COURSE DATA

DATA SUBJECT

Code: 33982
Name: Microbiology
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1103 - Degree in Food Science and Technology	Facultat de Farmácia i Ciències de L'alimentació	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1103 - Degree in Food Science and Technology	Microbiology	BASIC

COORDINATION

LUCENA REYES TERESA

SUMMARY

This is a general course in the first year of CYTA. It introduce the student's in the knowledge of the concept of micro-organisms, to the diversity of microbial world and provides a vision of microbiology as a multidisciplinary science, with both basic and applied aspects.

Focuses on the study of various aspects of the structure and physiology of microorganisms (relation structure / function, metabolism, growth, control of microbial populations, genetics, etc.), as well as the basic methodology for handling microorganisms.

This course is essential for understanding the involvement of microorganisms from both aspects, harmful or beneficial, in processing and preserving food. These specific contents are complemented with other related courses of the Grade (Food Microbiology, Biotechnology and Food Hygiene).

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

Basic module subjects, mainly Biology and Biochemistry

COMPETENCES / LEARNING OUTCOMES

1103 - Degree in Food Science and Technology

Apply preventive measures against the transmission of foodborne microbial diseases.

Differentiate between antibiotics and synthetic and semisynthetic chemotherapeutic agents and understand the importance and the genetic basis of microbial resistance to chemotherapeutic agents.

Gain basic knowledge of the different types of microorganisms.

Isolate pure cultures of microorganisms, evaluate microbial growth and work bearing in mind the aseptic technique and the concept of sterility.

Know and understand the criteria for the classification and identification of microorganisms, in particular, the differential physiological and biochemical characteristics of microorganisms of food significance.

Master the techniques of cultivation, isolation and identification of microorganisms in food.

Understand microbial genetics, the importance of the variability of the DNA in evolution and the applications of genetic engineering to the area of food.

Understand the growth of microorganisms both at individual and at population level, their requirements and the methods for controlling them.

Understand the mechanisms of microbial pathogenicity and the importance of the nonspecific and specific defences against infection.

DESCRIPTION OF CONTENTS

1. PART I. INTRODUCTION TO MICROBIOLOGY

UNIT 1. INTRODUCTION: MICROBIOLOGY AS A SCIENCE.
Definition of Microbiology and microorganism concept. Brief history of microbiology. Microbiology as a science. Types of microorganisms.

2. PART II. BASIC MICROBIOLOGICAL TECHNIQUES

UNIT 2. OBSERVATION OF MICROORGANISMS

Introduction. Optical microscope: foundation. Power of amplification and power of resolution. Techniques used in optical microscopy.

UNIT 3. MICROBIAL PURE CULTURES
Pure culture concept. Methods of isolation of pure cultures. Culture of enrichment. Methods of conservation of pure cultures. Collections of microorganisms.

3. PART III. RELATION STRUCTURE AND CELL FUNCTION

UNIT 4: STRUCTURE/FUNCTION IN EUCARYOTIC MICROORGANISMS
The eukaryotic cell. Types of eukaryotic microorganisms. Cell walls. Internal membranous structures: nucleus, endoplasmic reticulum, Golgi, mitochondria, chloroplasts, etc. Examples of eukaryotic microorganisms of interest: fungi and yeasts, algae, protozoa.

UNIT 5: BACTERIAL STRUCTURES AND FUNCTION
The prokaryotic cell. Morphology and bacterial groupings. Chemical composition of bacteria. Cell wall. Plasma membrane. Ribosomes. Nuclear region. Capsules and mucous layers. Appendices. Reserve substances. Other intracellular structures. Bacterial spores: structure and function.

4. PART IV. BACTERIAL GENETICS

UNIT 6. Concept of genetics. Genome, genotype and phenotype. Mutation and mutants. Types of mutants. Mutagenic agents. Reversion of mutations. Mutagenesis and carcinogenesis: Ames test.

UNIT 7. Genetic recombination in bacteria. Concept and importance. Transformation. Transduction; generalized and specialized. Conjugation Plasmids: concept, types and importance.

5. PART V. MICROBIAL NUTRITIONS AND METABOLISM

UNIT 8. MICROBIAL NUTRITION
Nutritional requirements of microorganisms: carbon source and energy source. Macro and micronutrients. Growth factors. Nutritional groups: autotrophy, heterotrophy phototrophy, chemotrophy. Types of culture media.

UNIT 9. MICROBIAL METABOLISM
Metabolism: anabolism and catabolism. Catabolic routes. Aerobic and anaerobic respiration. Fermentation: concept, types and importance. Lithotrophic metabolism. Photophosphorylation. Regulation of metabolism. Control of the production of enzymes. Routes of biosynthesis: repression. Catabolic routes: induction. Activators and inhibitors. Allosteric regulation.

6. PART VI. GROWTH AND CONTROL OF MICROORGANIMS

UNIT 10. MICROBIAN GROWTH

Cell growth. Population growth: curve of growth and growth phases of pure cultures. Continuous growth. Synchronous growth. Growth in natural conditions.

UNIT 11. EFFECT OF THE ENVIRONMENT ON MICROBIAL GROWTH
Effect of temperature, water and osmotic pressure, pH, oxygen and radiations, etc. on microbial growth.

UNIT 12. CONTROL OF MICROORGANISMS (I): PHYSICAL AGENTS
Introduction: need for microbial control. Disinfection and sterilization. Control by physical agents (wet heat, dry heat, cold, radiation, filtration, etc.).

UNIT 13. CONTROL OF MICROORGANISMS (II) CHEMICAL AGENTS
Control by chemical agents. Methods to quantify the antimicrobial power of a substance: CMI. Disinfectants and antiseptics. Mode of action and main groups. Chimioesterilizers. Antimicrobial chemotherapy: antibiotics. Mode of action. Resistances to antibiotics.

