COURSE DATA

DATA SUBJECT

Code: 33948
Name: Food Microbiology
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1205 - Degree in Human Nutrition and Dietetics	Facultat de Farmàcia i Ciències de l'alimentació	1	Second quarter
1938 - Doble grado en Nutrición Humana y Dietética y CAFD	Facultat de Farmàcia i Ciències de l'alimentació	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1205 - Degree in Human Nutrition and Dietetics 1938 - Doble grado en Nutrición Humana y Dietética y CAFD	Food microbiology	COMPULSORY

COORDINATION

VALERO RELLO ANA

HERNANDEZ RODRIGUEZ CARMEN SARA

SUMMARY

The subject provides the student with the basic knowledge of Microbiology, focusing learning on the applications and effects of microorganisms on food, at three levels: production, conservation and alteration. From an overview, all aspects of the biology of microorganisms are studied: taxonomy, structure, functions, genetics; as well as microbial growth control strategies.

Topics related to the unwanted effects of the presence of microorganisms in food are included, with special emphasis on aspects related to health, nutrition and food. The bases of immunology and pathogenesis are addressed, especially those of those species transmitted by food that cause infections and intoxications.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

In order to successfully address this Course, the student must master the fundamentals of subjects such as Biochemistry and Cell Biology

COMPETENCES / LEARNING OUTCOMES

1205 - Degree in Human Nutrition and Dietetics

Apply preventive measures against the transmission of foodborne microbial diseases.

Conocer y manejar las fuentes de información básica relacionadas con la Microbiología.

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 about foodborne pathogenic microorganisms.

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.

Know and understand the epidemiology of foodborne microbial diseases.

Know the main sources of microbial contamination of food.

Know the symptoms and treatment of major diseases caused by eating food contaminated with microorganisms.

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

Understand microbial genetics and the basic applications of genetic engineering in the area of food.

Understand the basic mechanisms of microbial pathogenicity.

Understand the growth of microorganisms, their requirements and the methods for controlling them.

DESCRIPTION OF CONTENTS

1. BASIC PRINCIPLES OF MICROBIOLOGY

Unit 1.- Introduction to general and food microbiology.

Field of Microbiology. Brief history of microbiology. Current interest and applications of Microbiology.

Unit 2.-Microbial diversity.

Microscopy. Diversity and classification of microorganisms. Morphology and grouping. Ecology and interactions.

Unit 3.- Microbial cell biology.

General characteristics of eukaryotic and prokaryotic cells. The prokaryotic cell: cytoplasmic membrane and functions, cell wall, capsule, appendix, cytoplasm, genetic material, ribosomes, inclusion bodies, endospores.

2. MICROBIAL PHISIOLOGY

Unit 4.- Microbial nutrition.

Nutrients. Nutritional classification. Culture media. Isolation techniques, maintenance and conservation of pure cultures.

Unit 5.- Microbial growth.

Microbial cell division. Growth of bacterial populations: generation time and the growth curve of pure cultures. Influence of environmental factors on growth: temperature, pH, osmotic pressure, oxygen concentration, radiation, pressure.

Unit 6. Microbial Metabolism.

Anabolism and catabolism. Obtaining energy. Glycolysis, oxidative phosphorylation, chemiosmosis. Aerobic and anaerobic respiration. Fermentations: concept, characteristics and types.

Unit 7.- Bacterial genetics.

Main characteristics of the DNA replication, transcription and translation processes in prokaryotes. Operons. Mutations: molecular bases, types, effects, mutagens. Genetic exchange and recombination in prokaryotes. Plasmids: concept and types.

4. CONTROL OF MICROBIAL GROWTH

Unit 8.- Physical and chemical control methods.

Kinetics of microbial death. Physical control methods: heat, low temperatures, dehydration, osmotic pressure, sound waves, radiation and mechanic methods. Chemical control methods: sterilization, disinfectants, antiseptics.

Unit 9.- Antimicrobial chemotherapeutic agents: antibiotics and synthetic antimicrobials.

Types, spectrum of activity, mechanisms of action. New antimicrobials. Antibiotics resistance: origin, evolution mechanisms. Antibiograms.

5. HOST-MICROORGANISM INTERACTIONS

Unit 10.- Microbiota and microbiome. Gut microbiota: origin, composition, evolution, functions, dysbiosis. Communication of gut microbiota with other systems: axis. Other human microbiotas. Probiotics and prebiotics.

Unit 11.- Microbial pathogenic mechanisms.

Pathogenicity and virulence. Virulence factors: structure based, enzymes, toxins. Microbial mechanisms to evade host defenses. Transmission of infectious diseases.

Unit 12.- Fundamentals of immunology.

Immune system. Innate immune response. Primary and secondary defense lines: barrier mechanisms, active mechanisms. Adaptive immune response: characteristics, humoral and cellular responses. Vaccines.

5. MICROORGANISMS INVOLVED IN FOODBORNE DISEASES AND FOOD SPOILAGE

Unit 13.- Counting and identification of microorganisms in feed.

Sampling methods for surfaces, air and feed. Direct counting methods. Detection and identification methods for microorganisms and toxins.

Unit 14.- Virus.

General characteristics of viruses. Structure and morphologies. Virus, viroids, virusoids and prions. Infection cycle. Foodborne viruses: Hepatitis A, Hepatitis E, Norovirus, Enterovirus, Rotavirus.

