



Course Unit: **935016 - Unit operations**

Year 2 Semester 3 ISCED Code: 721 ECTS: 5,0

Type of Course Unit: Compulsory Delivery Mode: Face-to-face Language of Instruction: Portuguese

COURSE COORDINATOR: Carlo Manuel Marques Ribeiro

HOURS OF WORK

TOTAL HOURS	Contact Hours								Hours in autonomous work
	Theory	Theory and practice	Practical and laboratory work	Field work	Seminar	Internship	Tutorial guidance	Other	
125	15		45						65

Prerequisites (if applicable): Not applicable

LEARNING OUTCOMES (knowledge, skills and competence)

Understanding and mastering the principles of a set of unit operations important in several transformation processes of agricultural raw materials and of food production. The student will acquire the following skills: clear communication abilities with food technology professionals about the unit operations and equipment involved in food processes; equipment dimensioning; development and implementation of new processes; management and improvement of processes already implemented.

CONTENTS

1. Energy and mass balance.
2. Cleaning, selection and classification of raw materials for food industry.
3. Size reduction.
4. Mixture and emulsification.
5. Sedimentation.
6. Centrifugation.
7. Psychometrics.
8. Dehydration.
9. Evaporation and crystallization.
10. Thermally pasteurization and sterilization

DEMONSTRATION OF THE CONTENTS COHERENCE WITH THE COURSE UNIT'S LEARNING OUTCOMES

One of the main food industry objectives is to process agricultural raw materials to food products for human consumption through a set of unit operations. Equipment of different types is used in various stages to accomplish these processing steps. The equipment calculation and the set-up of each of these unit operations is a major task of food technology. The process for obtaining a certain food consists almost always of a series of unit operations which have to be developed, implemented and managed in a way that leads to adequate, safe and quality food products. In order to get this objective it is essential the knowledge and the calculation mastering of these unit operations and associated equipment.

TEACHING METHODOLOGIES

In theoretical lectures, using audiovisual media, the fundamentals of the various operations will be presented and exemplified with its integration into various product transformation processes. Presentation by students of works on unit operations found in

various sources, such as visits to food industries and technical articles.

In practical classes, a number of practical case studies will be offered to calculate the various operations and equipment involved, and will be carried out lab work and pilot plant for implementation of various unit operations .

DEMONSTRATION OF THE COHERENCE BETWEEN THE TEACHING METHODOLOGIES AND THE LEARNING OUTCOMES

In theoretical classes will be described and discussed, using audio-visual equipment and action by students, the various operations and the associated equipment. Will be presented as an examples, applications of unit operations integrated in some food production processes. Students will be encouraged to submit collected examples, outside the classroom using diverse sources such as technical publications, commercial catalogs of equipment and visits to food industries, and describe them and explain them in classes based on the principles learned in this course.

In practical classes, several works on laboratory and pilot plant will be proposed. The students will carry out reporting on these works, where they will present, in addition to the objectives and methodologies, the data duly treated and interpreted. There will be also proposed case studies on unit operations and associated equipment, performing the students the necessary calculations and interpretation.

EVALUATION METHODS

Presence required to theoretical and practical classes .

Written exam at the end of the semester or two written tests, in the middle and at the end of the semester, respectively, on the matter taught in lectures and practical classes, whose scores have a weight in the final score fifty percent. The exam grade or the average grade of the two written tests will weight fifty percent of the final grade of the course.

The evaluation of the practical works and their discussion, wil weight fifty percent in the final grade

MAIN BIBLIOGRAPHY

Brennan JG, 2006. Food processing handbook. Wiley-Vch Verlag Gmb & Co. KGaA, Weiheim.

Doran P M, 1995. Bioprocess Engineering Principles. Academic Press Limited. London

Earle R L, 1988. Unit Operations In Food Processing. Pergamon Press Ltd., Oxford, England.

Fellows P, 1994. Food Processing Technology: Principles and Practice. Second Edition. Woodhead Publishing Limited and CRC Press LLC, England.

Foust A S, Wenzel L A, Clump CW, Maus L e Andersen L B, 1980. Principles of Unit Operations. 2nd Ed. John Wiley & Sons, Inc. NY.

Geankoplis C J, 1993. Transport Processes and Unit Operations. 3rd Ed. Prentice-Hall International, Inc. Editions. USA.

Richardson JF, Harker JH and Backhurst JR (2002). Coulson and Richardson's Chemical Engineering - Particle Technology and Separation Processes. Vol 2, 5th edition. Butterworth-Heinemann, Oxford.

Smith PG 2011. Introduction to food process engineering. Second Edition. Springer Science+Business Media, LLC 2011.

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