

## Course Unit: 15723 – Instrumental Methods of Analysis II

Year 2 Semester 4 ISCED Code: 531 ECTS: 5.0

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

COURSE COORDINATOR: Humberto Tomás Chaves

### 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	30		30						65

Prerequisites (if applicable):

### LEARNING OUTCOMES (knowledge, skills and competence)

It is intended that students develop the following skills:

- Know and master different extraction techniques.
- Know and master different chromatography techniques.
- Ability to decide the best extraction technique taking into account the conditions and objectives of the work.
- Planning, choosing and implementing the best chromatographic technique taking into account the constraints and objectives of the analysis.
- Have professional capacity for the use of different chromatographic methods in the analysis of different samples (water, soil, air, living organisms, tissue, biological samples, etc.)

### CONTENTS

General processes of separation and purification in laboratory.

Extraction: theory of extraction.

Liquid-liquid extraction.

Solid-liquid extraction.

Simultaneous steam distillation-solvent extraction (SDE).

Solid phase extraction (SPE).

Solid phase micro-extraction (SPME).

Supercritical fluid extraction (SFE).

Stir bar sorptive extraction (SBSE).

Theory of chromatography and chromatographic techniques.

Thin layer chromatography (TLC).

Column chromatography (CC).

Gas chromatography (GC).

High pressure liquid chromatography (HPLC).

Ion chromatography (IC).

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

In the theoretical classes (2h/week) the concepts and fundamentals are exposed and discussed to understand and apply to the study of extraction techniques and chromatography techniques. The domain of this knowledge is essential due to the increasing automation of chemical analysis laboratories. The student must also learn how to choose the best technique to use, taking into account the size of the laboratory and the desired results.

In practical classes (2h/week), students begin a process of application of the theoretical foundations (extraction techniques and chromatography) in cases of more applied analyses, such as amino acids in wines and beers, metals in water, aroma in foods, etc. It is intended thereby to provide to student, the knowledge that make it able to identify what is the best extraction technique to use in each situation as well decide on the most efficient chromatographic technique. So clearly the consistency of the program with the objectives set for this course.

#### **TEACHING METHODOLOGIES**

The program of this course consists of a theoretical part and another part with laboratory work. These two parts are interconnected, since the theoretical concepts and fundamentals are exposed to understand and apply in the study of the various techniques that are carried out in practical classes. The teaching method then includes a set of lectures, in which the expository and interactive classes are privileged, with audio-visual equipment in addition to resources for research. In the laboratory, students performed after their work, draw up their report. The evaluation in laboratory classes, results of continuous assessment and reporting of laboratory work. The theoretical evaluation is done by examination.

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

In recent years, the extraction techniques and chromatography, aided in part by the great evolution of electronics and information technology, have had a very great development and have an increasingly important role in chemical analysis.

The student will acquire ability to perform in the laboratory extraction and various chromatographic techniques that can be used in laboratory analysis applied to various areas. To achieve these objectives there will also be a more theoretical explanation, exhibition and debate. Then the students to a better understanding of the theoretical part, conduct some laboratory experiments related to the subjects studied, both in the extraction as in the chromatography. Some of these materials are recent, but are important to students in a future perspective in professional terms. On the other hand it is also very important that students learn to decide what is the best technique to use in different situations, taking into account the means available, the intended objectives and the purpose it is intended.

The acquired learning in these laboratory classes will be measured by conducting reports, one for each laboratory work. This methodology allows the evaluation of learning objectives in the process requires greater interaction between the students and the teacher, allowing a constant evaluation by the teacher of knowledge acquired by students, allowing you to make the necessary adjustments in the monitoring and support for students.

It is shown so that there is consistency of teaching methods to the learning objectives of the course.

#### **EVALUATION METHODS**

Continuous assessment and reports on Laboratory work (30% of the grade), final exam (70% of the grade).

#### **MAIN BIBLIOGRAPHY**

Gonçalves, M .L.S. (2001). Métodos Instrumentais para a Análise de Soluções - Análise Quantitativa. Fundação Calouste Gulbenkian. Lisboa. ISBN: 9789723109283

Skoog, D.A. & Leary, J.J. (2007). Principles of Instrumental Analysis. Thomson Brooks/Cole; 6th edition (2007). ISBN-13: 978-8131525579

Skoog, D.A., West, D.M. & Holler, F.J. (2003). Fundamentals of Analytical Chemistry. Cengage Learning; 9th edition (2013). ISBN-13: 978-0495558286

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