



Universitat de Lleida

## DEGREE CURRICULUM

# **FOOD MICROBIOLOGY**

Coordination: RAMOS GIRONA, ANTONIO JAVIER

Academic year 2022-23

## Subject's general information

Subject name	FOOD MICROBIOLOGY			
Code	102583			
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Character	Modality
	Bachelor's Degree in Agricultural and Food Engineering	3	COMPULSORY	Attendance-based
Course number of credits (ECTS)	6			
Type of activity, credits, and groups	Activity type	PRALAB		TEORIA
	Number of credits	2.7		3.3
	Number of groups	1		1
Coordination	RAMOS GIRONA, ANTONIO JAVIER			
Department	FOOD TECHNOLOGY, ENGINEERING AND SCIENCE			
Teaching load distribution between lectures and independent student work	Face-to-face classes: 60 h Independent student work:90 h			
Important information on data processing	Consult <a href="#">this link</a> for more information.			
Language	A.J. Ramos: Spanish I. Viñas: Spanish Spanish:100%			
Distribution of credits	Theory: 56.66% Practical lessons: 43.33%			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
RAMOS GIRONA, ANTONIO JAVIER	antonio.ramos@udl.cat	3,9	By appointment
VIÑAS ALMENAR, M.INMACULADA C.	inmaculada.vinas@udl.cat	2,1	By appointment

## Subject's extra information

The course aims to provide students with theoretical/practical knowledge necessary to understand the problems generated by the presence of microbial spoilage in food.

This compulsory subject is taught in the 2nd semester of 3rd year of the Bachelor Degree in Agricultural Engineering, in his specialty of Agricultural and Food Industries. Students must have previously studied the subject "Biology" (code 102510), where have acquired the basic concepts of General Microbiology required for this course, as general characteristics of prokaryotes, protists, fungi and viruses; microbiological media and their preparation; measurements of bacterial growth; chemical and physical methods of microbial control; environmental microbiology and microbiology of water.

The subject, could be complemented by "Food Analysis" (code 102580), an therefore graduates will be able to perform a complete analysis of a food.

## Learning objectives

The objectives to be achieved in the course include:

RA1: Describe the origin and evolution of microorganisms in food.

RA2: Identify the effect that different conservation systems have on microorganisms in food.

RA3: Identify the main bacterial agents viral, fungal and food-related infections.

RA4: Knowing how to identify the main microbial spoilage of food.

RA5: Using microbiological analysis techniques of food

RA6: Propose suitable production processes and cleaning methods, as well as tools for hygienic production.

RA8: Solve problems and cases related to the subject.

R A9: Know the most common laboratory material, operate correctly and know the minimum safety standards to follow.

RA10: Properly prepare a lab report.

## Competences

## Basic skills

CB1. That students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge from the cutting edge of your field of study

CB2. That students know how to apply their knowledge to their work or vocation in a professional way and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant issues of a social, scientific or ethical nature

CB4. That students can transmit information, ideas, problems and solutions to both specialized and non-specialized audiences

CB5. That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy

## General competences

CG6. Ability to direct and manage all kinds of agri-food industries, agricultural and livestock farms, urban and / or rural green spaces, and public or private sports areas, with knowledge of new technologies, quality processes, traceability and certification and the marketing techniques and commercialization of food products and cultivated plants.

CG8. Ability to solve problems with creativity, initiative, methodology and critical reasoning.

CG9. Leadership, communication and transmission of knowledge, abilities and skills in the social fields of action.

CG10. Ability to search and use the rules and regulations related to its scope of action.

## Transversal competences

CT1. Correction in oral and written expression

## Specific skills

CEIAA1. Ability to know, understand and use the principles of: Food engineering and technology. Engineering and basic food operations. Food Technology. Processes in the agri-food industries. Modeling and optimization. Quality and food safety management. Food analysis. Traceability.

## Subject contents

### Course programme (33h)

Unit 1. (2 hour) Natural food contamination. Origin of microbial contamination of food and food products. Contamination during processing, storage, transportation and marketing. Microbiological control of the environment.

Unit 2. (4 hours) General principles of food spoilage. Intrinsic factors: Water activity ( $a_w$ ), pH, redox potential, nutrients, antimicrobial substances, food structure and protective barriers. Extrinsic factors: temperature, humidity, gaseous atmosphere. Technological treatments. Implicit factors. Interaction of factors, synergisms and antagonisms.