7. PART VII. HOST-PATHOGEN RELATIONSHIP

UNIT 14. MECHANISMS OF MICROBIAL PATHOGENICITY
Introduction. Human microbiota: beneficial effects. Opportunistic pathogens and nosocomial infection. Pathogenicity and virulence. Mechanisms of virulence. Bacterial toxins. Mechanisms for transmission of infectious diseases

UNIT 15. BASIC IMMUNOLOGY
Introduction: innate and acquired immune response. Phagocytosis. Complement Antigens and antibodies. Artificial immunization: vaccination and serotherapy. Serological reactions for the identification of microorganisms and diagnosis.

8. PART VIII. ACELULAR BIOLOGICAL AGENTS: THE VIRUSES

UNIT 16. INTRODUCTION TO VIROLOGY
Characteristics of the viral particle. Nucleic acids and proteins. Viral multiplication. Bacterial viruses: lithic and lysogenic cycle. Animal viruses. Other infectious agents: viroids and prions

9. PRACTICALS

Session 1
- Material Handling
- Simple staining
- Negative staining
- Study of the influence of temperature on bacterial growth

Session 2
- Gram stain
- Study of the skin microbiota: Demonstration of the presence of mixed populations in nature
- Study of the type of metabolism of microorganisms. Hugh-Leifson method
- Study of the growth of microorganisms: selective, differential and enriched media

Session 3

- Catalase test
- Oxidase test
- Study of the effect of different antimicrobial agents on bacterial growth

Session 4
- Cell wall staining
- Acid-alcohol resistance staining.
- Study of the effect of UV light on bacterial growth and viability

Session 5
- Spore staining

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	2,00
Theory	38,00
Seminar	2,00
Laboratory	15,00
Total hours	**57,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	75,00
Preparation of lessons	5,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

Theory (4.52 ECTS, 113 hours):

Lectures aimed at providing the tudent with basic knowledge. Attendance: 38 hours; Preparation and study: 75 hours

Practical Classroom (workshops, problems) (0.48 ECTS, 12 hours):

There will be two seminars on topics provided by the teacher and related to the module. The seminars will be submitted in writing and orally presented by students. Following the oral presentation the work will be opened for discussion among students, and moderated by the teacher. **Attendance is mandatory**.

Attendance: 2 hours; Preparation and study: 10 hours

Laboratory and Computer Sessions (0.8 ECTS, 20 hours):

They will be conducted in small groups and **attendance is mandatory**. Attendance: 15 hours; Preparation and study: 5 hours

Tutorial Sessions (0.08 ECTS, 2h):

They will be organized in small groups and their **attendance is mandatory**.
Students will ask their questions about the subject and / or answer questions raised by the teacher

Attendance: 2 hours

Examinations (0.12 ECTS, 3 hours)

Attendance: 3 hours

TOTAL: 150 hours: 60 hours of attendance, 90 hours out of class

90 hours out of class

EVALUATION

Student's progress is assessed continuously throughout the course. In addition the teacher may evaluate positively student's attitude during lectures and practical sessions, as well as an active participation in the other teaching activities (tutorial sessions and seminars) or written reports if requested after the completion of activities.

Students will be assessed on their theoretical knowledge through a test / exam representing 80% of the final mark. The minimum mark, in the test of theoretical knowledge, to pass the course will be 5 out of 10. In addition, **the exam must be balanced and not present serious deficiencies in important concepts or parts of the subject. Oral exams may be part of the evaluation**

The assessment of laboratory sessions will contribute to the final mark by 10% and it is required at least to obtain a score of 5 out of 10 to pass the course. If the student does not pass the theoretical part, **the practical grade (passed) will only be maintained during the following two academic years whether the student enrolls in the subject or not**. After this time, the student **must repeat them again**, requesting inclusion in a group of practices.

This activity is **MANDATORY AND NON-RECOVERABLE**, in accordance with the provisions of

article 6.5 of the UV Evaluation and Qualification Regulations for Bachelor's and Master's degrees. In the event that, for **justified reasons**, it is not possible to attend, it must be communicated **sufficiently in advance**, so that the person in charge of the subject can assign the student a session in another group. Students will not be able to pass the course without doing and passing the laboratory practicals

Conducting the seminars is compulsory and its assessment will contribute to the final mark by 10%

Evidence of copying or plagiarism in any of the assessable tasks will result in failure to pass the subject and in appropriate disciplinary action being taken. Please note that, in accordance with article 13. d) of the Statute of the University Student (RD 1791/2010, of 30 December), it is the duty of students to refrain from using or participating in dishonest means in assessment tests, assignments or university official documents.

In the event of fraudulent practices, the **Action Protocol for fraudulent practices at the University of Valencia** will be applied (ACGUV 123/2020):

https://www.uv.es/sgeneral/Protocols/C83sp.pdf

REFERENCES

- Biología de los microorganismos (Brock). M.T. Madigan, J.M. Martinko, P.V. Dunlap y D. P. Clark. (2015) 14ª edición. Pearson Education S.A., Madrid (Pearson/Addison Wesley). ISBN: 9788490352793
- Microbiología. L.M. Prescott, J.P. Harley y A.K. Donald. (2016) 7ª edición. McGraw-Hill/Interamericana. ISBN: 9788448191207
- Introducción a la microbiología. G.J. Tortora, B.R. Funke, C.L. Case. (2017) 12ª edición. Panamericana. ISBN: 9789500695404
- Microbiology: Principles and Explorations. Jacquelyn G. Black. (2028) 10ª edición. Wiley & Sons. ISBN: 978-1119390152
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