

## COURSE SYLLABUS

**Academic Year: 2023/2024**

Identification and characteristics of the course			
Code	501250	ECTS Credits	6
Course title (English)	Food Technology		
Course title (Spanish)	<b>Tecnología de Alimentos</b>		
Degree programs	Degree in AgriFood Industries Engineering		
Faculty/School	Agricultural Engineering School		
Semester	Forth (4º)	Course type (compulsory/optional)	Compulsory
Module	Food Technology		
Subject matter	Food Technology		
Lecturer/s			
Name	Room	E-mail	Web page
<b>Ana Isabel Andrés Nieto</b>	D701	aiandres@unex.es	www.unex.es
<b>Juan Florencio Tejada Sereno</b>	D702	jftejeda@unex.es	www.unex.es
<b>Jose Manuel Martínez Torres</b>	D702	jmtorres@unex.es	www.unex.es
Subject Area	Food Technology		
Department	Animal Production and Food Science		
Coordinator (Only if there is more than one lecturer)	Ana Isabel Andrés Nieto		

Competencies*
<p><b>Basic and general competencies:</b></p> <p>CG6 – Capability to manage agrifood industries, with knowledge in new technologies, quality processes, traceability and certification, as well as marketing techniques of food products.</p> <p>CG7 – Knowledge in basic, scientific and technological subjects, allowing a continuous learning, as well as an adaptative capability to new situations and changing environments.</p> <p>CB3 – Students should have the capability of gathering and understand relevant data in order to infer judges or opinions about relevant social, scientific and ethical issues.</p> <p>CB4 – Students should learn to communicate information, ideas, problems and solutions to all kind of audience.</p> <p>CB5 – Students should develop learning skills necessary to begin latter studies with a high level of autonomy.</p> <p><b>Specific competencies:</b></p>

\* 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.

<p>CETE1: Food engineering and technology.          Capability to know, understand and use premises of Food engineering and technology. Food Engineering and basic operations. Food Technology. Processes in food industries. Modelizations and optimization. Quality management and food safety. Food Analysis. Traceability.</p> <p><b>Transversal competencies:</b>          CT2 – Foreign language knowledge (English)</p>
<b>Contents</b>
<b>Course outline*</b>
<p>The content included in this subject is related to the technology of processes of preparation of food raw matter to be elaborated and transformed. These processes include cleaning operations, size reduction, selection and classification, bleaching and peeling. Food preserving technologies are also studied: pasteurization, sterilization, refrigeration, freezing, dehydration, freeze drying, solute adding and smoking. Finally, packaging, storing, transportation and distribution processes are also studied in this subject.</p>
<b>Course contents</b>
<p><b>SECTION I.- INTRODUCTION</b></p> <p><b><u>Lesson 1. Food Science and Technology: definition, history, objectives.</u></b></p> <p>Historical development. Definition of Food Science and Technology. Objectives. Relationships with other sciences. The Spanish food industry nowadays.</p> <p>Developed skills: CECTA2          Learning results: RA74</p> <p><b>SECTION II.- TECHNOLOGICAL PROCESSES FOR PREPARING AND MANUFACTURING RAW MATERIAL.</b></p> <p><b><u>Lesson 2.- Operations for preparing raw material (I)</u></b></p> <p>Raw material reception in the food industry. Preparation of raw material. Cleaning: dry and humid methods.</p> <p>Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6          Learning results: RA71, RA72, RA73, RA74, RA75, RA76 y RA81</p> <p><b><u>Lesson 3.- Operations for preparing raw material (II)</u></b></p> <p>Selection and classification. Peeling. Peeling methods. Peeling equipment.</p> <p>Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6          Learning results: RA71, RA72, RA73, RA74, RA75, RA76 y RA81</p> <p>Description of the practical activities of lesson n 3 :Practical lesson #1: <b>Preparation of vegetable raw materials.</b></p> <p>Practical lesson content: cleaning, peeling, size reduction of vegetables. Blanching using hot water. Peroxidase test. Analysis and discussion of results.</p> <p>Type and place: Pilot plant(Vegetable PP)          Developed skills: CECTA2</p>

Learning results: RA71, RA72, RA73, RA74, RA75, RA76 y RA81

Material and instrumental equipment to be used: Materias primas vegetales (calabacín, patatas). Cuba de lavado-escaldado. Reactivos para determinación de la peroxidasa. Equipos de cortado de materias primas.

