCA to several industrial and urban systems in coastal areas. The LCA will be conducted according to the four standardized steps from the modeling of the system's life cycle to the results of the impact analysis and their interpretation. A software LCA and calculation of exposure doses to industrial emissions will be used to quantify environmental impacts on humans and aquatic species .

Knowledge prerequisites recommended : Analysis digital, processing and analysis of data ; ocean dynamics; geochemistry of marine waters, sediments, atmosphere and ocean biogeochemical cycles.

Contents of there matter

Course Magistral (3 p.m.)

I. There methodology of Analysis of Cycle of Life (ACV)

I.1 Introduction : Historical And development international of the approach cycle of life

I.2 Frame conceptual of LCA : THE steps standardized

a. Goals And field of the study
b. Analysis of the inventory
c. Analysis of the impacts
d. Interpretation of the results

II. The development of the ACV

II.1 There first stage : Goals And field of the study

a. Definition, function And boundaries of system
b. Functional unit And flow of reference
c. Rules assignment And hypotheses
d. Rigor methodological And review critical

II.2 There second stage : Analysis of the inventory

a. Subdivision of system And diagram conceptual
b. Identification of the flow incoming/outgoing of the system
c. Collection of data on site (investigation of ground, measures of land)
d. Estimate of data (Databases, bibliography specialized)
e. Results of the analysis inventory by matrix calculation
f. Software of ACV And matrices of the emissions/extractions

g. THE bases of data international

II.3 There third stage : Analysis of the impacts environmental

a. There conversion results of the inventory in impacts potentials
b. THE equations of the scores of impacts And of damages
c. THE models mathematics of characterization of the impacts
    i. THE warming climate
    ii. Exhaustion of the resources biotics And abiotic
    iii. Eutrophication And acidification
    iv. There toxicity human And others impacts sanitary facilities
    v. Ecotoxicity terrestrial (floors And sediments)
    vi. Ecotoxicity navy (waters And sediments sailors)
d. The aggregation of the classes impact in classes of damages
    i. THE change climate
    ii. There biodiversity And there quality of the ecosystems
    iii. There human health
    iv. The exhaustion of resources
e. THE models multimedia of transfer And exhibition to emissions
f. THE methods of ACV Midpoint And End- point

II.4 There fourth stage : The interpretation of the results

a. There synthesis of the results And THE settings keys
b. THE classes of impacts preponderant of cycle of life of system
c. There contribution of the different process of the system
d. THE majority contributions of the emissions And of the extractions
e. There comparison scenarios
f. THE axes improvement And THE recommendations

II.5 THE steps complementary :

a. There standardization And there weighting
b. The analysis of sensitivity
c. The analysis of uncertainty of Mounted Carlo

II.6 THE boundaries of LCA

III : Application of LCA to systems anthropogenic in area coastal (3 p.m.)

a) **TD1:** ACV of desalination of water of the sea (3h)
b) **TD2:** ACV of drilling oil tanker offshore (3h)
c) **TD3:** ACV of a refinery oil coastal (3h)
d) **TD4:** ACV of a station purification of the waters worn out (3h)
e) **TD5:** ACV of a unit of manufacturing pharmaceutical coastal (3h)

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 4

EMU 4.3 : INTELLIGENCE ARTIFICIAL

Credits : 3

Coefficients : 2

Matter 1: Intelligence Artificial and applications

Teaching objectives : THE course is made up of two parts has know The analysis of the data and Machine Learning. The first part is for objective to analyze the data in order to of to draw answers to problems that concern the field.
Machine learning (ML) is a form of artificial intelligence (AI) that is focused on creating systems that learn, or improve their performance, based on the data they process. He represents THE domain Who takes care of of the interpretation and modeling of data in order to allow decision making without human interaction

Recommended prior knowledge: to be able to follow the teachings of this subject, the student must have awareness in analysis digital and in programming with
python ,Matlab …

Contents of there matter

Course masterful : (24h)

1- Identify THE possibilities of Machine Learning
- Discover THE domain of there Data Science
- Identify THE different steps modeling
- Identify the different types learning automatic

1- Introduction to Python
- Numpy
- MathPlotlib
- Pandas

2- **Identify THE techniques And tools of Machine Learning**
- **Transform of the needs professions in problems of Machine**

Learning 3- Data cleaning
- Data Cleaning with Excel.
- Data Cleaning with Python.

