COURSE SYLLABUS

Academic Year: 2020/2021

Identification and characteristics of the course				
Code	502221	ECTS Credits		6
Course title (English)	Food chemistry and biochemistry			
Course title (Spanish)	Química y bioquímica de los alimentos			
Degree programs	Engineering in Agricultural and Food Industries			
Faculty/School	School of Agricultural Engineering			
Semester	(8th)	Course type (compulsory/optional)	Compulsory	
Module	Food science			
Subject matter	Food chemistry and biochemistry			
Lecturer/s				
Name		Room	E-mail	Web page
Lourdes Martín Cáceres		703 Jerte Valley Building	martinlu@unex.es	
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Subject Area	Food Technology			
Department	Animal Production and Food Science			
Coordinator (Only if there is more than one lecturer)	**Lourdes Martín Cáceres**			

Competencies*

Specific competencies

CETE1 - Ability to know, understand and use the principles of food engineering and technology. Food engineering and basic operations. Food Technology. Processes in the agro-food industries. Modelling and optimization. Quality and food safety management. Food analysis. Traceability.

* The sections concerning competencies, course outline, teaching activities, teaching methodology, learning outcomes and assessment methods must conform to those included in the ANECA verified document of the degree program.

Contents
Course outline*
Food components. Chemical and biochemical changes in foods during processing and storage. Food additives.
Course contents
Title of unit 1: **Water in food.** Contents of unit 1: Importance of water in food. Molecular structure and physicochemical properties of water. Water activity. Methods of determination. Sorption isotherms. Hysteresis.
Title of unit 2: **Molecular mobility.** Contents of unit 2: Molecular mobility. State diagrams: phase transition in foods. Technological importance of molecular mobility in industrial processes.
Title of unit 3: **Functional properties of carbohydrates.** Contents of unit 3: Characteristics of carbohydrate foods. Functional properties of mono-and oligosaccharides.
Title of unit 4: **Starch in food.** Contents of unit 4: Starch: structure and properties. Starch gel formation. Factors influencing the formation of gels. Stability of the starch gels. Modified starches.
Title of unit 5: **Structural polysaccharides and their roles in food.** Contents of unit 5: Pectins. Cellulose and other cell wall components. Gums. Polysaccharides derived from seaweed.
Title of unit 6: **Non-enzymatic browning.** Contents of unit 6: Non-enzymatic browning reactions. Caramelization. Maillard reaction. Mechanisms and control.
Title of unit 7: **Carbohydrates in fruits and vegetables.** Contents of unit 7: Metabolism of fruits and vegetables. Chemical modifications of carbohydrates. Postharvest control conditions.
Title of unit 8: **Functional properties of lipids.** Contents of unit 8: Characteristics of food lipids. Functional properties of lipids: crystal formation and fusion.
Title of unit 9: **Formation of emulsions in food.** Contents of unit 9: Emulsions. Formation and breaking of emulsions. Emulsifiers: stabilizing functions and HLB value.
Title of unit 10: **Changes of lipids in foods.** Contents of unit 10: Changes in lipids during processing and storage of food: lipolysis, autoxidation and enzymatic rancidity. Frying oil chemistry.
Title of unit 11: **Lipid modification treatments.** Contents of unit 11: Physico-chemical treatments for lipid modification in the food industry: hydrogenation, transesterification and fractionation. Fat replacers.
Title of unit 12: **Functional properties of proteins.** Contents of unit 12: Characteristics of amino acids and protein structure in food. Types of bonds in proteins. Functional properties.
Title of unit 13: **Food protein systems.** Contents of unit 13: Bread dough, milk and meat; effect of treatments on protein systems.

