

Course Unit	Applied Microbiology and Bioprocesses	Field of study	Biotechnology
Bachelor in	Chemical Engineering	School	School of Technology and Management
Academic Year	2023/2024	Year of study	3
Type	Semestral	Semester	1
Level	1-3	ECTS credits	6.0
Code	9125-755-3104-00-23		
Workload (hours)	162	Contact hours	T 30 TP - PL 30 TC - S - E - OT - O -

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Ana Maria Alves Queiroz da Silva, Joana Andrea Soares Amaral, Pedro Jorge Louro Crugeira

### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. To recognize the importance of Microbiology in the food industry, environment, biotechnology and pharmaceutical industry.
2. To recognize the microbiological characterization of water and food. To know the most common microbiological parameters used in microbiological analysis of water and food.
3. To know the risks associated with the presence of microorganisms in food and water.
4. Know the main reaction and separation steps of a bioprocess.
5. Know how a bioreactor works.

### Prerequisites

Before the course unit the learner is expected to be able to:

1. Have concepts taught in Biology I.
2. Have knowledge of the differences between eukaryotic and prokaryotic microorganisms.
3. Know nutrition demands, culture and growth of microorganisms.

### Course contents

Microbiologic characterization of water and food. Risks associated with microorganism's presence in water and food. Microbiologic parameters used in water and food microbiologic analysis. Bioprocesses. Main reaction and separation steps involved in a bioprocess. Material balances and flow diagrams. Bioreactors.

### Course contents (extended version)

1. Microbiological Characterization of Water and Food
  - Identification of the most common sources of contamination in water and food.
  - Most common contaminant microorganisms in water and several different foods.
  - Identification of the factors which can influence the growth of bacteria and fungi in food.
2. Risks Associated with the Presence of Microorganisms in Food and Water
  - EFSA and monitoring of zoonoses.
  - Most frequent source of food contamination.
  - Main pathogenic microorganisms associated with foodborne diseases and their risk factors.
  - Recognize the food-borne diseases: by ingestion of toxins, non-invasive and invasive infections.
  - Basic rules of food handling and adequate prevention measures.
3. Microbiological Parameters Used in Water and Food Analysis
  - To identify the main microbiological parameters in the analysis of water and different foods.
  - Main types of microbiological quality criteria. Different types of sampling plans.
4. Bioprocesses.
  - Introduction to biotechnology and bioprocesses: concepts and industrial applications.
  - Application of microorganisms and enzymes in the chemical and food industry and in bioremediation.
5. Bioreactors.
  - Introduction and basic concepts of bioreactors.
  - Types of bioreactors.
6. Carrying out laboratory work on microbiological analyses and bioprocesses.

### Recommended reading

1. B. Ray, Fundamental Food Microbiology, 4th Edition, CRC Press, 2004.
2. M. J. Pelczar, E. C. S. Chan, N. R. Krieg, Microbiologia – conceitos e aplicações, 6th Edition, Makron Books, 1996.
3. Legislação diversa. Normas Portuguesas e Normas ISO.
4. P. M. Doran, Bioprocess engineering principles, Academic Press, 2003.
5. I. O. Moraes, Biotecnologia Industrial, Blucher, 2021.

### Teaching and learning methods

Theoretical classes: Explanation of theoretical concepts. Laboratory classes: Execution of laboratory experiments and analysis of results. Presentation of a bibliographic research work and a development work. Non-presentational time: Writing and discussion of the experimental reports. Individual and group study of the course contents and laboratory protocols. Bibliographic research.

### Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
  - Intermediate Written Test - 20% (Mini-test carried out between the 8th and 10th week of classes)
  - Reports and Guides - 40% (Laboratory classes reports and laboratory classes performance (minimum of 70% of the works))
  - Presentations - 20% (Presentation and discussion of an ISI paper and a research work on a bioprocess)
  - Final Written Exam - 20%
2. Alternative 2 - (Regular, Student Worker) (Supplementary, Special)
  - Final Written Exam - 40%
  - Reports and Guides - 40% (Laboratory classes reports and laboratory classes performance (minimum of 70% of the works))
  - Presentations - 20% (Presentation and discussion of an ISI paper and a research work on a bioprocess)

## Language of instruction

English

## Electronic validation

Ana Maria Alves Queiroz da Silva, Joana Andrea Soares Amaral	Hélder Teixeira Gomes	Ramiro José Espinheira Martins	José Carlos Rufino Amaro
14-10-2023	25-10-2023	25-10-2023	31-10-2023