4- Data Analysis
- Mean.
- Variance.
- Histograms.

5- Classification
- Logistics Regression.
- Validation.
- Support Vector Machine
- Artificial Neural Network

6- **Train THE first algorithm of Machine Learning**
- Establish A model statistical
- Program there regression linear

- Validation.
- Regression Polynomial.
- Decision Trees.

Program of the works practices : (9 p.m.)

- TD1- Identify THE different steps of modeling
- TD2-Identify THE different types machine learning
- TD3- algorithm with python
- TD4- Transforming business needs in problems of Machine Learning
- TD5-Data Cleaning with Excel.
- TD6-Data Cleaning with Python.
- TD7- Data analysis
- TD8- classification with machine learning
- TD9- programming

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 4

EMU 4.3 : INTERNSHIP

Credits : 4

Coefficients : 2

Matter 1 : Internship insertion professional

Goals of teaching : See and put in the practice in A professional environment and/or of search for them knowledge theoretical And practices acquired in the semesters previous, notably THE UEF And EMUs .

Knowledge prerequisites recommended : For to be able to carry out the internship of 30 days, the student must have followed the courses provided in previous semesters, in particular the UEF and UEM.

Contents of there matter

THE volume hourly global and of the order of 60 h.

The student will be assigned, according to the possibilities offered and the student's desire, to a public establishment Or private Or he will be able to perform A internship on a thematic Who will be jointly defined by a teacher from the school and a scientist from the host institution. The two scientists will be responsible for the student's internship (or internships).

Work staff : development of a report of internship according to A canvas Who will be provided.

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 4

UED 4.1 : Biodiversity And Anthropization

Credits : 2

Coefficients : 1

Matter 1: Biodiversity and anthropization

Goals of teaching : Analyze THE challenges And THE challenges of there protection of there biodiversity navy and coastal In THE context of a anthropization accelerated and reflection on the sustainable management of marine resources

Recommended prior knowledge: The various courses in marine ecology and biology, of geochemistry environmental And of marine pollution are required For follow adequately this teaching.

Contents of there matter

THE volume hourly overall East 8 p.m.

Introduction has there biodiversity navy

1- Species emblematic, ecosystems remarkable
2- There global marine biodiversity in numbers
3- THE different shapes of use Or operating of biodiversity navy

Problematic of there biodiversity navy And coastal

1- Difficulties analysis And of observations
2- Erosion of there biodiversity by anthropization And state of reference

Impact of the activities anthropogenic with there biodiversity navy Mediterranean

Effects of the activities industrial
effects of fishing
Effects aquaculture
Effects of desalination of water of sea
Effect of urbanization, development And works of protection
Effects of coastal and maritime tourism
Effects of transportation maritime
Effects of the infrastructure Energy
Effects of other maritime activities

Conservation And Protection of there biodiversity navy

1. There conservation *in situ*
2. There conservation *ex located*
3. THE tools of there conservation And protection

THE teachings are organized in the form workshop interactive

Work staff : Documentary research

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 4

UET 4.1 : METHODOLOGY OF DOCUMENTARY RESEARCH

Credits : 1

Coefficients : 1

Matter 1 : Methodology of documentary research

Goals of teaching : the objective of this matter East to master THE methods and documentary research techniques.

Knowledge prerequisites recommended :

Contents of there matter

Course masterful (8 p.m.)

I. Research And exploitation of documents scientists

1. There presentation methodological :

- Define his needs
- To research THE documents
- Assess THE documents
- There day before

2. There synthesis of documents scientists:

- How synthesize THE documents scientists ?
- Writing of a form of reading.

3. There written communication In there research (Scientific production And technical) :

- Presentation of the different documents scientists (article, publication, memory, reports,…) ;
- Parts constitutive of the different types of documents ;
- Writing of a memory according to there standard iso;
- Writing of the references bibliographical of all types of documents ;

II. There communication oral In there research

- Rules of communication oral (preparation, message, support, posture, debate And answer to questions);
- Realization of a presentation (Posters, PPT).

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 4

UET 4.2: ENGLISH FOR SPECIFIC PURPOSE 4

Credits : 2

Coefficients: 1

Matter 1: English for Specific Purpose 4

Objectives of teaching : will allow the student to prepare for entry into the world of work, which requires the application of their English language skills. The program includes the writing of reports of internships For services provided, In different structures. After THE curriculum university,
The student must be able to write job applications and prepare his CV, and prepare for interviews

Knowledge prerequisites recommended : UET- 3

Contents of there matter

Volume hourly : 8 p.m.