Title of unit 14: **Food enzymes.** Contents of unit 14: Food enzymes. Types and applications. Immobilized enzymes and their use in the food industry. Enzymes as indicators of treatment.
Title of unit 15: **Pigments in foods I.** Contents of unit 15: General concepts. Myoglobin and Hemoglobin. Meat color. Chemistry of myoglobin. Effect of storage and processing on the colour of meat.
Title of unit 16: **Pigments in foods II.** Contents of unit 16: Chlorophyll. Effects of processing on chlorophylls. Carotenoids. Anthocyanins. Structure. Colour changes and chemical reactions of anthocyanins. Betalains. Flavonoids.
Title of unit 17: **Enzymatic browning.** Contents of unit 17: Enzymatic browning reaction. Factors influencing enzymatic browning. Measures to minimize enzymatic browning.
Title of unit 18: **Food additives.** Contents of unit 18: General concept of food additive. Classification. Legislation.
Title of unit 19: **Additives that prolong the shelf-life.** Contents of unit 19: Preservatives: sulfites; nitrites; organic acids and related products; antibiotics; other preservatives. Antioxidants.
Title of unit 20: **Additives that enhance flavor, aroma and color.** Contents of unit 20: Sweeteners. Acids. Aromas. Flavour enhancers. Colours.
Title of unit 21: **Additives that improve texture.** Contents of unit 21: Thickeners, gelling agents and stabilizers. Emulsifiers. Humectants. Anti- caking agents. Firming agents. Emulsifying salts. Bulking agents. Flour treatment agents.
Title of unit 22: **Other additives.** Contents of unit 22: Acidity regulators. Contrast enhancers. Raising agents. Anti-foaming agents. Glazing agents. Packaging gases and propellants. Carriers.
Practical sessions
Laboratory practices:
Description of practical activities 1: **Determination of water activity (2h).** Contents P1: Determination of water activity in food.
Description of practical activities 2: Evaluation of polysaccharides (5h). Contents P2: Determination of soluble solid content. Evaluation of chemically modified starch. Assessing the strength of pectin gels. Preparation of alginate and other polysaccharides gels.
Description of practical activities 3: **Browning reactions (5h).** Contents P3: Non-enzymatic browning reaction. Fehlings test for reducing sugars. Enzymatic browning reaction.
Description of practical activities 4: **Determination of lipids (4h).** Contents P4: Fat extraction and quatification by method of Folch. Peroxide, acidity and iodine values and slip point. Determination of TBA.
Description of practical activities 5**: Evaluation of pigments (3h).** Contents P5: Evaluation of the effect of pH on anthocyanins. Pigment separation from green leafy vegetables.
Description of practical activities 6: **Evaluation of food dispersions (3h).** Contents P6: Albumin foam stability. Use of emulsifiers.

Seminar:
It consists of making a presentation that describes at least 5 authorized food additives included in commercial food products (one or more products).
The fundamental aspects of the chosen additives regarding their function, action mechanism and particularities should be briefly explained. The choice of food products containing infrequent food additives is more valued.

Educational activities *

Student workload (hours per lesson)		Lectures	Practical sessions				Monitoring activity	Homework
Lesson	**Total**	**L**	**HI**	**LAB**	**COM**	**SEM**	**SGT**	**PS**
1-2	21	4		4			1	12
3-7	28	7		7				14
8-11	23	4		6			1	12
12-13	18	4		3			0,5	10,5
14	10	2					1	7
15-16	14	3		1			1	9
17	8	1		1				6
18-22	26	8,5				2,5		15
Assessment **	2	2						
TOTAL ECTS	**150**	**35,5**		**22**		**2,5**	**4,5**	**85,5**

L: Lectures (100 students)
HI: Hospital internships (7 students)
LAB: Lab sessions or field practice (15 students)
COM: Computer room or language laboratory practice (30 students)
SEM: Problem-solving classes, seminars or case studies (40 students)
SGT: Scheduled group tutorials (educational monitoring, ECTS type tutorials)
PS: Personal study, individual or group work and reading of bibliography

Teaching Methodology*

- **Expository classes with discussion of theoretical content.** They are taught in 3 hours a week from the beginning to the middle of the term and 2 hours a week from the middle of the term until the end of the course. In the last minutes of each large group expository class, small evaluations can be made of what has been discussed in the class.

- **Laboratory practices.** They are carried out in 5 sessions of 4 hours and 1 session of 2 hours. The student has the practice protocol to develop the proposed practices. Students must prepare and deliver a Practice Report.

- **Development and presentation of seminars.** Students prepare a paper on the proposed topic, which must be presented.

** Insert as many rows as necessary. For instance, you can include one row for a partial exam and another for the final exam.

- **Use of the virtual classroom.** Students have the presentations used in the expository classes and the practical protocols in the virtual area. It also provides a space that allows communication through forums, announcements, etc.
- **Study of the subject.** This is the personal work that students must undertake.

- **Search and management of scientific bibliography.** Adequate bibliographic sources are required to consult aspects related to the contents of the subject and, especially, to prepare the seminar.