**Lesson 4.- Size reduction and increase (I)**

Size reduction and increase (I). Aims. Size reduction of dry particulate foods . Equipment and application. Size reduction of fibrous foods. Equipment and application. Effect on foods

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA74, RA75, RA76 y RA81

Description of the practical activities of lesson N 4: Practical lesson #4:  
**Manufacturing of a meat product**

Practical lesson content: mixing, chopping, casing, salting, thermal treatment of a meat product. Analysis and discussion of results.

Type and place: Pilot plant(Meat PP)

Developed skills: CECTA2, CECTA3, CECTA5

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

Material and instrumental equipment to be used: Cutter, mixer and chopping equipment. Raw meat.

**Lesson 5.- Size reduction and increase (II)**

Size reduction in liquid foods: emulsification, homogenisation and atomization. Equipments and applications. Size increase: agglomeration

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA74, RA75, RA76 y RA81

**SECTION III.- FUNDAMENTALS IN FOOD PRESERVATION.**

**Lesson 6.- Factors and reasons for food alteration.**

Factors involved in food alteration. Actions against physical and chemical alteration. Potential actions in preventing or delaying microbial activity

Developed skills: CECTA2 y CECTA3

Learning results: RA77 y RA78

**SECTION IV.- TECHNOLOGICAL PROCESSES OF PRESERVATION (HEAT AND COLD)**

**Lesson 7.- Blanching.**

General objectives. Blanching methods: hot water, vapour. Other blanching methods. Evaluation of blanching in fruit and vegetables. Equipment and applications. Effects on

nutritive and sensory characteristics of food.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

Description of the practical activities of lesson N 7: Practical lesson #1: **Preparation of vegetable raw materials.**

Practical lesson content: cleaning, peeling, size reduction of vegetables. Blanching using hot water. Peroxidase test. Analysis and discussion of results.

Type and place: Pilot plant(Vegetable PP)

Developed skills: CECTA2

Learning results: RA71, RA72, RA73, RA74, RA75, RA76 y RA81

Material and instrumental equipment to be used: Materias primas vegetales (calabacín, patatas). Cuba de lavado-escaldado. Reactivos para determinación de la peroxidasa. Equipos de cortado de materias primas.

### **Lesson 8. Fundamentals in thermobacteriology.**

Basic fundamentals. Kinetics for microbial death by heat. Survival graphic. D value. Thermodestruction graphics. Z value. Commercial sterility. F and F<sub>0</sub> value. Practical examples of calculation of thermal treatments in canning industry

Developed skills: CECTA2

Learning results: RA71, RA72, RA73, RA77 y RA78

Practical lesson #3: **Use of thermobacteriology in canning**

Practical lesson content: can sealing. Manufacture of a vegetable can. Thermal monitorization at the critic point. F<sub>0</sub> calculation. Analysis and discussion of results.

Type and place: Pilot plant(Vegetable PP)

Developed skills: CECTA2, CECTA3

Learning results: RA71, RA72, RA73, RA77 y RA78

Material and instrumental equipment to be used: Semiautomatic sealer of metal cans. Temperature probes. Heating equipment. Letality calculation.

### **Lesson 9. Pasteurization.**

Concept and objectives. Types of pasteurization. Applications in food industry. Effect on food.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

Description of the practical activities of lesson N 9: Practical lesson #2: **Milk pasterization.**

Practical lesson content: application and control of a pasteriration operation of raw milk. Knowledge and handling of the equipment. Lactoperoxidase test. Analysis and discussion of results.

Type and place: Pilot plant(Milk PP)

Developed skills: CECTA2, CECTA3

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

Material and instrumental equipment to be used: raw milk. Plate pasteurization equipment. Heating batch.

### **Lesson 10. Sterilization**

Objectives. Sterilization of packaged food: Filling, exhausting and sealing of cans. Types of sterilization: continuous and discontinuos. UHT treatment. Effect on food.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

Description of the practical activities of lesson N 10: Practical lesson #3: **Use of thermobacteriology in canning**

Practical lesson content: can sealing. Manufacture of a vegetable can. Thermal monitorization at the critic point.  $F_0$  calculation. Analysis and discussion of results.

