GUÍA DOCENTE

Edition 2015-2016

1. SUBJECT DESCRIPTION

Degree:	**Biotechnology**
Course:	**INSTRUMENTAL ANALYSIS**
Módulo:	**METHODS IN INSTRUMENTAL ANALYSIS. MOLECULAR BIOLOGY OF SYSTEMS**
Department:	**Physical, Chemical and Natural Systems (SFQN) / Physiology, Anatomy and Cell Biology (FABC)**
Year:	**2014-15**
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%**

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2. Professors

Coordinator	
Name:	**BRUNO MARTÍNEZ HAYA**
School:	FACULTY FOR EXPERIMENTAL SCIENCES
Department:	PHYSICAL; CHEMICAL AND NATURAL SYSTEMS
Area:	Physical Chemistry
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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

We recommend taking the course during the second semester of the second year, with good marks in the following subjects:

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 Degree competences developed within this subject

1) Development of strategies for information acquisition, interpretation and analysis for critical and contextualized understanding. Usage of knowledge with professionalism and development of proper rationale and problem-solving skills within their field of study.
2) To develop learning skills needed to undertake further high-level autonomous studies.
3) To acquire basic experimental skills adequate to other subjects by formal description, quantification, analysis and critical evaluation of the experimental results obtained.
4) Multidisciplinary knowledge assimilation for proper writing, based on knowledge integration.
5) Professionalism and responsible initiative.
6) To be aware of the importance of teamwork and improve critical discussion within common goals.
7) Awareness of the importance of the contribution of biotechnology for social development.
8) Development of creative ability resulting in innovation and identification of analogies between situations enabling to solve new problems.
9) Ability to analyse, synthesize and use critical thinking in science.
10) Understanding of the scientific method.
11) Understanding of the basic mechanisms of analysis and design downstream and upstream systems to solve complex processes.
12) To connect and interrelate areas of knowledge that encompasses biotechnology, from biological and physicochemical principles to industrial use or application of R & D.
13) To work properly in a biological, chemical or biochemical laboratory, and follow the rules and techniques related to health and safety, laboratory animal handling and waste management.
14) Know and apply the tools, techniques and protocols in laboratory experimentation.
15) To acquire the skills of observe and interpret results.

4.2. Third-year competences developed within this course

1) Knowledge and application of the analytical methodology and its validation criteria.

2) Knowledge of the main analysis/ quantification techniques used with biomolecules and biopolymers.
3) Knowledge of how to identify the appropriate analytical instrumental technique for each problem, evaluating pros and cons with alternative techniques.
4) Development of a correct attitude in the laboratory to ensure personal safety, environmental protection and quality of results.
5) Holding of a global, methodological and analytical attitude during development of experimental methods/techniques during implementation.
6) Knowledge and use of data processing systems with different techniques.
7) Skills to correctly analyse final results obtained from different techniques and provide a reliable interpretation.

4.3. Course-specific competences

1) Knowledge of the major modern instrumental analysis techniques in biochemistry and the basics of their adequate use and range of application.
2) To acquire practical experience about the scope of each instrumental technique, its pros, cons and limitations.

5. CONTENTS (Topics)

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

2. Advanced Spectroscopy
IR Spectroscopy. Infrared absorption y Raman dispersion. UV-Vis Spectroscopy. Absorption- and Fluorescence-based techniques.

3. Microscopy
Optical Microscopy. Electron Microscopy (SEM, TEM). Scanning Microscopy Techniques (AFM, STM)

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

5. Nuclear Magnetic Resonance
Fundamentals y 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 AT THE REGULAR CALL IN JUNE are as follows:
1) Evaluation of the lab sessions: Three written tests throughout the course, based on the labs sessions conducted, and supported by the report of each student's individual practice (40%).
2) Written exam on the entire agenda: a test at the end of the course (60%).

To pass this course, it is obligatory 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 examination, will lead to evaluation activities EXTRAORDINARY IN JULY CALL:
1) A written examination on the entire syllabus of the course (60%)
2) A written examination on laboratory practices, supported by reports done by each student individually (40%)

8. RECOMMENDED LITERATURE

-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.
- Physical chemistry for the life sciences. Peter Atkins, Julio de Paula. Oxford University Press, 2006