Universitat de Lleida

DEGREE CURRICULUM

FOOD MICROBIOLOGY

Coordination: RAMOS GIRONA, ANTONIO JAVIER

Academic year 2021-22

FOOD MICROBIOLOGY 2021-22

Subject's general information

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<tr><td>Subject name</td><td>FOOD MICROBIOLOGY</td></tr>
<tr><td>Code</td><td>102583</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Agricultural and Food Engineering</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><td>PRALAB</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>2.7</td><td>3.3</td></tr>
<tr><th>Number of groups</th><td>1</td><td>1</td></tr>
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<tr><td>Coordination</td><td>RAMOS GIRONA, ANTONIO JAVIER</td></tr>
<tr><td>Department</td><td>FOOD TECHNOLOGY</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>Non-contact classes:
Face-to-face classes:
Independent student work:</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan: 30%
Spanish: 70%</td></tr>
<tr><td>Distribution of credits</td><td>Theory: 56.6%
Practical lessons: 43.3%</td></tr>
</table>

FOOD MICROBIOLOGY 2021-22

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

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 (aw), 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. Thermodestruction 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 ºC.
► Molds and yeasts.
► Enterobacteria and kligler test.
► E. coli β-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

Sanitary mask

The EPI can be purchased at UdL's ÚDELS store

Center for Cultures and Cross-Border Cooperation - Cappont Campus

Carrer de Jaume II, 67 low. 25001 Lleida.

Methodology

As long as the health circumstances arising from the COVID do not prevent this, this subject is taught through theoretical master classes and laboratory practices, in both cases of a face-to-face type.

Development plan

The course development plan follows the following schedule:

Week day	Day	Month	Hour	Accumulated hours	Kind of class	Teacher
Monday	7	FEBRUARY	2	2	THEORY	**A.J. Ramos**
Wednesday	9	FEBRUARY	2	4	THEORY	**A.J. Ramos**
Monday	14	FEBRUARY	2	6	THEORY	**A.J. Ramos**
Wednesday	16	FEBRUARY	2	8	THEORY	**A.J. Ramos**
Monday	21	FEBRUARY	2	10	THEORY	**I. Viñas**
Wednesday	23	FEBRUARY	2	12	THEORY	**I. Viñas**
Monday	28	FEBRUARY	2	14	THEORY	**I. Viñas**
Wednesday	2	MARCH	2	16	THEORY	**I. Viñas**

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Monday	7	MARCH	2	18	THEORY	**I. Viñas**
Wednesday	9	MARCH	2	20	THEORY	**A.J. Ramos**
	10	**MARCH**	**Laboratory 16 to 18h***			**A.J. Ramos**
Monday	14	MARCH	2	22	THEORY	**A.J. Ramos**
		MARCH	**All week laboratory (from 14 to 18, afternoons)****			
Wednesday	16	MARCH	2	24	THEORY	**A.J. Ramos**
Monday	21	MARCH	2	26	THEORY	**A.J. Ramos**
Wednesday	23	MARCH	2	28	THEORY	**A.J. Ramos**
	24	MARCH	**Exam 10-13h**			
Monday	4	APRIL	2	30	THEORY	**A.J. Ramos**
Wednesday	6	APRIL	2	32	THEORY	**A.J. Ramos**
			HOLY WEEK 9-18 DE APRIL			
Wednesday	20	APRIL	2	34	THEORY	**A.J. Ramos**
Monday	25	APRIL	1	35	THEORY	**A.J. Ramos**
Wednesday	27	APRIL	--	--	--	**--**
Monday	2	MAY	--	--	--	**--**
Wednesday	4	MAY	--	--	--	**--**
Monday	9	MAY	--	--	--	**--**
Monday	16	MAY	--	--	--	**--**
Wednesday	18	MAY	--	--	--	**--**
Monday	23	MAY	--	--	--	**--**
Wednesday	25	MAY	--	--	--	**--**
Monday	30	MAY	--	--	--	**--**
Wednesday	1	JUNE	--	--	--	**--**
	7	JUNE	**Exam 10-13h**			
	22	JUNE	**Final exam 10-13h**			

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

* On the 10th of MARCH, from 4:00 p.m. to 6:00 p.m., 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 14 to 18, 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.

Observations regarding the health crisis derived from COVID-19:

The evaluation will follow what is described above. In the event that due to restrictions caused by the health crisis, the planned face-to-face evaluations cannot be carried out, alternative evaluations will be carried out in a non-face-to-face way.
In the event that the practices cannot be carried out in person, they will be replaced by a report about methods of microbiological analysis of food, the weight of which in the evaluation of the subject will be equivalent.

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, Zaragoz

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., VOGE, 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.