



## SCIENCE AND MARITIME TECHNOLOGY AREA

SUBJECTS AVAILABLE FOR ERASMUS STUDENTS

Spring Semester

Science and Maritime Technology		
Code	Subject	ECTs
9014417	Animal Physiology	6
9014438	Aquatic Production Technology	6
9016116	Biochemistry II	6
9016107	Biological Diversity	6
9087306	Food Chemistry Laboratory	6
9087307	Food Microbiology Laboratory	6
9016117	Industrial Biotechnology	5
9016129	Marine Biotechnology	5
9014436	Maritime Resource Management	6
9016106	Mathematics II	5
9016109	Methods of Instrumental Analysis	7
9016110	Microbiology I	6
9016119	Molecular Biology	7
9016126	Molecular genetics	6
9014419	Oceanography	6
9016108	Organic Chemistry	6
9014437	Pathology	6
9014427	Pharmaceutical Biotechnology	6
9014420	Pollution and Ecotoxicology	6

 **Note** <sup>1)</sup>: All subjects are teach in **Portuguese**. It depend on each teacher to give the class in English or other language. Students will be given material in English and evaluation will also be in English. Tutorial appointments can be schedule with each teacher. All subject **must be approved** on the **theoretical** and on the **practical component**.

 **Note** <sup>2)</sup>: Due to the practical component, some of these subjects have a limited number of enrolment.

## Syllabus Résumé

### **Animal Physiology**

**6 ECTS**

This subject intends to provide to the students solid baseline knowledge regarding Animal Physiology, particularly concerning marine animals.

#### **Aims:**

To know how to evaluate the relationship between the structure and the function of animals. To understand the importance of the maintenance of the ionic and osmotic equilibrium on the cells and body fluids of animals. To know how to explain the way in which the animals' organ systems function, such as the circulatory and the respiratory systems. Understand the distinct ways of obtaining and using energy in animals. To be able to discuss the effects of temperature on animals.

### **Aquatic Production Technology**

**6 ECTS**

The subject intends to frame technically and scientifically the aquatic production systems used to produce phytoplankton, zooplankton, shellfish, fish and crustaceans.

#### **Aims:**

Know and apply the appropriate methodology for the production of food chains in Aquaculture; Know and apply the appropriate methodology for the production of the main species of fish, molluscs and crustaceans, grown in Portugal and Worldwide; Develop practical skills in aquaculture planning.

### **Biochemistry II**

**6 ECTS**

The Metabolism program will have a particular focus on the regulation of the metabolic pathways. Students will perform several laboratorial experiments related with the metabolic pathways. All of this agrees with the view that the syllabus coherence are in the agreement with the curricular unit's objectives.

#### **Aims:**

To understand that the main metabolic pathways are similar to entire live organism. To acquire fundamental concepts concerning to the main metabolic pathways of cellular metabolism in order to allow students competences to understand and analyze several metabolic pathways. To understand that the regulation of the metabolic pathways, particularly at the intracellular signaling transduction.

### **Biological Diversity**

**6 ECTS**

The main purpose of this subject is to recognize the main characteristics of living organisms, as well as the existing biotechnological applications of such organisms. The subject also aims to teach laboratory and field practices, related to biology.

#### **Aims:**

Recognize the main components of the diversity of living organisms. Understanding the evolutionary relationships among different taxa. Characterize of the different taxa of living organisms. Recognize the implications for the use and conservation of biological diversity. Development of basic laboratory techniques applied to biodiversity. Integrate and apply acquired knowledge. Research scientific papers and internet sources. Progress of scientific writing, through the development of scientific reports.

### **Food Chemistry Laboratory**

**6 ECTS**

To know some rules of the nomenclature used for organic components, including some biomolecules. To know hydrolysis reactions in organic components (biomolecules: carbohydrates, proteins, lipids). To understand the main chemical mechanisms used in analytical chemistry. To know some technics in chemical analysis: volumetric, gravimetric, potentiometric, chromatography and spectrophotometric methods. To adjust, in a comprehensive way, an analytical method.

#### **Aims:**

Nomenclature of organic compounds. Hydrolysis reactions in organic compounds. Acid base titrations Complexation reactions and Reactions of precipitation titrations and titrations Gravimetric, Potentiometric. Redox titrations and potentiometric introduction to optical Atomic Spectroscopy methods molecular absorption spectrophotometry introduction to chromatograph. Practical laboratory of work food analysis with application of the previous techniques.