Type and place: Pilot plant(Vegetable PP)

Developed skills: CECTA2, CECTA3

Learning results: RA71, RA72, RA73, RA77 y RA78

Material and instrumental equipment to be used: Semiautomatic sealer of metal cans. Temperature probes. Heating equipment. Letality calculation.

### **Lesson 11. Microwave heating**

General aspects of electromagnetics radiations. Characteristics of microwaves. Dielectric properties of materials. Transformation of microwave energy into heat. Equipments. Applications. Effect on food.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

### **Lesson 12. Infrared radiatons**

Theoretical aspects. Equipments and facilities. Applications.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA77 y RA78

### **Lesson 13. Chilling**

Fundamentals of preservations using chilling. Effect on the velocity of chemical reactions and microbial development. Factors to control during chilling. Refrigerators and refrigeration storage. Effect on food.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

### **Lesson 14. Freezing**

Process and freezing stages: crystalization theory. Freezing curves. Changes in food during freezing. Effect on chemical and biochemical reactions. Effect on microoganisms. Freezers and freezing storage. Thawing.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

**Lesson 15.- Mechanical refrigeration**

Calculation of the necessities for chilling and freezing. Calculation of freezing time. Cold production.. Mechanical refrigerator and cryogenic systems.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

**SECTION V.-FOOD PRESERVATION THROUGH WATER ACTIVITY REDUCTION**

**Lesson 16. Dehydration**

Concept, objectives and fundamental. Psychrometry. Applications of the psychrometric diagram. Drying velocity, drying curves and stages. Effect on food. Equipment.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

Description of the practical activities of lesson N 16: Practical lesson #5:  
**Dehydration**

Practical lesson content: Simultation and control of a dehydration process. Use of a dry and humid bulb termometer. Use and application of a psicrometric diagram. Calculation of water loss. Analysis and discussion of results.

Type and place: Pilot plant(Meat PP)

Developed skills: CECTA2, CECTA3

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

Material and instrumental equipment to be used: Drying chamber. Dry and humid bulb termometer. Psicrometric diagram

**Lesson 17. Freeze drying and freeze concentration**

Freeze drying. Theory. Equipment. Effect on food. Freezing concentration Theory. Equipment.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

**Lesson 18. Reduction of water activity of food.**

Salt as agent depressor of water activity. Curing salts. Salting methods.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

**Lesson 19. Smoking.**

Definition. Smoked food. Applications on food industry.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

## **SECTION VI.- FINAL OPERATIONS**

### **Lesson 20.- Food packaging**

Function of packaging. Requirements of containers. Types of packaging materials. Packaging systems.

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA79, RA80 y RA81

Description of the practical activities of lesson N 20: Practical lesson #7: **Modified atmosphere packaging**

Practical lesson content: Use of gas mixtures for prolonging shel life. Use of the thermosealing equipment, gas mixer and gas analyzer. Analysis of the headspace of the packs.

Type and place: Pilot plant(Vegetable PP)

Developed skills: CECTA2

Learning results: RA79, RA80 y RA81

Material and instrumental equipment to be used: Rigid packs. Plastic material. Thermosealing equipment. Gas mixer. Gas analyzer. Gases.

### **Lesson 21.- Food transport**

Transport systems. Transport within the industry. Transport in the distribution chain

Developed skills: CECTA2, CECTA3, CECTA4, CECTA5 y CECTA6

Learning results: RA79, RA80 y RA81

Description of the practical activities of lesson N1-21: Practical lesson #6: **Food product manufacturing**

Practical lesson content: The students, in groups, will manufacture a food product from different raw material. They will be able to use the available equipment at the pilot plants Among the potential food products to be manufactured are: smothies, tomato and olive oil gelatin, olive paté, tomato soft candy..etc.

Type and place: Pilot plant(Meat PP)

Developed skills: CECTA2, CECTA6

Learning results: RA71, RA72, RA73, RA77, RA78 y RA81

Material and instrumental equipment to be used: Equipments and material in the pilot plants. A wide variety of raw material (tomato, olives, olive oil...)

**Writing of a monographic report (Seminar)**, related with practical lesson n. 6.

The students should describe the characteristics of the produced product, the flow chart, the alterations or problems observed, etc.

