VNIVERSITAT DE VALÈNCIA

Course Guide
33982 Microbiology

COURSE DATA

Data Subject	
Code	33982
Name	Microbiology
Cycle	Grade
ECTS Credits	6.0
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
1103 - Degree in Food Science and Technology	Faculty of Pharmacy and Food Sciences	1	Second term

Subject-matter

Degree	Subject-matter	Character
1103 - Degree in Food Science and Technology	10 - Microbiology	Basic Training

Coordination

Name	Department
FALOMIR LLORENS, MARIA PILAR	275 - Microbiology and Ecology
GOZALBO FLOR, DANIEL	275 - Microbiology and Ecology

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

OUTCOMES

1103 - Degree in Food Science and Technology

- Gain basic knowledge of the different types of microorganisms.
- Understand the growth of microorganisms both at individual and at population level, their requirements and the methods for controlling them.
- 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.
- Understand the mechanisms of microbial pathogenicity and the importance of the nonspecific and specific defences against infection.
- Understand microbial genetics, the importance of the variability of the DNA in evolution and the applications of genetic engineering to the area of food.
- Differentiate between antibiotics and synthetic and semisynthetic chemotherapeutic agents and understand the importance and the genetic basis of microbial resistance to chemotherapeutic agents.
- Isolate pure cultures of microorganisms, evaluate microbial growth and work bearing in mind the aseptic technique and the concept of sterility.
- Master the techniques of cultivation, isolation and identification of microorganisms in food.
- Apply preventive measures against the transmission of foodborne microbial diseases.

LEARNING OUTCOMES

The result of the acquisition of skills described above will be reflected in a range of abilities, competences and skills that will make the student self-reliant to learn a basic knowledge of the structure, metabolism and genetics of microorganisms important in food microbiology, as well as techniques for their isolation, cultivation and control.

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: 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.

UNIT 5: 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.

4. PART IV. MICROBIAL NUTRITION AND METABOLISM

UNIT 6. 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 7. MICROBIAL METABOLISM

Metabolism: anabolism and catabolism. Catabolic routes. Aerobic and anaerobic respiration. Fermentation: concept, types and importance. Lithotrophic metabolism. Photophosphorylation.

UNIT 8. REGULATION OF METABOLISM

Regulation of metabolism. Control of the production of enzymes. Routes of biosynthesis: repression. Catabolic routes: induction. Activators and inhibitors. Allosteric regulation.

5. PART V. GROWTH AND CONTROL OF MICROORGANISMS

UNIT 9. MICROBIAN GROWTH

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

UNIT 10. EFFECT OF THE ENVIRONMENT ON MICROBIAL GROWTH

Effect of temperature, water and osmotic pressure, pH, oxygen and radiations, etc. on microbial growth.

UNIT 11. 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 12. CONTROL OF MICROORGANISMS (I) 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.

6. PART VI. HOST-PATHOGEN RELATIONSHIP

UNIT 13. 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 14. 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.

7. PART VII. ACELULAR BIOLOGICAL AGENTS: THE VIRUSES

UNIT 15. 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

8. PART VII. BACTERIAL GENETICS

UNIT 16. Concept of genetics. Genome, genotype and phenotype. Mutation and mutants. Types of mutants. Mutagenic agents. Reversion of mutations. Mutagenesis and carcinogenesis: Ames test.

UNIT 17. Genetic recombination in bacteria. Concept and importance. Transformation. Transduction; generalized and specialized. Conjugation Plasmids: concept, types and importance.

12. 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 flora: 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
- Counting of viable organisms. Plate count technique

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

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Laboratory practices	15,00	100
Seminars	2,00	100
Tutorials	2,00	100
Development of group work	5,00	0
Development of individual work	5,00	0
Study and independent work	70,00	0
Readings supplementary material	5,00	0
Preparation of practical classes and problem	5,00	0
TOTAL	**147,00**	

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

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. 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. The mark for laboratory sessions will include a test / exam, the mandatory attendance, plus writing a report on the experimental exercises performed.

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

REFERENCES

Basic

- Biología de los microorganismos (Brock). M.T. Madigan, J.M. Martinko, P.V. -Dunlap y D. P. Clark. (2009) 12ª edición. Pearson Education S.A., Madrid (Pearson/Addison Wesley). ISBN: 978-84-7829-097-0
  -Microbiología. L.M. Prescott, J.P. Harley y A.K. Donald. (2004) 5ª edición. McGraw-Hill/Interamericana. ISBN: 84-486-0525-X
  -Introducción a la microbiología. G.J. Tortora, B.R. Funke, C.L. Case. (2007) 9ª edición. Panamericana. ISBN: 978-950-06-0740-7
  - Microbiology: Principles and Explorations. Jacquelyn G. Black. Wiley ISBN: 04714208Essential Microbiology. Stuart Hogg (2013). 2ª edition. Wiley-Blackwell.
  - Essential Microbiology, 2nd Edition. Stuart Hogg. Wiley-Blackwell. May 2013. ISBN : 978-1-118-52728-3

Additional

- http://www.aesa.msc.es/
  -http://www.who.int/foodsafety/en/
  -http://www.semicro.es/

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

1. Contents

The contents initially included in the teaching guide are maintained.

2. Volume of work and temporal planning of teaching

The workload for the student is maintained, derived from the number of credits, but the methodology of the activities changes with respect to the conventional teaching guide, due to the current situation that makes it necessary to adopt a hybrid teaching model

3. Teaching methodology

- Theoretical teaching: it will be carried out through synchronous sessions (synchronized videoconferences on BBC) and face-to-face. The distribution of students will be done by groups, so that 50% will be in the Faculty classroom while the other 50% will connect online, alternating their attendance for weeks, as long as the maximum capacity of the classrooms allows it. The class will always be held following the schedule (date and time) approved by the Center Board.
- Tutorials: They will all be face-to-face according to the dates set by the course calendar.
- Coordinated or non-coordinated seminars: They will all be face-to-face according to the dates set by the course calendar
- Practical classes: They will be face-to-face and according to the course calendar, but with the appropriate modifications to comply with the safety regulations against CoVid19. These may consist of: Limitation of the capacity of the laboratories to 50% establishing shifts in each group; Reduction of sample processing times by showing the student the result that would be obtained if the standard incubation times (24 hours) had elapsed, and temporary redistribution of practices. In this way, the student will be able to carry out complete practices, concentrated in a shorter time spent in the practical laboratory.

If a state of total confinement were to occur, all face-to-face teaching would be carried out online.

4. Evaluation

If the evolution of the current pandemic allows it, it will be face-to-face and in the terms indicated in the teaching guide. Only if this is not possible, the evaluation will be carried out by means of an individual oral examination by videoconference, which will last for the days necessary to evaluate all students.

The relative weight of theory, practices and seminars is maintained as indicated in the teaching guide.