### **Food Microbiology Laboratory**

**6 ECTS**

Know the bacterial morphology and structure. Know the main factors influencing the microbial growth and its control. Know the potential effects of pathogenic microorganisms in terms of human health. Interpret the main microbiological criteria for the microbiological quality of food. Recognise the importance of microorganisms in food production.

#### **Aims:**

Introduction to the study of microbiology. Microbial Nutrition. Differentiation of microorganisms according to their nutritional requirements. Microbial growth. How to measure microbial growth. The influence of environmental factors on growth. Physical and chemical agents in the control of growth. Growth of microorganisms in food. Control of factors that influence the food spoilage. Pathogenic microorganisms. Foodborne diseases. Infections and intoxications. The microbiological quality of water for human consumption. Indicator Microorganisms and the safety and quality of food. The main pathogens in food. Detection and quantitation of microorganisms in food. Identification of microorganisms. The microorganisms and the production of food.



## **Industrial biotechnology**

**5 ECTS**

The syllabus includes an historical introduction for the understanding the evolution and acceptance of biotechnology processes in industry and society, and of the biological systems involved in industrial processes. The component bioreactors is an essential tool in this area of biotechnology and is a prominent target. The economic, social and environmental conditions are vital for bio industries hence their integration in this program.

### **Aims:**

To provide a vision of a multidisciplinary approach, as well as the importance and variety of areas of industrial biotechnology today, accompanied with a historical perspective of the evolution and integration of biotechnological steps in industrial processes. The emphasis given to the selection and design of bioreactors allows the understanding of the development of an industrial bioprocess in one of the biotechnology areas.

## **Instrumental Methods of Analysis**

**7 ECTS**

This content will lead to the progressive development of a familiarization with different analytical techniques commonly used in biotechnology both in the sense of execution, experimental performance of the analysis, and in the critical analysis of results made by others, important in the presence of these future professionals in multidisciplinary working groups.

### **Aims:**

Understanding the basics of instrumental methods of chemical analysis and their importance in biotechnology. Develop the ability to select the proper technique to obtain the desired results. Know the basic operation of laboratory equipment. Program a sequence of complete analysis and make critical analysis of the experimental results. Compare and interpret analytical results of different instrumental methods.

## **Marine Biotechnology**

**6 ECTS**

This subject has become an umbrella term for a plethora of diverse research activities aimed at providing sustainable food and energy sources, protecting environmental and human health, and facilitating the development of novel industrial products and processes.

### **Aims:**

Recognize the importance of marine resources for biotechnological purposes. Understanding the physiology and genomics associated with marine microorganisms. Mastering the basic techniques applied in marine biotechnology. Describe the biotechnological applications of seaweed. Recognize the utility of biotechnological tools in aquaculture

## **Maritime Resource Management**

**6 ECTS**

Understanding multiple strategies of fisheries and marine resource management and conservation.

### **Aims:**

Knowing and understanding methods of stock assessment and monitoring; Acknowledging the relevance of production models in fisheries science and understanding how they work; Identifying biological reference points and telling the difference between target and limit points; Understanding the importance of upholding a strict code of ethics when working in fisheries biology.

## **Microbiology I**

**6 ECTS**

Mastering theoretical concepts in multidisciplinary areas, particularly in Chemistry, Biochemistry and Cell Biology applied to Microbiology, allowing the perception, interpretation and resolution of problems related to microorganisms

### **Aims:**

To provide fundamental knowledge about the biology and biochemistry of the microorganisms. To know the organization and diversity of microorganisms. To recognize Microbiology as a science present in areas as diverse as food, public health and biotechnology.

## **Mathematics II**

**5 ECTS**

A professional of the area of Biotechnology dominate advanced techniques where Mathematics plays a fundamental role. The domain of such tools allows these professionals to formulate problems involving mathematical concepts, to select and apply convenient techniques, to interpret critically the results obtained and to communicate correctly. In the curricular unit it is intended, particularly, the acquisition of knowledge and competences in calculus with several variables, differential equations solving and applications.

### **Aims:**

Formulate problems mathematically. Develop resolution processes, analyse results and try alternative strategies. Interpret, communicate and discuss results. Understand the concepts and applications of calculus with several real variables (srv). Understand the concepts of limit and continuity of fsrv. Calculate and interpret partial and directional derivatives. Calculate multiple integrals with rectangular, polar/cylindrical and spherical coordinates. Recognize and solve different classes of differential equations (DE). Verify if a function is a solution of a given DE. Apply differential equations to describe situations and problems. Use technological tools to solve contextualized problems, by means of a mathematical approach.

## **Molecular Biology**

**7 ECTS**

This curricular unit is a follow-up to other curricular units such as Biochemistry II, allowing a better understanding of the structure and function of nucleic acids.