Unit 1: Writing reports
Evaluation
Exercises

Unit 2 : Application Forms
Evaluation
Exercises

Unit 3 : Preparation CVs
Evaluation
Exercises

Unit 4 : **Oral Interviews and Tips**
-Questions and answers : Speaking about your skills
-Play role activities for students
Evaluation

Semester 5

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 5

UEF 5.1 : CHANGE CLIMATIC: OBSERVATIONS & ASSESSMENT

Credits : 5

Coefficients: 3

Matter 1 : Change climate In THE areas marines And coastal

Teaching objectives : the objective is to deepen knowledge about the climate, climate change and climate anomalies. Learners will be required to master the study and analysis of the impacts of the changes climatic and the factors and parameters natural and anthropogenic factors that are at the origin of climate change.

Knowledge prerequisites recommended: Cycles biogeochemical global ; geochemistry navy, dynamic of the oceans … etc.

Contents of there matter

Course masterful (27h)

Chapter 1 – THE climates from the Quaternary on Earth

1- Cycles Glacial Ŕ Interglacials (Theory of Milankovitch)
2- Climates current of there planet Earth
3- Anomalies natural of climate on Earth

Chapter 2 – Effect of Tight Natural and Anthropogenic

1- Radiation planetary : Balance sheet radiative planetary
2- Gas has effect of tight (Composition And contents natural of quaternary And anthropogenic)
3- Causes and factors amplification of the changes climate (Emissions industrial greenhouse gases; deforestation). Current and pre-anthropogenic carbon balance

Chapter 3- Evaluation of changes climatic

1- Observations of global warming
2- THE changes climatic in Mediterranean

Chapter 4- Impacts of the changes climatic on THE medium marine

1- Impact of warming on THE medium marine :
   a. extreme events
   b. traffic oceanic
   c. dilation thermal of the oceans and cast iron of the ice creams (elevation of level of there sea) 2- Impact of ocean acidification:
   a. Observations Ŕ penetration of carbon anthropogenic in sea
   b. Impacts of acidification on the cycle of carbon: saturation of the oceans in CO_2 ; calcium carbonate saturation
   c. Others effects on THE process geochemical sailors

4- THE tools of there struggle against THE climate change
   a. The adaptation to the CCs
   b. Mitigation of the emissions of GHG

Chapter 5 – Climate change & Marine Biodiversity

Effects of the elevation of there
temperature Effects of acidification
Effects of the elevation of level of there sea
Effects of ecological tropicalization
Others effects

Works directed : (3 p.m.)
TD 1 Ŕ Climatology, Trends climatic, Normals seasonal, calculation of anomalies, calculation of climatic indices.
TD 2 Ŕ Elevation of level of there sea by dilation thermal; Font of the ice creams (analysis TD 3 – Calculation methods of the penetration of anthropogenic carbon into the ocean
TD 4 - quantification of acidification and depths of compensation of the carbonates TD 5 – Effect of climate change on marine biodiversity (Article analysis)

Matter 2 : Balance sheet Carbon

Teaching objectives : This course allows to understand the evaluation methodology of the mass of carbon emitted into the atmosphere on a year of all activity industrial or tertiary as well as on a territorial scale. In practice, it is a question of estimating the balance of direct emissions and indirect greenhouse gas emissions from an activity, as defined by the IPCC. The aim is to identify the main emission sources of the activity anthropic and consequently, the engagement in a approach priority of their reduction. In addition, students are led to estimate what any human activity (or need) has an impact on the resources natural, and take awareness of the actions likely of limit these impacts .