Competences: CB2, CG3, CG4, CT1, CT2, CECTA2, CECTA3, CECTA4, CECTA5, CECTA6

Learning outcomes: RA71 a RA81, RA83, RA87 y RA89



Educational activities *								
Student workload (hours per lesson)		Lectures	Practical sessions				Monitoring activity	Homework
Lesson	Total	L	HI	LAB	COM	SEM	SGT	PS
1	3	1						2
2	3,5	1,5						2
3	7	2					1	4
4	5	2						3
5	3	1						2
6	4	1					1	2
7	5	2						3
8	11	3					1	7
9	4	1						3
10	5	2						3
11	8	2					1	5
12	4	2						2
13	6	2					1	3
14	6	2						4
15	6	2						4
16	7	2					1	4
17	6	2						4
18	8	2						6
19	8	2					1,5	4,5
20	6	2						4
21	2	1						1
LABORATORY	0							
1	5			3				2
2	5			3				2
3	5			3				2
4	3			2				1
5	4			3				1
6	4			3				1
7	4			3				1
SEMINARIO	2,5					2,5		
<u>Assesment**</u>	2,5							
<b>TOTAL ECTS</b>	150	37,5	0	20	0	2,5	7,5	82,5

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)

<p>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</p>
<b>Teaching Methodology*</b>
<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Practical lessons in pilot plant</li> <li>• Seminar and monographic report</li> <li>• Tutorials</li> </ul>
<b>Learning outcomes *</b>
<p>RA71. Comprender y conocer los fundamentos de las operaciones unitarias de la industria alimentaria y ser capaz de seleccionar las alternativas posibles para un fin concreto.</p> <p>RA72. Ser capaz de analizar la influencia de las variables de operación sobre el rendimiento y la eficacia del proceso y su posible efecto sobre los alimentos.</p> <p>RA73. Comprender la necesidad de trabajar con criterios ingenieriles para el control y la optimización de los procesos y la sostenibilidad del medio ambiente.</p> <p>RA74. Conocer los diferentes mecanismos de los que dispone la tecnología alimentaria para la preparación de las materias primas para su posterior transformación en alimentos elaborados.</p> <p>RA75. Conocer los fundamentos básicos y las diferentes tecnologías para la transformación de los alimentos a lo largo de toda la cadena productiva.</p> <p>RA76. Aplicar los conocimientos anteriores para adaptar los procesos tecnológicos más adecuados en la transformación de cada tipo de materia prima en alimentos elaborados.</p> <p>RA77. Comprender los fundamentos de las distintas tecnologías de conservación de los alimentos de las que dispone la industria alimentaria.</p> <p>RA78. Aplicar a cada alimento el método de conservación más adecuado en función de sus características y del producto final deseado.</p> <p>RA79. Conocer los sistemas de envasado de los alimentos y analizar las posibilidades y condiciones de envasado de los alimentos procesados.</p> <p>RA80. Planificar el almacenamiento y transporte de materias primas y productos elaborados en la industria alimentaria.</p> <p>RA81. Los alumnos deberán conocer los equipos y maquinarias auxiliares de la industria agroalimentaria. Automatización y control de procesos. Ingeniería de las obras e instalaciones. Construcciones agroindustriales. Gestión y aprovechamiento de residuos.</p> <p>RA83. Utilizar correctamente las TIC para la búsqueda de información, su procesamiento y la elaboración de informes y redacción de proyectos.</p> <p>RA84. Conocimiento de las vías de búsqueda de fuentes de información relacionadas con la tecnología de los alimentos.</p>

## Assessment methods \*

1. Final evaluation: **Final exam**<sup>1</sup> in order to evaluate content and competencies related to activities of Big Group. It will consist on test-type and short answer-type questions as well as problems. It will be up to **60%** of the final calification.
2. Continuous evaluation: **Reports of practical lessons and questionnaires** in order to evaluate contents and competencies related to seminars/laboratory activities<sup>2</sup>. It will consist on delivering reports based on practical lessons and/or short questions, which will be answered by students during the practical lesson (if attending) or in a final exam (in case of not attending). This will sum up to **35%** of the final calification.
3. Attendance with achievement to on-site activities: **other activities** (attendance to tutorías ECTS, reports writing, attendance to class, participating, questionnaires, kahoot questions, correct grammar. This will sum up to **5%** of the final calification.