Unit 3. (2 hour) General principles of food preservation. Application of bacterial growth curve to food preservation. The theory of combined methods. Principal methods of conservation. Asepsis. Maintenance under anaerobic conditions. Removal of microorganisms: washing, centrifugation, filtration.

Unit 4. (1.5 hours) Food preservation by radiation. Main characteristics of radiation of interest in food preservation: ionizing radiation and U.V. Factors influencing the lethal action. Microbial resistance and repair strategies. Influence on food quality. Legal status of the use of radiation.

Unit 5. (2 hours) Food preservation by drying. Desiccation effect on microorganisms. Pre-treatment and post-treatment of dry foods. Factors controlling desiccation. Main methods of drying. Intermediate moisture foods.

Unit 6. (2 hours) Food preservation by heat. Factors influencing the heat resistance of microorganisms. Thermostability concept. Survival plots the heat treatment temperature and time of death. Heat penetration. Effect of sublethal heat treatment.

Unit 7. (2 hours) Food preservation by cold. Influence of low temperatures on microorganisms. Key features of the psychrophilic and psychrotrophic microorganisms. Growth of microorganisms at low temperatures. Refrigeration. Effect of freeze/thaw on food. Microorganisms response to stress freezing/thawing.

Unit 8. (1 hour) Conservation by high pressures. Effect of high pressure on microorganisms. Mechanism of action. Advantages and disadvantages of treatment.

Unit 9. (1.5 hour) Chemical Food Preservation. Additives and preservatives: definitions and categories. The ideal preservative. Preservatives are added to food preservatives and originating in foods. Main organic and inorganic preservatives: type, structure, mechanism of action and properties. Curing and smoking. Gases and conservatives: modified atmospheres.

Unit 10. (2 hours) Water Microbiology. native and non-native microbiota. Types of water. microbiological parameters which determine water quality. Major pathogens: diseases and epidemiology. Purification and distribution of water for human consumption.

Unit 11. (2 hours) Microbiology of cereals, flours and derivatives. Initial contamination. Collection, transportation and storage of grains. Factors influencing the alteration of stored grains. Main pathogens and spoilage microorganisms. Molds and mycotoxins. major alterations. Main conservation methods.

Unit 12.- (2 hours) Microbiology of fruits, juices, vegetables and dairy products. Natural protection systems of fruit and vegetables. Initial microbiota. Post-harvest evolution. Juices. Main pathogens and spoilage microorganisms. Main alterations. Main conservation methods.

Unit 13.- (2 hours) Microbiology of meat and meat products. Initial microbiota. Obtaining hygienic meat. Main pathogens and spoilage microorganisms. Main alterations. Main conservation methods.

Unit 14. (1 hour) Microbiology of poultry meat. Initial microbiota. Influence of industrial processing stages on poultry meat microbial contamination. Main pathogens and spoilage microorganisms. Main alterations. Main conservation methods.

Unit 15.- (2 hours) Microbiology of eggs and egg products. Structure and composition of the egg: physico-chemical barriers. Routes of egg contamination. Main pathogens and spoilage microorganisms. Main alterations. Main conservation methods.

Unit 16.- (2 hours) Microbiology of milk and dairy products. Types of milk. Initial microbiota. Influence of industrial processing stages on milk microbial contamination. Main pathogens and spoilage microorganisms. Main alterations. Main conservation methods.

Unit 17.- (2 hours) Microbiology of fish and other foods from aquaculture. Peculiarities of fish, crustaceans and molluscs. Initial microbiota. Effect of initial treatment and storage on board. Importance of evisceration. Influence of ground handling. Main pathogens and spoilage microorganisms. Main alterations. Main conservation methods.

Unit 18.- (2 hours) Microbiology of canned foods. History of canning process. Canned and semi-canned food: definition and types. Classification of canned foods according to their acidity. Biological sterility and commercial sterility. Major pathogens and cause alterations in canned foods. Main alterations. Systematic examination of canned foods and microbiological analysis.

## **Practical lessons (25h)**

At the Microbiology laboratory, sited at the building 2 of the ETSEA, lab. 3.01.