Unit 15.- Fungi.

Structure. Classification. Mycetism and mycotoxins. Allergies and mycosis.

Unit 16.- Gram-positive bacteria involved in foodborne diseases.

Types of foodborne diseases, *Enterococcus faecalis*, *Staphylococcus aureus*, *Listeria monocytogenes*, *Bacillus cereus*, *Clostridium botulinum*, *C. perfringens*.

Unit 17.- Gram-negative bacteria involved in foodborne diseases.

Campylobacter jejuni, Vibrio cholerae, V. parahemolyticus, V. vulnificus, Aeromonas hydrophila, Salmonella enterica, *Shigella dysenteriae*, *Yersinia enterocolitica*, *Escherichia coli*, *Brucella melitensis*.

Unit 18.- Indicator and index microorganisms.

Hygienic-sanitary and commercial quality. Indicators and index microorganisms: total aerobic viable count, aerobic mesophilic viable count, indicator enteric bacteria, D group *Streptococcus*, sulphate-reducing *Clostridium*, *Staphylococcus aureus*, moulds and yeasts.

Unit 19.- Food spoilage caused by microorganisms.

Food microbial ecology. Usage of chemical compounds by microorganisms. Main microorganisms causing food spoilage.

Unit 20.- Agenda 2030, Objective 6. Clean water and sanitation. Analysis of the impact caused by sanitation and hygiene deficiencies on growth of water- and borne microorganism.

6. Practicals

Session 1
- Aseptic technique for inoculation
- Simple staining
- Negative staining
- Study the influence of incubation temperature on bacterial growth
- Study of the skin microbiota: Demonstration of the presence of mixed populations in nature.
- Preliminary test for the detection of *Escherichia coli*

Session 2
- Gram stain
- Detection and count of sulphite-reducing *Clostridium*
- Study the effect of UV light on bacterial growth
- Study of the growth of microorganisms: Media selective, differential and enriched
- Confirmative test for the detection of *E. coli*

Session 3
- Catalase test
- Oxidase test
- Complementary test for the detection of *E. coli*
- Counting of viable organisms. Plate count technique
- Inoculation of a miniaturised system for identification of bacteria

Session 4
- 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	9,00
Independent study and work	76,00
Preparation of lessons	5,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

Theory (4.56 ECTS, 114 hours):

Lectures and active learning methodologies aimed at providing the student with basic knowledge.

Attendance: 38 hours; Preparation and study: 76 hours

Practical Classroom (workshops, problems) (0.44 ECTS, 11 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: 9 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 structured in small groups and attendance is mandatory. Students will have the opportunity to ask questions about the course, and provide answers to short questions given beforehand. 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

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

The assessment of laboratory sessions will contribute to the final grade 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

and the mandatory attendance.

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.

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**

Conducting and attendance the seminars is compulsory and its assessment will contribute to the final grade 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

- Brock Biología de los microorganismos. 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: 978-84- 7829-097-0
- Microbiología de Prescott, Harley y Klein. J. M. Willey, L. M. Sherwood y C. J. Woolverton. (2009) 7ª edición. Editorial: McGraw-Hill-Interamericana de España, S.A.U. ISBN: 978-84-481-6827-8
- Sherris, Microbiología médica. K.J. Ryan (2021). 7ª edición. Editorial: McGraw-Hill Interamericana de México, D.F. ISBN: 978-1264268719
- Microbiology An Introduction. G. J. Tortora, B. R. Funke & C. L. Case. (2016) 12th edition. Pearson Benjamin Cummings, San Francisco. ISBN: 978-0-321-55007-1
- Fundamental Food Microbiology. B. Ray & A. Bhunia. (2008) 4th edition. CRC Press, Taylor & Francis Group, Boca Raton. ISBN: 978-0-8493-7529-3
- Pathogens and Toxins in Foods. Challenges and Interventions. V. K. Juneja & J. N. Sofos. (2009). ASM Press, Washington D.C. ISBN: 978-1-55581-459-5
- The microbiology of safe food. S.J. Forsythe. (2020) 3rd edition. Editorial: Wiley Blackwell, Hoboken,

New Yersey. ISBN: 9781119405252

- Foodborne infections and intoxicacions. J.G. Morris & D.J. Vugia. (2021) 5th edition. Editorial: Elsevier Inc. ISBN: 0-12-820574-1

- Benson's Microbiological Applications. Laboratory Manual in General Microbiology. Short Versión. A. E. Brown. (2015) 13th edition. McGraw-Hill Education. ISBN-13: 978-0073402413

- Food Microbiology: Fundamentals and Frontiers. M. P. Doyle & R.L Buchanan. (2013) 4th edition. ASM Press, Washington D.C. ISBN: 978-1-55581-626-1

- Microbiology: a laboratory manual. J.G. Cappuccino. (2019) 12th edition. Editorial: Pearson, New York. ISBN: 9780135188996

Webpages:

- OMS: www.who.int/es/

- ECDC: www.ecdc.europa.eu/en/food-and-waterborne-diseases-and-zoonoses

- Food alerts: www.sanidad.gob.es/areas/alertasEmergenciasSanitarias/alertasActuales/alertaAlimentaria.htm

- AECOSAN: www.aesan.gob.es/AECOSAN/web/home/aecosan_inicio.htm