


	<b>PROCESO PARA EL DESARROLLO DE LAS ENSEÑANZAS DE LA ESCUELA DE INGENIERÍAS AGRARIAS</b>		
		<b>CÓDIGO:</b> <b>P/CL009_D002</b>	

## PROGRAMME IN UNIT OPERATION IN FOOD INDUSTRY

**Academic course: 2019-2020**

Identification and characteristics of the subject			
Code	501248	Credits ECTS	6
Name (Spanish)	Operaciones Básicas en la Industria Agroalimentaria		
Name (English)	Unit Operations in Food Industry		
Degree	FOOD SCIENCE AND TECHNOLOGY		
Center	Agricultural Engineering School		
Semester	Third (3º)	Type	Compulsory
Module	Food Technology		
Subject	Food Technology		
Language	Spanish		
Professor/s			
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Field of knowledge	Food Technology		
Department	Animal Production and Food Science		
Coordinator (if there is more than one professor)	<b>María Luisa Timón Andrada</b>		
Lessons and contents			
Syllabus			
<b>SECTION 1. INTRODUCTION</b>			
<b>Lesson 1. Basic Principles</b> Basic principles of Unit Operations. Fluid flow (momentum transfer), heat transfer and mass transfer. Material and Energy balances: Problems and resolution methods. Process definition. Continuous processes. Flow Chart			
<b>SECTION II. FLUID FLOW (MOMENTUM TRANSFER). UNIT OPERATIONS BASED ON MOMENTUM TRANSFER</b>			
<b>Lesson 2. Fluid: Basic Principles</b> Fluid statics and fluid dynamics. Continuous equation and Bernoulli equation.			
<b>Lesson 3. Fluid flow</b> Type of flow. Flow measurement and instrumentation			

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**Lesson 4. Centrifugation**

Centrifugal force. Separation of solid-liquid and immiscible liquids. Types of centrifuge. Applications in food industry

**Lesson 5. Filtration**

Filtration at constant pressure and constant flow. Filtration equipment. Applications in food industry

**Lesson 6. Pressing.**

Principles and applications. Equipment and efficiency

**Lesson 7. Stirring, mixing and emulsifying.**

Introduction. Classification of mixtures. Stirring: definition, power, similarity criteria and stirring mechanisms. Mixing: definition, high viscosity material mixing, solid material mixing and mixers. Emulsifying: definition, interfacial properties, emulsion stability and equipment. Food industry applications.

**SECTION 3. HEAT TRANSFER. UNIT OPERATIONS BASED ON HEAT TRANSFER**

**Lesson 8. Heat transfer**

Conduction heat transfer. Convection heat transfer. Radiation heat transfer

**Lesson 9. Heat exchanger**

Heat transfer mechanism in heat exchanger. Type of equipment

**Lesson 10. Evaporation**

Heat transfer mechanism in evaporation. Heat transfer coefficients and factors that affect these coefficients. Factors affecting boiling liquid point. Boiling liquid characteristics. Calculations: one effect and multiple effect evaporation. Evaporators. Evaporation applications in Food Industry.

**SECTION 4. MASS TRANSFER. UNIT OPERATIONS BASED ON MASS TRANSFER**

**Lesson 11. Mass transfer**

Heat transfer by diffusion: Fick law

**Lesson 12. Distillation and rectification**

Theory, equipments and applications in food industry

**Lesson 13. Solid liquid extraction**

Introduction. Mass transfer in the extraction. Extraction efficiency and parameters. Calculations. Equipments. Applications in Food Industry

**Lesson 14. Clarification of gases**



Principles, equipments and applications

**Lesson 15. Membrane separation: Ultrafiltration and reverse osmosis**

Theory. Types of membranes. Equipment and applications.

**PRACTICAL SYLLABUS**

Practical lesson 1: **Solution preparation**

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Practical lesson 2: **Centrifugation**  
 Practical lesson 3: **Filtration**  
 Practical lesson 4: **Meat emulsion preparation**  
 Practical lesson 5: **Heat transfer by conduction and convection**  
 Practical lesson 6: **Distillation**

Monographic work: **Flow chart preparation and oral presentation**