### Observations

<sup>1</sup> El examen final solamente tendrá validez en la nota final de la asignatura si se supera con al menos un 5 de puntuación.

<sup>2</sup> Las actividades Seminario-Laboratorio son "no recuperables", a menos que el alumno repita esa parte del plan de trabajo al año siguiente.

Para superar la asignatura será necesario obtener una puntuación mínima de 5 en el examen teórico y superar las prácticas. Así mismo, se valorará negativamente sobre la nota final la presencia de faltas ortográficas.

Las convocatorias, calificaciones y periodos de reclamación de los exámenes serán expuestos en tiempo y forma según establece la normativa publicada por Resolución 26/10/2020, DOE nº 212, del martes, 3 de noviembre de 2020.

## **ALTERNATIVE EVALUATION SYSTEM WITH FINAL AND GLOBAL EXAM**

En cumplimiento con la resolución 26/10/2020, DOE nº 212, del martes, 3 de noviembre de 2020, se incluye en el presente apartado las características y condiciones de la prueba alternativa de carácter global para la evaluación de las competencias de esta asignatura.

De acuerdo al artículo 4 de la citada resolución, los alumnos/as que deseen acogerse a este sistema de evaluación, deberán comunicarlo al profesor a través del espacio específico creado para ello en el Campus Virtual de la asignatura. El plazo para elegir la modalidad global será durante el primer cuarto del periodo de impartición de las mismas o hasta el último día del periodo de ampliación de matrícula si este acaba después de ese periodo.

La prueba global alternativa consta de dos partes:

**1ª Parte: examen final escrito (65% de la nota final):** constará de preguntas de tipo test y cortas relacionadas con el temario impartido. Las preguntas de tipo test solamente tendrán una respuesta verdadera; aquellas preguntas contestadas de forma errónea restarán

1/3 del valor de la pregunta, es decir, tres respuestas erróneas anulan una acertada. Las preguntas cortas serán puntuadas, en el caso de ser contestadas

correctamente, como una pregunta tipo test. Esta parte será evaluada sobre un total de diez puntos.

**2ª Parte: Prueba teórico-práctica (35% de la nota final):** constará de preguntas cortas, de desarrollo y/o prácticas de los contenidos prácticos trabajados durante el curso.

Esta parte

será evaluada sobre un total de diez puntos.

Para aprobar la asignatura por este sistema alternativo de evaluación será necesario alcanzar un mínimo de cinco puntos en cada una de estas dos partes. Competencias que se evalúan: CECTA2, CECTA3, CECTA4, CECTA5, CECTA6.

En ambos sistemas de evaluación se aplicará el sistema de calificaciones vigente en cada momento. Los resultados obtenidos por el alumno en cada una de las materias del plan de estudios se calificarán en función de la siguiente escala numérica de 0 a 10, con expresión de un decimal, a la que podrá añadirse su correspondiente calificación cualitativa: 0 - 4,9: Suspenso (SS), 5,0 - 6,9: Aprobado (AP), 7,0 - 8,9: Notable (NT), 9,0 - 10: Sobresaliente (SB). La mención de "Matrícula de Honor" podrá ser otorgada a estudiantes que hayan obtenido una calificación igual o superior a 9,0. Su número no podrá exceder del cinco por ciento del número de estudiantes matriculados en la asignatura en el correspondiente curso académico, salvo que este sea inferior a 20, en cuyo caso se podrá conceder una sola "Matrícula de Honor".

### Bibliography (basic and complementary)

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- Aleixandre y García (1999). *Prácticas de procesos de elaboración y conservación de alimentos*. Servicio de publicaciones de la Universidad Politécnica de Valencia, Valencia.
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- Paine, F. y Paine, H.(1994). *Manual De Envasado De Alimentos*. Ed. A. Madrid Vicente Ediciones. Madrid.
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- Rodríguez, F. y cols. (2002). *Ingeniería de la Industria Alimentaria*. Vol. II y III. Ed. Síntesis. Madrid.
- <http://www.consumaseguridad.com>

### Other resources and complementary materials

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- Barbosa, G.V., Pothakamury, U.R., Palou, E. y Swanson, B.G. (1999). *Conservación No Térmica De Alimentos*. Acribia, Zaragoza.
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