### **Aims:**



Distinguish and characterize the different types of nucleic acids. Describe the main mechanisms involved in the replication, recombination and repair of genetic material. Understand the mechanisms of DNA transcription and mRNA translation. Understand the general mechanisms of regulation of gene expression. Master laboratory techniques and elaborate simple experimental protocols applied to molecular biology. Understand and apply Molecular Biology techniques to molecular characterization studies.

### **Molecular Genetics**

**6 ECTS**

The Curricular Unit will introduce basic concepts in molecular biology, genes and nucleic acids manipulation techniques.

#### **Aims:**

The Curricular Unit will have an Introduction to genetic engineering. Methods for detection of DNA. Construction of cDNA libraries and genomic DNA. Techniques for gene transfer into plants (gene transfer mediated by *Agrobacterium* and plant viruses), animals and microorganisms. Microbial biotechnology. Gene therapy.

### **Oceanography**

**6 ECTS**

Oceanography studies the geologic, physical, chemical and biological processes, which regulate the oceans.

#### **Aims:**

To recognize the main geologic, physical, chemical and biological processes which regulate the oceans. To describe the sea floor spreading process, the types of lithosphere plates boundaries and the oceanic provinces. To identify physical and chemical properties of the seawater and the processes of circulation. To explain the origin of waves and tides and its importance to the marine environment. To describe the biological structure of the ocean and its relation with the physical and chemical processes. To identify distribution patterns of plankton and marine benthos in space and time. To know the main laboratory and field practices related to oceanography. To select techniques of sampling, treatment of samples and of data.

### **Organic Chemistry**

**6 ECTS**

This course intends to give students the theoretical and theoretical- practical concepts in the field of Organic Chemistry that allow the perception, interpretation and problem solving related to biotechnology.

#### **Aims:**

Master the geometry concepts of molecules in space associated with the study of stereochemistry. Identification and classification of characteristic reactions of each class of organic compounds. Understanding of the chemical reactions of organic compounds through the reaction mechanism involved. Application knowledge of the reactivity of the different functional groups in order to synthesize new compounds. Students will acquire skills to understanding and master related areas such as the pharmaceutical, agrochemical, food and biochemistry areas.

### **Pathology**

**6 ECTS**

Disease outbreaks occurring in aquaculture are the bottleneck for production. Students will achieve skills to recognize disease, diagnose and prevention.

#### **Aims:**

To know pathological, immunological and environmental problems which affect aquatic organisms. To know diseases caused by virus, bacteria, parasites that affect fish, crustacean and molluscs, both wild and farmed. Diagnose and identify main diseases of fish, molluscs and crustacean. Perform and interpretation of parasitological, microbiological and histopathological analysis. To know prophylactic techniques and treatment of disease in aquatic organisms.

### **Pharmaceutical Biotechnology**

**6 ECTS**

It allows the students to recognize the importance of biotechnology in general industry and pharmaceutical industry in particular, allowing the acquisition of skills in pharmaceutical biotechnology.

#### **Aims:**

Acquire ability to percept the potential for development of new products, new therapeutic strategies and diagnostic associated with pharmaceutical biotechnology. Relate and apply acquired knowledge to the area of drug development and new therapies. Knowing the lines of investigation and types of basic compounds. Master the laboratory techniques applied to Pharmaceutical Biotechnology. Recognize the complexity and the time gap between the development process at laboratory level and the effective implementation of a therapeutic drug. Know the statutory and regulatory bodies. To know the future prospects of the sector.

### **Pollution and Ecotoxicology**

**6 ECTS**

The subject purposes to introduce the students to some basic concepts related to negative impacts derived from marine pollution, describe the diversity and sources of pollutants/contaminants and the fate of pollutants/contaminants. It also intends to address concepts related to Ecotoxicology with emphasis on marine ecosystems and biological populations by analysis of selected case studies.

#### **Aims:**

Understand the basic concepts related to Pollution and Ecotoxicology. Knowledge of the main methodologies applied on the evaluation of pollution and toxicology; Recognition of the main ecological impacts derived from marine pollution/contamination. Recognize situations of marine pollution and marine contamination. Identify the most frequent pollutants/contaminants of marine ecosystems. Describe the main negative impacts derived from the situations of marine pollution. Specify the biochemical effects of pollutants. Understand toxicology and detoxication mechanisms. Recognize ecological consequences resulted from marine pollution. Describe the key aspects related with ecotoxicology assays design in order to evaluate chronic and lethal effects on biological models.

