GUÍA DOCENTE

Edition 2017-2018

1. SUBJECT DESCRIPTION

Degree:	**Biotechnology**
Course:	**INSTRUMENTAL ANALYSIS**
Module:	**METHODS IN INSTRUMENTAL ANALYSIS.** **MOLECULAR BIOLOGY OF SYSTEMS**
Department:	**Physical, Chemical and Natural Systems (SFQN) / Physiology, Anatomy and Cell Biology (FABC)**
Year:	**2017-18**
Semester:	**2 (SPRING SEMESTER)**
ECTS credits:	**6**
Course:	**3rd year**
Type:	**OBLIGATORY**
Language:	**ENGLISH**

Model:	**C1**
a. Basic Teaching (BT):	**50%**
b. Practical Teaching (PT):	**50%**

GUÍA DOCENTE

Edition 2017-2018

2. Professors

Coordinator	
Name:	**BRUNO MARTÍNEZ HAYA**
School:	FACULTY FOR EXPERIMENTAL SCIENCES
Department:	PHYSICAL; CHEMICAL AND NATURAL SYSTEMS
Area:	Physical Chemistry
Category:	Senior Lecturer
Office hours:	Mondays and Fridays 10:00-13:00, appointment required
Office:	22.3.10
E-mail:	bmarhay@upo.es
Phone:	954977562

3. TRAINING PLAN

3.1. Goals

To provide students with theoretical and practical knowledge about the basic principles of instrumental analysis in Biochemistry. To transmit a general, multidisciplinary and modern vision of the current status of instrumental bioassays. To link bio-analytical applications with the underlying biochemical and physicochemical principles that make them possible. To provide students with the ability to design application protocols in instrumental techniques to detect and quantitate chemical compounds of relevance in biochemistry and biotechnology.

3.2. Contribution to training plan

This course provides two main contributions to the degree training plan:

1) It extends the concepts acquired in previous courses in General Chemistry, Organic Chemistry, Biochemistry and Bio-analytical Chemistry and outlines in depth the application of modern instrumental techniques to the detection and quantitation of biomolecular species of relevance in Biotechnology

2) It provides the basis for a better development of the biology and engineering courses within this degree.

3.3. Recommendations or previous knowledge required

A solid background in the following subjects of the Degree programme is strongly recommended.

General Chemistry (first year)
Organic Chemistry (first year)
Biochemistry (Biomolecules) (first year)
Thermodynamics and Chemistry Kinetics (second year)
Bioanalytical Chemistry (elective)

4. COMPETENCES

4.1 Competences of the degree in Biotechnology developed in the subject

Basic competences

CB2 Students must be able to apply their knowledge to their working activity in a profesional fashion. The students must adquire skills to argue and face complex problems within their area of research.

CB3 Students must be capable of collecting and interpreting relevant data within their area of research, to produce reflexive statements about topics of social, scientific or ethical topics.

CB5 Students must adquire the skills for autonomous learning required in postgraduate programs.

General competences

CG4 Understanding of the scientific method. Capability of applying the experimental tools, techniques and protocols of a biotechnology laboratory. Skills for experimental observation and data interpretation.

CG5 Development of skills in biotechnology through the description, quantification, analysis and critical evaluation of experimental data collected in an autonomous way.

CG6 Development of proper working procedures in the biology, chemical and biochemical laboratory, being aware of the legislation and techniques related to health and security, animal manipulation and handling of waste materials.

CG18 Understanding and integration of multidisciplinary concepts relevant to the field of work.

CG19 Capability of demonstrating initiative and responsible work in a profesional environment.

CG23 Understanding and application of critical thought in science.

CG27 Integrated vision of the general process of research, development and

innovation and of the inter-relation of the different fields of knowledge relevant to Biotechnology, from the biological and physico-chemical principles to novel scientific insights leading to the development of specific applications and novel biotechnological products.

4.2. Competences of the learning module to which the subject belongs

CE24 Comprehension of the concept of measure in science, including the proper use of magnitudes and units, as well as the meaning and handling of the experimental errors involved in any observation.

CE31 Knowledge and skill for application of the analytical methodology in the laboratory and validation procedures.

CE32 Knowledge of the main techniques for the analysis and quantification of biomolecules and biopolymers.

4.3. Course-specific competences

CE1 Knowledge of the major modern state-of-the-art techniques of instrumental analysis in biochemistry, and the basics of their adequate use and range of application.

CE2 Practical experience about the scope of each instrumental technique, its pros, cons and limitations.

5. CONTENTS (Topics)

1. Instrumental techniques for analyte separation
Gas chromatography, Liquid chromatography, capillary electrophoresis.

2. Nuclear Magnetic Resonance
Fundamentals y applications in Biological Systems

3. Mass spectrometry
Volatilization and ionization of biomolecular compounds. Ion detection and mass analysis. Fragmentation techniques. Biomolecular identification. Applications in proteomics and metabolomics.

4. Advanced Spectroscopy
Vibrational spectroscopy. Infrared absorption and Raman dispersion. Identification and structural characterization of biomolecules. UV-Vis Spectroscopy: Absorption- and Fluorescence-based techniques. Fluorescence microscopy.

5. Scanning Microscopy
Electron Microscopy (SEM, TEM). Scanning Microscopy Techniques (AFM, STM). Applications in biological systems.

6. METODOLOGY AND RESOURCES

Methodology
Lectures (twenty-three 1-hour sessions), Lab practical sessions (four 3-hours sessions)
Seminars (four 2.5-hours sessions)
Resources
Multimedia-equipped classroom, Virtual Campus, laboratory

7. EVALUATION

The evaluation will include all training activities: concepts and procedures transmitted by the teacher through lectures and extended by the students from the recommended literature, conducting laboratory practices and development of the relevant reports.

Evaluation activities in THE REGULAR CALL are as follows:
1) Evaluation of the lab sessions: Three written exams throughout the course, based on the results of the lab sessions, and supported by the individual lab reports of each student (40%).
2) Written exam on the entire subject: a written examination at the end of the course (60%).
To pass this course, it is mandatory to attend all lab sessions and to get a grade of at least 5 out of 10 in the lab assessment (average of three tests) and also in the examination on the entire syllabus.

Failure to pass this subject in the ordinary examinations, will lead to the following evaluation activities in the EXTRAORDINARY CALL:
1) Evaluation of the lab sessions: If the evaluation was passed in the ordinary call, the grade of this part will be kept unchanged (no exceptions). Otherwise, a written examination on the full lab course will be performed, supported by the reports done by each student individually (40%)
2) Written exam on the entire subject: a mandatory written examination on the full content of the course (60%).
A grade of at least 5 out of 10 in each of the two exams is required.

8. RECOMMENDED LITERATURE

- Physical chemistry for the life sciences. Peter Atkins, Julio de Paula. Oxford University Press, 2006
-Análisis Química Cuantitativo. Harris, Daniel. Editorial Reverte, 2007. 3ª edición (6ª edición del original).
-Principios de análisis instrumental. Skoog, Douglas A. Cengage Learning, cop. 2008 / McGraw-Hill, D.L. 2000.
- Mass Spectrometry Handbook, Hoboken (New Jersey): Willey, cop. 2012
- Mass spectrometry: a foundation course, Downard, K., Cambridge, 2012