Learning outcomes *

- a. Demonstrate the knowledge of chemical and biochemical characteristics of food components, providing conclusions of the implication of these characteristics in the transformation of food.

- b. Explain in detail the functional properties of food components.

- c. Evaluate the mechanism and consequences of the chemical and biochemical reactions involved in food spoilage.

- d. Explain the influence of technological treatments and storage on food components.

- e. Demonstrate an understanding of the use of authorized food additives in the food industry, the study of their mechanisms of action and their applications.

- f. Explain the activities carried out in the laboratory, demonstrating the ability to observe, interpret the results and obtain final conclusions.

Assessment methods *

Continuous evaluation system

To calculate the course ratings, the following percentages are used:

- **60%** of the final mark comes from the final evaluation through a theory exam, which consists of preferably short questions, although it can also include test questions. Test questions have four possible answers with only one correct; 2 wrong answers subtract 1 correct answer. At least 5 points up to 10 must be obtained in the theory exam.

Competences that are evaluated: CETE1.

- **20%** of final mark comes from laboratory practices evaluation. Students must prepare a Practice Report that should reflect the development, the relevant calculations and conclusions in every experiment that had been carried out. The Practice Report must be submitted in paper format at the end of the practice period or until the deadline, which

is the last theory class of the course. To evaluate the practical part, the quality of the Practices Report and the development of the practices are taken into account.

In case not attending the practical classes or not reaching at least 5 point in laboratory practices ratings, students are required to do a Practice Exam, that coincides in time and place with the final theory exam. The Practice Exam consists of short questions about the laboratory practices that had been developed in the course.

It is required for passing the course to have passed the practical part. In the case of not passing the practical part, the final mark of the course will be no more than 4.5 points, despite the weighted average has been higher.

Competences that are evaluated: CETE1.

- **15%** of the final mark comes from the evaluation of the attendance in the expository classes, which comes from the rating of the small exams that are carried out in the last minutes of every class.

Competences that are evaluated: CETE1.

- **5%** of the final mark derives from the seminar that students must do and present.

Competences that are evaluated: CETE1.

Alternative evaluation system with global final exam

To opt for this global evaluation system, students must fill out, sign, register and apply at the EIA Office, an application form that is available on the EIA website (Secretariat, administrative procedures), within the first three weeks of the semester. When students do not make this communication, it is understood they choose the Continuous evaluation system.

The alternative system involves taking a written Final Exam that has two parts:

- The first part (70%) evaluates the theoretical content of the course. It consists of preferably short questions, although it can also include test questions. Test questions have four possible answers of which only one is correct; 2 wrong answers subtract 1 correct answer.

- The second part (30%) consists of short questions about the laboratory practices that have been developed in the course.

Competences that are evaluated: CETE1.

Bibliography (basic and complementary)

Basic bibliography
-Damodaran, S., Parkin, K. L. Fennema, O. R. (2015). Fenemma, Química de los alimentos. Acribia, Zaragoza.

Complementary bibliography
-Badui, S. (2006). Química de los alimentos. Pearson Educación. México
-Baltes W. (2007). Química de los alimentos. Acribia, Zaragoza.
-Barros, C. (2009). Alimentos nuevos y nuevos ingredientes alimenticios y/o alimentarios según la Comunidad Europea. Visión Libros. Madrid.
-Coultate T. P. (2007). Manual de química y bioquímica de los alimentos. Acribia, Zaragoza
-Fayle S.E. (2005). La reacción de Maillard. Acribia, Zaragoza.
-Fisher C., Scout T.R. (2000). Flavores de los alimentos. Biología y química. Acribia, Zaragoza.
-Jeantet, R. et al (2010). Ciencia de los alimentos: bioquímica, microbiología, procesos, productos. Acribia. Zaragoza.
-Multon J.L. (2001). Aditivos y auxiliares de la fabricación en industrias agroalimentarias. Acribia, Zaragoza.
-Sahin, S. (2009). Propiedades físicas de los alimentos. Acribia. Zaragoza.

Websites
Scientific and popular articles searching through http://biblioteca.unex.es/.

Other resources and complementary materials

- Power point presentations used in classroom are available on the course's virtual page (http://campusvirtual.unex.es/portal/).
- Laboratory practices protocols are available on the virtual classroom (http://campusvirtual.unex.es/portal/).
- Documents derived from legal regulations that affect the content of the course.