

Course Unit	Introduction to Industrial Processes		Field of study	Engineering and engineering trades	
Bachelor in	Food Engineering		School	School of Agriculture	
Academic Year	2023/2024	Year of study	1	Level	1-1
Type	Semestral	Semester	1	ECTS credits	6.0
Code	9087-641-1104-00-23				
Workload (hours)	162	Contact hours	T -	TP -	PL -
			TC -	S -	E -
			OT -	O -	

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) António Manuel Coelho Lino Peres, Luís Manuel Cunha Santos

#### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:  
Gain skills in the analysis of procedural units. Understand and analyze the operation of equipment in different separation processes used in industrial processing in the food sector.

#### Prerequisites

Not applicable

#### Course contents

1. Introduction to food processes: type of systems (ideal and deviations from ideality), units systems, global vision of the process (flow charts), types of processes, thermodynamic properties of pure substances, mass and energy balances. 2. Basic Unit operations and processes at room temperature: preparation of raw materials, grinding, size reduction, separation and concentration (centrifugation, filtration and tangential conventional liquid-liquid extraction, etc. ).

#### Course contents (extended version)

1. System concept (isolated, closed and open). Dimensions and units. Dimensional consistency.
2. Thermodynamic properties. Extensive and intensive properties.
3. Pure Substances: rule of stages, changes of phase, diagrams of properties.
4. State equation for ideal and real gas. State equation for liquids. Tables of properties.
5. First law of thermodynamic: isothermic, isochoric, isobaric, adiabatic, isentropic.
6. Closed Systems: Energy balances. Specific heats and their relationship with U and H.
7. Control volumes: permanent, transient and uniform flow
8. Mass and energy balances: fluxograms
9. Basic Operations: descriptive approach and applications
10. Importance of separation processes for food engineering. Processes selection
11. Preparation of raw materials, grinding, size reduction, separation, concentration: general concepts
12. Filtration: Conventional at constant pressure or flow.
13. Tangential filtration (microfiltration, ultrafiltration, nanofiltration, hiperfiltration): membranes
14. Centrifugation: particles and immiscible liquids - concepts and applications at food level
15. Evaporation: basic concepts

#### Recommended reading

1. Figura L. O. , Teixeira A. A. (2007). Food Physics: Physical Properties – Measurement and Applications Springer
2. Gomes de Azevedo E. , Alves A. M. (2009). Engenharia de Processos de Separação, Coleção Ensino da Ciência e da Tecnologia, IST Press
3. Moran, M. J. , Shapiro, H. N. (2000). Fundamentals of Engineering Thermodynamics, John Wiley & Sons, Inc
4. Rao M. A. (2007). Rheology of Fluid and Semisolid Foods. Principles and Applications. 2ª Edição. Springer
5. Sahin S. , Sumnu S. G. (2006). Rheological Properties of Foods in Physical Properties of Foods Springer, Alemanha, Capítulo 2: pp39-101

#### Teaching and learning methods

Teaching theoretical-practical lessons: - Oral presentations using audiovisual media; - Works based on technical-scientific bibliography; - Possible visits to companies and to traditional products exhibitions; - Encouraging participation of students: presentation/discussion of real cases, involvement in the organization of workshops, seminars or other technical/scientific events.

#### Assessment methods

1. Continuous: Exam (85%) + Works (15%) - (Regular, Student Worker) (Final)
2. Final Exam (100%) - (Regular, Student Worker) (Final, Supplementary, Special)

#### Language of instruction

1. Portuguese
2. Portuguese, with additional English support for foreign students.

#### Electronic validation

António Manuel Coelho Lino Peres, Luís Manuel Cunha Santos	Maria Fátima Alves Pinto Lopes da Silva	Elsa Cristina Dantas Ramalhosa	José Carlos Batista Couto Barbosa
16-01-2024	16-01-2024	16-01-2024	17-01-2024