Practice 1.- Introduction to the Food Microbiology laboratory.

Practice 2.- Sampling and preparation of samples. Decimal dilutions.

Practice 3.- Microbiological recounts:

- ▶ Mesophilic aerobic microorganisms at 30 °C.
- ▶ Molds and yeasts.
- ▶ Enterobacteria and kligler test.
- ▶ E. coli  $\beta$ -glucuronidase positive
- ▶ Staphylococcus coagulase positive.
- ▶ Bacillus cereus
- ▶ Clostridium perfringens
- ▶ Enterococcus

Practice 4.- Salmonella.

Practice 5.- Listeria.

Practice 6.- Fungal infection of grains.

Practice 7.- Identification of filamentous molds.

Practice 8.- Report of results.

It is MANDATORY that students have the following individual protection teams (EPI) in the course of teaching practices.

White lab coat

Safety glasses

Gloves for chemical / biological protection

In addition, they must carry a permanent marker.

The EPI can be purchased at UdL's ÚDELS store

Center for Cultures and Cross-Border Cooperation - Cappellet Campus

Carrer de Jaume II, 67 low. 25001 Lleida.

## Methodology

This subject is taught through theoretical master classes and laboratory practices, in both cases of a face-to-face type. Attendance to practical lessons is compulsory.

## Development plan

To date of the closing of this guide, the Development Plan of this topic follows the following calendar (with some dates still to confirm, pending of the availability of laboratory):

### CURSO 2022-2023 v1.0

Week day	Day	Month	Hour	Sum of hours	Kind of activity	Teacher
Monday	6	FEBRUARY	2	2	THEORY	A.J. Ramos
Wednesday	8	FEBRUARY	2	4	THEORY	A.J. Ramos
Monday	13	FEBRUARY	2	6	THEORY	A.J. Ramos
Wednesday	15	FEBRUARY	2	8	THEORY	A.J. Ramos
Monday	20	FEBRUARY	2	10	THEORY	I. Viñas
Wednesday	21	FEBRUARY	2	12	THEORY	I. Viñas
Monday	27	FEBRUARY	2	14	THEORY	I. Viñas
Wednesday	1	MARCH	2	16	THEORY	I. Viñas

Monday	6	MARCH	2	18	THEORY	I. Viñas
Wednesday	8	MARCH	2	20	THEORY	A.J. Ramos
	¿?	<b>MARCH</b>	<b>Practical lessons from XX to XXh* TO BE CONFIRMED</b>			A.J. Ramos
Monday	13	MARCH	2	22	THEORY	A.J. Ramos
	¿?	<b>MARCH</b>	<b>Practical lessons week (13-17, afternoons)** TO BE CONFIRMED</b>			
Wednesday	15	MARCH	2	24	THEORY	A.J. Ramos
Monday	20	MARCH	2	26	THEORY	A.J. Ramos
Wednesday	22	MARCH	2	28	THEORY	A.J. Ramos
Thursday	30	MARCH	<b>Exam 10-13h, 3.1.03.2</b>			
			<b>HOLY WEEK 1-10 APRIL</b>			
Wednesday	12	APRIL	2	30	THEORY	A.J. Ramos
Monday	17	APRIL	2	32	THEORY	A.J. Ramos
Wednesday	19	APRIL	2	34	THEORY	A.J. Ramos
Monday	24	APRIL	1	35	THEORY	A.J. Ramos
Wednesday	26	APRIL	--	--	--	--
Wednesday	3	MAY	--	--	--	--
Monday	8	MAY	--	--	--	--
Monday	15	MAY	--	--	--	--
Wednesday	17	MAY	--	--	--	--
Monday	22	MAY	--	--	--	--
Wednesday	24	MAY	--	--	--	--
Monday	29	MAY	--	--	--	--
Wednesday	31	MAY	--	--	--	--
Monday	5	JUNE	<b>Exame 10-14h, 3.1.03.2</b>			
	21	JUNE	<b>Final exam 10-14h, 3.1.03.2</b>			

35 hours of theory + 25 hours of face-to-face practices = 60 hours of class = 6 ECTS

\* On the XXof MARCH, from XXX to XXXh., unless it is not possible due to health restrictions, a laboratory practical session will be held in the Microbiology practical laboratory of building No. 2, 3rd floor, lab. 3.01. **COMPULSORY ATTENDANCE.**

\*\*The week of MARCH XXth to XXth, unless it is not possible due to health restrictions, will be a week of face-to-face practices in the Microbiology laboratory of building No. 2, 3rd floor, lab. 3.01., in the afternoons. **COMPULSORY ATTENDANCE.**

## **COURSE SCHEDULE**

- Monday: from 10:10 a.m. to 12:00 p.m.