Knowledge prerequisites recommended :

Contents of there matter

Course Magistral (9 h)

1. Introduction
    a. Reminders on THE emissions of the GHG And THE change climate
    b. There distribution global of the GHG
2. Context reference And tools methodological
    a. There standard ISO 14064
    b. Balance sheet regulatory of the gas has effect of tight (GES)
    c. The method Balance sheet Carbon
    d. There method GreenHouse Gas Protocol (GHG Protocol)
    e. There relationship Balance sheet carbon/LCA
    f. There relationship Balance sheet carbon/ ecological footprint
3. Software of calculation of balance sheet Carbon
4. Calculation of the Balance Sheet Carbon of an organization
    a. THE factors of emissions physical
    b. THE factors of monetary issues
    c. THE results of the emissions direct and indirect
    d. THE results of the emissions by site And by activity
    e. THE uncertainties on THE results
5. Synthesis And plan of reduction of the emissions of GHG
    a. THE positions of reduction concerned
    b. Actions Or tracks of actions considered
    c. Time limit of bet in place

6. **Study of case** : Balance sheet Carbon of a activity tertiary

TD1 (3 h): Perimeter of study And collection of the data (3h)
TD2 (3 h): Calculation And estimate of the emissions of the GHG
a) Emissions related to consumption of energy
b) Emissions related to travel of people
c) Emissions from the manufacturing of durable goods d) Emissions related to purchases of materials and services
e) Emissions related At freight
f) Related emissions to waste direct
TD3 (3 h) **: Results And interpretations**
g) Results global And analyses complementary h) Uncertainties and margins of error

Titled of the Training : Marine Environment Engineering And Ecosystems Protection
Semester: 5

UEF 5.2: ACTION OF THERE SEA ON THE INFRASTRUCTURE COASTLINES

Credits : 4

Coefficients : 2

Matter 1 : Action of the sea on THE infrastructure coastal

Teaching objectives : This unit aims to develop technical skills and legal of the students in monitoring and evaluation matters of the marine environment as well as feedback from the sea on marine and coastal installations and infrastructures. The scientific foundations of such techniques are explored in depth and allow the learner to develop analytical skills integrated into coastal and marine environmental management

Knowledge recommended prerequisites: Chemistry general, chemistry of the waters natural, UEF1,
UEF2, UEF3 And UEF4, Metrology 1 & 2.

Contents of there matter

Course masterful (33h)

Chapter I : THE different infrastructure coastal Chapter II:
Properties of materials
Chapter III : Concepts of corrosion and of bio-corrosion In the marine environment Chapter IV: action of sea water on concrete
Chapter V : actions of water of sea on metals
Chapter VI: Action of sea water on ceramic materials Chapter VII : action water of the sea on materials natural (drink, ..) Chapter VIII: action of sea water on composites
Chapter IX: struggle against there marine corrosion

Works practices (12 h) :

TP No. 1 Study of the corrosion
TP No. 2 : action water of sea on the alloys TP N°2: Action of chlorides on iron
TP No. 3 : carbonation of concrete

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 5

UEF 5.3: EVALUATION ENVIRONMENTAL

Credits : 4

Coefficients : 2

Matter 3 : Assessment environmental

Goals of teaching : This unit has For objective of develop the SKILLS technical and legal skills of students in monitoring and assessing impacts on
the environment marine.

Knowledge Recommended prerequisites: Chemistry general, chemistry of the waters natural, UEF1,
UEF2, UEF3 And UEF4, Metrology 1 & 2.

Contents of there matter

Course masterful (21 h)

1. **INTRODUCTION HAS THE STUDY OF IMPACT**
   - 1.1 Meaning, scope, goals
   - 1.2 Historical (evolution)
   - 1.3 Context regulatory Algerian

2. **ACKNOWLEDGEMENT OF THE STATE INITIAL**
   - 2.1 Principles
   - 2.2 Indicators of the state initial in area coastal
   - 2.3 Method And criteria analysis
   - 2.4 Sources of data And of information

3. **IDENTIFICATION AND ANALYSIS OF THE IMPACTS**
   - 3.1 Awareness of project submitted has the EIA
   - 3.2 Effects induced, typology of the impacts
   - 3.3 Impacts crusaders (method)

4. **MEASURES HAS TAKE**
   - 4.1 THE measures of deletion
   - 4.2 THE measures of reduction
   - 4.3 THE measures compensatory

Works practices : (24h)

STUDY OF CASE : THE themes of the works directed below are at title for example: they can be enriched, modified/updated, depending on the data and resources available.

