

Course Unit: **93509 - Transport phenomena**

Year 1 Semester 2 ISCED Code: 721 ECTS: 5

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

COURSE COORDINATOR: Antónia Teresa Zorro Nobre Macedo

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 the main transfer mechanisms and their applications. Identifying the transport processes involved in several food processing operations.
- Working with the different transport equations for determining transfer rates.
- Solving problems applying the studied contents.

CONTENTS

1. Momentum transfer: fluid properties; study of fluids at rest and in motion. Dimensionless numbers relevant to the momentum transfer.
2. Heat transfer. Fundamental mechanisms for transfer: heat conduction in stationary and non-stationary state; heat transfer by convection and useful correlations in this kind of transfer; heat transfer by radiation. Relevant dimensionless numbers in heat transfer.
3. Mass transfer: mass transfer by diffusion, diffusion coefficients, molecular diffusion in stationary state; mass transfer by convection. Relevant dimensionless numbers in mass transfer.
4. Analogies among the various transfer processes.
5. Examples of application in food processing.

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

The study of the transfer phenomena which occur in the various processes involves transfer of momentum, heat and mass. In some processes, one of these forms is predominant, whereas in others the various transport mechanisms occur at the same time, with different relative importance. The syllabus cover concepts and the fundamental laws associated with each transport phenomena, so that the student can understand and identify, in many practical cases, the main phenomena that occur in the food processes. This knowledge also allows him to evaluate the efficiencies of the various processes involved, by determining the respective transfer rates and related operating parameters.

TEACHING METHODOLOGIES

- Expositive approach of fundamental theoretical concepts.
- Solving Problems.
- Other practical applications.

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

An expository approach of the several key concepts during which these have been mentioned and explained through the presentation of several practical examples, will allow the students to have a deeper understanding of them. In the same way, problem solving is a fundamental tool since it can make an important contribution to a better interiorization, preservation and extrapolation of acquired knowledge.

EVALUATION METHODS

The evaluation involves the realization of two partial tests or an exam in normal time and an exam on appeal, for students who have not obtained approval in the discipline at the normal time.

Admission to the exam necessitates the presence in 3/4 of the practical classes, according to the Internal Rules.

MAIN BIBLIOGRAPHY

BIRD, R. B., STEWART, W. E., LIGHTFOOT, E. N. (2001). Transport Phenomena, 2nd Ed. John Wiley & Sons, Inc.

BALMER, R. T. (1990). Thermodynamics. St. Paul, MN, West Publishing.

WELTY, J. R., WILSON, R. E., WICKS, C. E. (2001). Fundamentals of Momentum, Heat and Mass Transfer, 4th. Ed. John Wiley & Sons, Inc.

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