- Wednesday: from 12:10 to 2:00 p.m.

Classroom: 3.1.03.2

## Evaluation

### Exams:

- First exam: will include the theory of the topics explained until the first evaluation period of the semester (tentatively from topics 1 to 10). Value: 40% of the subject.
  - Second exam: will include the theory explained from what was examined in the first exam until the end of the subject (tentatively from topics 11 to 18) + questions from the practical part of the subject. Value: 45% of the subject (30 + 15%).
- Each exam will have the following structure:
- Test with questions of true/false, in which every two bad will subtract a good (value: 70% of the value of the exam).
  - 1 or 2 short questions (value: 30% of the exam value).

### Practices:

- The practices are of compulsory attendance. The attention and attitude in the practical class is evaluated + preparation of a report of practices to be delivered as the deadline for the 2nd exam of theory of the subject. The report can be done in pairs. The non-presentation of the report or not doing it in time supposes the failure in the subject. Value of the practices (attitude + report): 15%.
- In the practice report, the exercises must be recorded, as well as the critical discussion of the results. To carry out this report, the criteria specified in the document "Check-list and rubric of the practice report" available in the "Resources" section of the Virtual Campus must be taken into account, where the value of each element that forms the memory. This document must be submitted signed by the authors together with the report.

### Distribution of the evaluation:

Theory + practical exams: 85% (8.5 points). In any case, each exam must obtain a minimum score of 4.0 points (out of 10) so that it can average with the rest of the evaluation activities.

Practice report: 15% (1.5 points). The practice report is scored from 0 to +1.5 points. In any case, in the practice report a minimum score of 0.6 points (out of 1.5) must be obtained so that it can average with the rest of the evaluation activities.

**Those students who get less than a 4 in any of the exams, will be able to recover it, but in the recovery exam they will have to get at least a 5 so that it averages with the rest of the marks.**

## Bibliography

### **Basic books**

FRAZIER, W.C. y D.C. WESTHOFF. (1993). Microbiología de los alimentos. Acribia, Zaragoza.

I.C.M.S.F. (1983). Ecología microbiana de los alimentos. Vol I.: Factores que afectan a la supervivencia de los microorganismos en los alimentos. Acribia, Zaragoza

I.C.M.S.F. (2001). Microorganismos de los alimentos 6. Ecología microbiana de los productos alimentarios. Acribia, Zaragoza.

MADIGAN, M., MARTINKO, J. Y PARKER, J. (2003). Brock Biología de los Microorganismos. 10ª Edición. Ed. Prentice-Hall. Madrid.

MARKELL, E.K., VOGEL, M. y JOHN, D.T. (1990). Parasitología Médica. Editorial Interamericana×McGraw-



Hill.

PRESCOTT, L.M, HARLEY, J.P y KLEIN, D.A (2004). Microbiología. McGraw-Hill Interamericana, Madrid.

## **Complementary references**

ACHA, P.N. y SZYFRES, B. (1989). Zoonosis y enfermedades transmisibles comunes al hombre y a los animales. Organización Panamericana de la Salud.

ALLAERT, C. y ESCOLÀ, M. (2002). Métodos de análisis microbiológicos de los alimentos. Díaz de Santos, Madrid.

JAY, J.M. (2002). Microbiología moderna de los alimentos. Acribia, Zaragoza.

MOSSEL, D.A.A., J.E.L. CORRY, C.B. STRUIJK *et al.* (1995). Essentials of the microbiology of foods. A textbook for advanced studies. John Wiley & Sons, Chichester.

MOSSEL, D.A.A. y B. MORENO. (1985). Microbiología de los alimentos: fundamentos ecológicos para garantizar y comprobar la inocuidad de los alimentos. Acribia, Zaragoza.