TD 1 **:** Impacts of the infrastructure port

- Area industrial Port
- Port of pleasure boating, port of fishing

TD 2 : Impacts of the dredging port (extraction, putting in deposit)
TD 3: Impacts of marine aggregate extraction
TD 4: Impacts of a station of treatment of the waters worn out

TD 5 : Study Environmental Impact in the case of the areas expansion of the sites tourist (ZEST)
TD 6 : Study environmental impact of the works of study, of prospecting and offshore mining and oil exploitation.
TD 7 : Study impact environmental of spills of waters industrial has there sea
TD 8 : Study impact environmental of a station of desalination of water of sea

Titled of the Training : Marine Environment Engineering And Ecosystems Protection Semester: 5
UEF 5.4: RIGHT NATIONAL AND INTERNATIONAL OF THE MARINE ENVIRONMENT
Credits : 3 Coefficients : 2
Matter 1 : Right international of the environment marine
Teaching Objectives : The objective of this subject is to teach students about legislation and the challenges nationals and international in matter of protection and of preservation of the environment, particularly the marine environment, and the fight against its degradation on a national scale, regional And international
Knowledge Recommended prerequisites: Law of there sea (UEF4.3)
Contents of there matter

Course masterful (30 h)

Introduction :

- Origin of right international of the environment
- Definitions
- Big fundamental principles
- Challenges majors of right international of the environment marine

1- Protection of the environment marine And development sustainable

1.1-Scale international :

- UNCLOS
- There convention international of 1973 And his protocols
- There convention international of 1972 And her protocol
- There convention international of 1969 And her protocol
- There convention international of 1990 And her protocol
- There convention international of 2004
- There convention international of RIO - JANUARY
-

1.2- Ladder Mediterranean :

- There Convention of Barcelona For there protection of there sea Mediterranean against there pollution
- Strategy Mediterranean of development sustainable (SMDD)
- Protocol relative has management integrated deszones coastal of there Mediterranean (GIZC)

1.3- National scale (legislation Algerian)

- Law No. 02-02 relative has there protection And has there valuation of coastline.
- Law No. 03-10 relating to environmental protection within the framework of sustainable development
- Law No. 11-02 of February 17, 2011 relating to protected areas in the context of development sustainable
- National Strategy for Integrated Coastal Zone Management (SNGIZC) and Réghaia Coastal Plan (PCR).
- Decree Presidential No. 18-96 of 2 Rajab 1439 corresponding as of March 20, 2018 establishing an exclusive economic zone off the Algerian coast.

2- Protection of there biodiversity

2.1-Scale international :

- THE protocol from Cartagena
- THE protocol from Nagoya
- There convention of RAMSAR
- There convention of BONN
- There convention on THE change climate
- THE protocols of KYOTO And of DOHA

2.2- Ladder Mediterranean

- Protocol relative to Areas Especially Protected And has there Diversity Biological in the Mediterranean (ASP/DB Protocol)
- Agreement on there conservation of the cetaceans of there sea Black, of the **Mediterranean** and of there adjacent Atlantic zone

2.3- National scale (legislation Algerian)

- Strategy And Plan of action nationals For there biodiversity 2016-2030 .
- Plan national Climate 2020-2030 .

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 5

UEM 5.1 : MONITORING AND STRATEGY OF MONITORING OF THE MARINE ECOSYSTEMS

Credits : 5

Coefficients : 3

Matter 1 : Monitoring And strategy of monitoring of the ecosystems sailors

Teaching objectives : This subject aims to develop students' methodological, technical and legal skills in environmental monitoring. marine And coastal. this education will allow Also to students there awareness And
mastery of autonomous equipment and devices used in the observation and monitoring of the marine environment.

Knowledge recommended prerequisites : UEF1, UEF2, UEF3, UEF4, metrology 1 & 2.

Contents of there matter

Course masterful (9 p.m.)

Introduction has there monitoring marine environmental

Chapter 1 – Strategies of there monitoring has there sea

1.1) Definition of the object of there strategy of monitoring (that should we to watch and for what objectives?)
1.2) Choice of the sites of monitoring (which sites are representative For give the maximum amount of information desired?)

1.3) Choice of the matrices and parameters of monitoring (that should we follow as parameters for achieving the objectives ?)

1.4) Choice of the frequency (periodicity) of the monitoring (has what pace should we follow the chosen environmental parameters?)

1.5) Means humans And materials has put in artwork

1.6) Control of there quality

Chapter 2- Methods of monitoring (physical, biogeochemistry):

2.1) Sites observation fixed Ŕ network of monitoring
2.1.1) Observations discreet
2.1.2) Observations punctual by multi-probes settings
2.1.3) Observations has means And long term by the systems of moorings
2.2) Campaigns oceanographic
2.3) Observations by satellite combined to data experimental in sea.

