

## COURSE PROGRAM

Academic Year: 2019/2020

Identification and characteristics of the course			
Code	501250	ECTS Credits	6
Course name (English)	<b>Tecnología de Alimentos</b>		
Course name (Spanish)	Food Technology		
Degree programs	Food Science and Technology Degree		
Faculty/School	Agricultural Engineering School		
Semester	Forth (4º)	Type of course	Compulsory
Module	Food Technology		
Matter	Food Technology		
Lecturer/s			
Name	Office	E-mail	Web page
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Subject Area	Food Technology		
Department	Animal Production and Food Science		
Coordinating Lecturer (If more than one)	<b>Ana Isabel Andrés Nieto</b>		

### Competencies\*

#### Specific competencies of the matter:

1. CECTA2 – Capability for knowing, understanding and using the basic

\* The sections concerning competencies, course outline, educational activities, teaching methodologies, learning outcomes and assessment systems must conform to that included in the ANECA verified document of the degree program.



fundamentals and technological processes for producing, packaging and preserving foods.

2. CECTA3: Capability for evaluating the effect of processing on foods.

3. CECTA4: Capability for evaluating the technological advances for innovation of food and food processes in food industry.

4. CECTA5: Capability for knowing, understanding and using the facilities of food industries, equipments and auxiliary equipments in food industries.

5. CECTA6: Capability for knowing, understanding and controlling the processes in food industry. Modelling and optimizing food processes.

### Contents

#### Course outline\*

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.

#### Course syllabus

### SECTION I.- INTRODUCTION

#### Lesson 1. Food Science and Technology: definition, history, objectives.

Historical development. Definition of Food Science and Technology. Objectives. Relationships with other sciences. The Spanish food industry nowadays.

Developed skills: CECTA2

Learning results: RA74

### SECTION II.- TECHNOLOGICAL PROCESSES FOR PREPARING AND MANUFACTURING RAW MATERIAL.

#### Lesson 2.- Operations for preparing raw material (I)

Raw material reception in the food industry. Preparation of raw material. Cleaning: dry and humid methods.

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

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

### **Lesson 3.- Operations for preparing raw material (II)**

Selection and classification. Peeling. Peeling methods. Peeling equipment.

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 3 :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 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.  $F_0$  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 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 microorganisms. 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 in hours by lesson	Lectures	Practical activities	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	10	3					1	6
9	4	1						3
10	5	2						3
11	7	2					1	4
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	7,5	2					1,5	4
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>	<b>150</b>	<b>37,5</b>	<b>0</b>	<b>20</b>	<b>0</b>	<b>2,5</b>	<b>7,5</b>	<b>80</b>

L: Lectures (100 students)

HI: Hospital internships (7 students)

LAB: Laboratory or field practices (15 students)

COM: Computer room or language laboratory practices (30 students)

SEM: Problem classes or 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 Methodologies\*

- Lectures
- Practical lessons in pilot plant
- Seminar and monographic report
- Tutorials

### Learning outcomes \*

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.

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.

RA73. Comprender la necesidad de trabajar con criterios ingenieriles para el control y la optimización de los procesos y la sostenibilidad del medio ambiente.

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.

RA75. Conocer los fundamentos básicos y las diferentes tecnologías para la transformación de los alimentos a lo largo de toda la cadena productiva.

RA76. Aplicar los conocimientos anteriores para adaptar los procesos tecnológicos más adecuados en la transformación de cada tipo de materia prima en alimentos elaborados.

RA77. Comprender los fundamentos de las distintas tecnologías de conservación de los alimentos de las que dispone la industria alimentaria.

RA78. Aplicar a cada alimento el método de conservación más adecuado en función de sus características y del producto final deseado.

RA79. Conocer los sistemas de envasado de los alimentos y analizar las posibilidades y condiciones de envasado de los alimentos procesados.

RA80. Planificar el almacenamiento y transporte de materias primas y productos elaborados en la industria alimentaria.

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.

RA83. Utilizar correctamente las TIC para la búsqueda de información, su procesamiento y la elaboración de informes y redacción de proyectos.

RA84. Conocimiento de las vías de búsqueda de fuentes de información relacionadas con la tecnología de los alimentos.

### Assessment systems \*

Theoretical lessons	Qualification criteria
Final exam consisting on test-type and "short-answer-type questions" <sup>1</sup>	60 %
Attendance and progress. Participation in the classes through direct questions and discussion of results	5 %

Practical lessons <sup>2</sup>	Qualification criteria
Attendance (compulsory) and progress. Practical skills and ability to integrate with theoretical knowledge. Participation in the classes through direct questions and discussion of results.	20%

Report	Qualification criteria
Qualification of the report	15 %

Considerations:

<sup>1</sup> Final exam will only be valid in case the final calcification is higher than 5 points.

<sup>2</sup>Seminar-Lab activities are "non-recoverable" activities.

The student should get a callification higher than 5 in both the theoretical exam and practical activities.

### Bibliography (basic and complementary)

- Aleixandre, JL y García, MJ (1999). Industrias agroalimentarias. Servicio de publicaciones de la Universidad Politécnica de Valencia, Valencia.
- 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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- Cheftel y Cheftel (1980-1982). *Introducción a la bioquímica y tecnología de los alimentos*. Vols. 1 y 2. Ed. Acribia. Zaragoza.
- Fellows, P. (1993). *Tecnología del procesado de alimentos: Principios y prácticas*. Ed. Acribia. Zaragoza.
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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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- <http://www.consumaseguridad.com>

### Other resources and complementary educational 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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- Sielaff, H. (2000). *Tecnología de la fabricación de conservas*. Ed. Acribia. Zaragoza.
- Walter, K. (1995). *Manual práctico de ahumado de los alimentos*. Ed. Acribia. Zaragoza.
- <http://www.casals-vinicola.com/Catalogo-Indice.htm>
- <http://www.perryvidex.com/perry/perryvidex2.nsf/pSearchFood?OpenPage>
- [http://www.spec-equip.com/desalinadora\\_por\\_osmosis\\_inversa.html](http://www.spec-equip.com/desalinadora_por_osmosis_inversa.html)
- <http://www.diquima.upm.es/Investigacion/proyectos/chevic/catalogo/FILTROS/Func4>



htm

- <http://www.komline.com/SiteDirectory.html>
- <http://www.solidliquid-separation.com/PressureFilters/pressure.htm>
- <http://www.carbuos.com/>
- <http://www.unavarra.es/genmic/micind-0.htm>
- <http://www.agronort.com/informacion/abcbiotec/abcbio1.html>