# PROGRAMME IN UNIT OPERATION IN FOOD INDUSTRY

## Academic course: 2018-2019

| 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 | | | |
| Departament | Animal Production and Food Science | | | |
| Coordinator (if there is more than one professor) | **María Luisa Timón Andrada** | | | |

## Lessons and contents

### Syllabus

**SECTION 1. INTRODUCTION**

**Lesson 1. Basic Principles**
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

**SECTION II. FLUID FLOW (MOMENTUM TRANSFER). UNIT OPERATIONS BASED ON MOMENTUM TRANSFER**

**Lesson 2. Fluid: Basic Principles**
Fluid statics and fluid dynamics. Continuous equation and Bernoulli equation.

**Lesson 3. Fluid flow**
Type of flow. Flow measurement and instrumentation

**Lesson 4. Centrifugation**
Centrifugal force. Separation of solid-liquid and immiscible liquids. Types of centrifuge. Applications in food industry

**Lesson 5. Fitration**
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 stabitlity 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**

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**

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