Chapter 3- Observations and study of the changes on there marine biodiversity

1. Observation And monitoring
2. Prospective And modeling in ecology navy

Chapter 4 – Platforms autonomous of monitoring :

3.1) Program international ARGO For THE climate : THE floats Ŕ profilers
3.2) Remotely Operated Vehicles (ROV)
3.3) Autonomous Underwater Vehicles (AUV)
3.4) Observations spatial
3.5) Others means observation And of monitoring

Chapter 5 – Programs And Networks of monitoring in medium marine

4.1) HAS the scale local : A country, a region
4.2) HAS the scale regional: large region as there sea Mediterranean
4.3) HAS the scale global : ocean overall
4.4) Others kind Observation and of monitoring: stations oceanic and monitoring of the climate

Chapter 6 – Basics of data :

5.1) Elements constituents of a base of data oceanographic
5.2) THE metadata
5.3) Treatment and purification of the data
5.4) Quality of the data
5.5) Formatting of data
5.6) interoperability

Works Directed : 18 h

TD 1- Definitions of strategies sampling: Study of case : EOV ; System coastal pollution ; Bio-monitoring
TD 2- Monitoring of the settings physical: post-processing of TD data 3-
Monitoring of the settings chemicals : post-processing of TD 4-
Biomonitoring Methods data:
Biotic indices
monitoring of the
habitats keys
Use of the news technologies
TD5 - Development and calculation of a painting of edge of the marine
biodiversity TD6 - Integrated monitoring of marine biodiversity
TD7 - Design of a plan of management of a area navy protected TD8 -
Assessment of the exploitation of marine species

Works Practices : 9 h

TP 1- Calibration of the data of probe in the laboratory : protocols of calibration (salinity, oxygen, chlorophyll, etc.)
TP 2- Treatment of data of campaigns oceanographic And base of data
TP 3- Comparison And validation of data from of different sensors on A even site

Exit in Sea (6h) - Deployment of probe multi-parameter in sea And sampling for calibration (one full day)
Exit of visit on Area Navy Protected : (6h)

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 5

UED 1 : MANAGEMENT OF COASTLINE AND OF THE ECOSYSTEMS COASTAL

Credits : 3

Coefficients: 2

Matter 1: Management of coastline and coastal ecosystems

Teaching objectives : This course aims to equip students with the necessary knowledge about complexity of the marine areas And coastal, characterized by ecosystems remarkable and fragile that they shelter And there diversity of the activities and of the uses Who y are confined. The objective final being to apprehend THE
process And THE tools of management sustainable of these spaces that must take consideration THE ecological, environmental, socio-economic, institutional and regulatory aspects while mobilizing a multitude of actors

Knowledge prerequisites recommended : none

Contents of there matter

A. Course masterful (27h)

I. Introduction

- There area coastal And navy : Perception vs reality
- There management of the areas marines And coastal
- The approach ecosystemic

II. Management integrated of the coastal areas

- Approach And context, definitions
- Historical
- Principles fundamentals of the ICZM
- THE different types integration
- Principle And progress of the process ICZM
- There ICZM : A tool of development sustainable ?
- THE tools of there ICZM And its bet in artwork
- THE actors of there ICZM
- Follow up And assessment : THE indicators

III. There planning of the spaces maritime

- Definitions
- Historical
- Principles keys
- Steps of there bet in artwork of there PEM
- Links between there PEM and the others approaches integrated

IV. There management of areas marines coastal protected

- Definitions and historical of the AMCP
- The interest and the benefits of ranking of areas protected
- There governance And there management of the AMCP : approach And tools
- THE follow up And the assessment of management

V. Analysis of sustainability systemic And prospective

- Definitions

- Method imagine

VI. There management of the risks coastal

- Problematic
- Definitions : hazards, challenges, risk coastal, vulnerability, resilience
- Assessment of there vulnerability
- Methods of management

B. Works directed (6 p.m.)

- Analysis of the actors: Method MACTOR
- Exercise of simulation : workshops of actors For the development and validation of a plan of integrated management of a coastal municipality
- Study And analysis of there strategy national ICZM of Algeria
- Study And analysis of Plan of Development Coastal (PAC) Algiers
- Study And analysis of Plan coastal of Réghaia
- Application of the method prospective Imagine (method of the scenarios)
- Exercise of planning of maritime space
- Study of case : process of ranking And management of the areas protected in Algeria

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 5

UED 2.1 : NAVIGATION

Credits : 1

Coefficients : 1

Subject 1 : Navigation

Goals of teaching : this matter allows learners of to get started and of to introduce oneself to means, terms and logistics necessary For browse and explore THE medium marine in order to carry out scientific, industrial, tourist and other work there...

