

Course Unit	Biology	Field of study	Biology
Bachelor in	Chemical Engineering	School	School of Technology and Management
Academic Year	2022/2023	Year of study	1
Type	Semestral	Semester	2
Level	1-1	ECTS credits	6.0
Code	9125-755-1201-00-22		
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) Joana Andrea Soares Amaral, Maria Olga de Amorim Sá Ferreira

Learning outcomes and competences

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

1. Know the basic fundamentals of microbiology. Classify live organisms. Know current applications of microbiology.
2. Identify the main types of microscopes and microscopy. Plan a preparation of microorganisms for optical microscopy.
3. Recognize the ultra-structure of eukaryotic and prokaryotic cells. Distinguish the morphological and ultrastructural characteristics of prokaryotic microorganisms and latent forms.
4. Know the nutritional demands and the microbiological medium suitable for microorganisms.
5. Recognize the culture methods for microorganisms and determine its growth. Identify the methods of reproduction and growth.
6. Recognize the main methods for the control of microorganisms. Identify the main physical and chemical agents for the control of microorganisms.
7. Know the main classes of antibiotics, their chemical structure and mode of action. Know notions of antibiotic resistance.

Prerequisites

Before the course unit the learner is expected to be able to:
not applicable

Course contents

Objectives of Microbiology. Characterization of Microorganisms. Structure of Prokaryotic Cells. Nutritional Requirements and Culture Media. Cultivation and Growth of Microorganisms. Control of Microorganisms. Major classes of antibiotics and antibiotic resistance. Importance of Bacteria and Fungi in Biotechnology. Laboratory techniques in microbiology.

Course contents (extended version)

1. Basic Concepts of Microbiology
 - Microbiology as a science.
 - Objectives and applications of microbiology.
 - The cell as a structural unit of life.
 - Classification of live organisms. Classification of Whittaker and Woese.
 - Eukaryotic and prokaryotic microorganisms.
 - Characterization of the main types of microorganisms.
2. Characterization of Microorganisms
 - Pure culture techniques. Isolation, growth and conservation of pure cultures.
 - Main types of microscopy.
 - The optical microscope. Planning of a preparation of microorganisms for optical microscopy.
 - Staining techniques.
 - Information used for the characterization of microorganisms.
3. The Structure of Prokaryotic and Eukaryotic Microorganisms
 - Distinguish the morphological characteristics of prokaryotic and eukaryotic microorganisms.
 - Recognize and distinguish the ultra-structure of prokaryotes.
 - Properties and chemical composition of the bacteria cell wall. Mechanism of the Gram staining.
 - Latent forms.
4. Nutritional Demands and Microbiological Media
 - Chemical elements as nutrients.
 - Nutritional classification of microorganisms.
 - Media used to grow microorganisms.
 - Selective, differential and enrichment media.
5. Culture and Growth of Microorganisms
 - Factors that affect the microbial growth.
 - Reproduction and growth of eukaryotic microorganisms.
 - Reproduction in prokaryotic microorganisms.
 - Growth of a bacterial culture.
 - Growth curve of unicellular microorganisms in a batch system.
6. Microorganisms Control
 - Fundamentals of microbial control.
 - Death pattern in a microbiological population.
 - Conditions that influence antimicrobial activity.
 - Physical and chemical agents for microorganisms control.
7. Antibiotics
 - Main classes of antibiotics: chemical structure and mode of action.
 - Mechanisms of antibiotic resistance.
8. Laboratory techniques in microbiology.

Recommended reading

1. Ferreira, W. F. C. , Sousa, J. C. F. e Lima, L. , Microbiologia, Lidel - Edições Técnicas, Lda, 2010.
2. Benson, H. J. Microbiological Applications, Laboratory Manual in General Microbiology (7th Ed.), McGraw-Hill, 1998.
3. Ferreira, W. F. C. e Sousa, J. C. F. , Microbiologia Vol. I, II e III (1ª ed.), Lidel - Edições Técnicas, 1998.
4. Pelczar, M. J. . Chan, E. C. S. e Krieg, N. R. , Microbiologia – Conceitos e Aplicações, Vol I e II. (2ª Ed.), Makron Book, 1997.
5. Azevedo, C. , Biologia Celular (3ª Ed.), Lidel - Edições Técnicas, 1999.

Teaching and learning methods

Explanation of theoretical concepts. Analysis and discussion of application examples. Execution of the proposed laboratory experiments. Writing and discussion of experimental reports. Individual and group study of the course contents.

Assessment methods

1. Method 1 - (Regular) (Final, Supplementary, Special)
 - Laboratory Work - 15% (Degree of preparation of the experiments, laboratorial performance and reports.)
 - Final Written Exam - 50% (Global exam concerning theoretical knowledge.)
 - Laboratory Work - 15% (Individual laboratorial exam to be performed in the last week of classes.)
 - Final Written Exam - 20% (Global exam concerning practical concepts.)
2. Method 2 - (Student Worker) (Final, Supplementary, Special)
 - Laboratory Work - 15% (Degree of preparation of the experiments and reports. Minimum of 3 works should be performed.)
 - Final Written Exam - 50% (Global exam concerning theoretical knowledge.)
 - Laboratory Work - 15% (Laboratorial exam to be performed in the last week of classes.)
 - Final Written Exam - 20% (Global exam concerning practical concepts.)

Language of instruction

English

Electronic validation

Joana Andrea Soares Amaral, Maria Olga de Amorim Sá Ferreira	Hélder Teixeira Gomes	Ramiro José Espinheira Martins	José Carlos Rufino Amaro
06-03-2023	21-03-2023	21-03-2023	25-03-2023