

COURSE SYLLABUS

1. Identification

Code and title: QUP 167 – Biosensors: Fundamentals and Applications

Professor: Jacqueline Arguello and Klester S. Souza

Level: Master and Doctorate

Credit hours: 2

Revised: August_2019

2. Summary

This course provides an overview of biosensors, their principles and applications. Electrochemical, optical, piezoelectric and calorimetric biosensors are presented in detail, emphasizing the immobilization of biological materials, support materials, properties and characteristics of biosensors, as well as factors influencing analytical performance.

3. Objective

The objective of this course is to provide students with an overview of the preparation and operation of biosensors, which are analytical devices that use biological components associated with physicochemical transducers. The course covers the main elements of biological recognition, the different methods of immobilization and transduction, as well as its main applications in the areas of health, food and the environment. At the end of the course, students are expected to acquire advanced knowledge about the foundation and applications of various biosensor technologies.

4. Contents

4.1 Introduction and overview: Brief history of biosensor development. Definition. Classification and main components.

4.2 Biorecognition elements: Enzymes. Antibodies Receptor Proteins Nucleic Acids. Tissues and Whole Cells.

4.3 Immobilization methods: adsorption, trapping, affinity, polymeric film occlusion, covalent and covalent cross-linking.

4.4 Electrochemical Transducers: potentiometric, voltammetric, conductometric and impedimetric biosensors.

4.5 Optical Transducers: UV/Vis/IR biosensors, fluorescence, luminescence, optical fiber, evanescent wave, surface plasmon resonance.

4.6 Other types of transducers: Piezoelectric and calorimetric biosensors.

4.7 Nanomaterials and technologies used in the construction of biodetection systems.

4.8 Applications of biosensors in clinical, food and environmental analysis.

5. Assessment

Due to the multidisciplinary nature of the course, the assessment will consist of individual work and presentation of a project, namely:

- Preparation of a research project: This activity focuses on the practice of critical thinking, exploring the ability to research, write a scientific proposal and oral communication.

- Weekly assignments: After each class, students will receive an assignment as an assignment to be delivered the following week. The work will consist of a questionnaire or a discussion about scientific articles. Each work will receive equal weighting in the calculation of the grade, assuming attendance in all classes. Works delivered late without proper justification will not be accepted, as well as plagiarized works. The student, who obtains a final grade of A, B or C, awarded as per the list below, will be considered approved:

A: grade equal to or above 9.0

B: grade equal to or above 7.5 and below 9.0

C: grade equal to or above 5.0 and below 7.5

D: grade below 5

FF: lack of frequency

6. Methodology

Lectures, exercises lists, seminars and examinations.

7. Bibliography

- Biosensors: Essentials, Lecture notes in chemistry 84; Gennady Evtugyn; Springer Berlin Heidelberg, ISBN 978-3-642-40241-8; 2014.
- Understanding Bioanalytical Chemistry: principles and applications; Victor A. Gault, Neville H. McClenaghan; Wiley-Blackwel; ISBN: 9780470029077; 2009.
- Introduction to experimental biophysics: biological methods for physical scientists, 2nd Ed.; Jay L. Nadeau; CRC Press, ISBN: 9781498799591; 2017.
- Introductory bioelectronics: for engineers and physical scientists; Ronald R. Pethig, Stewart Smith; John Wiley & Sons, Ltd; ISBN: 978-1-119-97087-3; 2013.
- Bioanalytical Chemistry; Andreas Manz; Imperial College Press, ISBN: 1860943713; 2004.
- Optical Biosensors: Present & Future, 1st Ed; F.S. Ligler and C.A. Rowe Taitt (editors); Elsevier Science B.V, ISBN: 9780444509741; 2002.
- Biosensors and Nanotechnology: Applications in Health Care Diagnostics; Zeynep Altintas (Editor) Wiley, ISBN: 9781119065012; 2017.