Goals of teaching : None

Knowledge prerequisites recommended :

Contents of there matter

Course masterful (3 p.m.)

1) There planet Earth :
   - shape,
   - dimensions,
   - geoid,
   - parallels,
   - meridians.
2) Elements For the establishment of maps marines :
   - ellipsoid of reference,
   - systems of projections : Different systems geodesics (datum).
   - The WGS84.
3) Description And use of the maps marines (on paper) :
   - latitude,
   - longitude,
   - positioning,
   - bathymetry,
   - nature of bottom.
4) Different formats of positioning :
   - degrees decimals,
   - decimal minutes ,
   - DMS,
   - UTM
5) Use of there ruler Cras :
   - Cap,
   - Route (waypoints),
   - Bitters,
   - Recovery.
6) Distances And speeds.
   - Definition of nautical mile ,
   - of the node,
   - Applications …
7) Works scientists in sea :

- Preparation d 'a exit in sea and a campaign oceanographic on map paper and on electronic card

8) THE System of positioning overall (Glogal Positioning System, GPS) :
   - Principle of functioning And THE main settings
   - Use on board and/or has earth.
9) Meteorology navy :
   - Reading And decryption of the bulletins of meteorology navy
10) Echo sounder :
   - Description And Operation

Basic settings

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 5

UET 5.1 : ECONOMY OF THE ENVIRONMENT

Credits : 3

Coefficients : 1

Matter 1: Economy of the Environment

Goals of teaching : The objective of the matter **Economy of the environment** is of give the fundamental benchmarks in environmental economics, in particular, applying economic principles to public environmental policies and the management of natural resources. Emphasize the analyses economic of the impacts And of the costs/benefits.

Knowledge prerequisites recommended : None

Contents of there matter

Course masterful (9 p.m.)

Chapter I : Introduction to the general economy

1.1. Object of there science economic
1.2. THE big currents of there thought economic
1.3. THE circuit economic
1.4. THE functions economic
1.5. THE models organizational economic

Chapter II : Economy of the environment marine

2.1. Interaction between the economy And the environment natural
2.2. Resources natural And system economic
2.3. Assets environmental And failure of the market :
2.3.1. Right of property And dimension of GOOD common, GOOD public of the environment
2.3.2. Externalities In the environment marine
2.3.3. Theory well-being (optimum Pareto)
2.4. Policies of regulation of the environment marine
2.4.1. Negotiation
2.4.2. Instrument of regulation (Standards, Taxes, subsidies, etc.).

Chapter III : Economy Blue And Economy social And solidarity

3.1. Concepts And applications

TD: (21 h)

Exercises, Exhibits, …

Titled of the Training : Marine Environment Engineering And Ecosystems Protection

Semester: 5

UET 5.2 : MANAGEMENT OF PROJECTS

Credits : 2

Coefficients : 1

Matter 2 : Management of projects

Teaching objectives : The objective of this module is to make the student understand the basics of project management and master the organization to start a project. It allows him to know the skills of project management, assess and anticipate risks, master the actors and authorities of a project, understand the roles and responsibilities in a project environment and also lead a project team

Knowledge prerequisites recommended :

Contents of there matter

Course masterful = 15 h.

Chapter I : Formalization of project

- Definitions andTypology
- THE seven facets of management of project
- Cycle of life of project

Chapter II : Approach general of there conduct of project

- Organization of project
  - Perimeter
  - Teams
  - Tasks and responsibility
  - Parts stakeholders of project
  - Matrix SWOT
- Planning of project
  - Diagram of GANTT, PERT
  - Management of the finances
  - Management of the risks And of the opportunities
- Project management
  - Follow up of the resources
  - Indicator of piloting
  - Approach quality
- Communication of the project
  - Means of communication
  - Plan of communication

Chapter III : Studies technical and economic of project

- Case studies

TD: (15 h)

Exercises, Presentations...