66029 - Advanced methods in biophysics

Información del Plan Docente

Academic Year	2016/17
Academic center	100 - Facultad de Ciencias
Degree	537 - Master's in Molecular and Cellular Biology
ECTS	6.0
Course	1
Period	First semester
Subject Type	Compulsory
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

The learning process is designed so that on the basis of an intensification of theoretical knowledge students acquire an applied orientation in the use of different biophysical techniques. The course intends that students are able to choose the most adequate technique in each particular case.

To achieve this objective, the theoretical classes and practical cases are interspersed to optimize the learning process, reducing the time from students' acquisition of theoretical knowledge until its application.

This strategy is adapted to the resolution of practical problems that in short is the most practical part of the subject, and a way to bring students to the situations that they would confront in their daily work in a laboratory. Thus, the subject has a fundamentally applied orientation, the proposed activities focus on the application of a serie of principles to specific real cases, either through the analysis in teams of experimental results provided by the teacher and interpretation from the biological point of view, or the individual preparation by the student of specific cases that require the application of one or more of the explained techniques.

In general, the studied techniques require equipment of high cost that is not available in teaching laboratories. However, the students will be introduced to some equipment from the research laboratories.

5.2.Learning activities

Master classes (20 hours).

Oral presentations by specialized researchers about the most commonly used biophysical techniques, giving practical examples of their applications to resolve scientific problems in biology and biotechnology.The material of lectures will be provided by the professors to the students through the UNIZAR learning platform

Practical lectures: problem solving and practical exercises (20 hours)

Practical exercises exemplifying the main topics discussed during theoretical lectures and exploring the application of the above biophysical techniques.

This activity is interspersed with theoretical classes. The material will be provided by professors to the student through the UNIZAR learning platform. The problems will be resolved and discussed in class. These activities will allow students to acquire the ability to analyze and resolve experimental problems related to the learned techniques. The student will be able to design experiments (or applications) by himself, quantify, analyze and critically evaluate the results obtained.

Seminars (20 hours)

Analysis of proposed scientific articles, oral presentations and group discussions. The used methodology will be: management of bibliography, individual and/or group work, oral presentation and defence of the selected case. The work will be performed individually or in groups of 2-3 students. Professors will follow the individual work of students by scheduling tutoring sessions. The work will be exposed and defended by each group of student in class.

This activity will instruct students in the management of bibliography (scientific publications) and relevant information, the use of databases and networked applications. The students will practice how to interpret results and communicate conclusions to a specialized and general public.

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Written test (2h).

At the end of the course, students will make a written test to evaluate the acquisition of basic concepts and procedures of the subject. The written test will be based on the program of learning activities scheduled.

5.3.Program

Theoretical Lectures (20 hours)

1. **Spectroscopic principles**
2. **Mass spectrometry**
3. **UV/visible spectroscopy**
4. **Circular dichroism (CD) and optical rotatory dispersion**
5. **Emissions spectroscopy**
6. **Infrared spectroscopy and Raman spectroscopy**
7. **Nuclear magnetic resonance (RMN)**
8. **Electronic paramagnetic resonance**
9. **Calorimetry**
10. **X ray diffraction**
11. **Optical Biosensors based on Surface Plasmon Resonance (SPR). Biaocore**
12. **Atomic force microscopy (AFM)**

Practical lectures: problem solving and practical exercises (20 hours)

The following activities are proposed:

- Theoretical estimation of protein concentrations and purity

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- Theoretical prediction of the UV/Vis spectra components of proteins. pKa estimation of some aminoacids

- Calculation of equilibrium constants. Determination of thermodynamic parameters and stability constants of biological complexes and ligand binding

- Rapid kinetic techniques: laser flash photolysis and stopped-flow.

- Determination of protein activities. Determination of steady-state and pre-steady state kinetic constants.

- Determination of protein redox potentials.

- Characterization of protein folding (NMR, CD). Thermal denaturation profiles. Determination of thermodynamic parameters.

- Protein Secondary, ternary and quaternary protein determination

Seminars (20 hours)

Analysis of proposed scientific articles, oral presentations and group discussions.

5.4.Planning and scheduling

The course will begin in mid-October according to the academic calendar of the master. The first 40 hours of the course will correspond to the master classes and practical lectures.

The offer of seminars will be announced at the beginning of the course and the deadline for seminars selection by students will be at the end of October.

Oral presentations will be from December to January.

The writing test will take place in late January in the place and date indicated by the Faculty of Sciences.

5.5.Bibliography and recomended resources

Recommended reading and textbooks:

1. Lehninger Principles of Biochemistry (6º Ed.) D.L. Nelson and M.M. Cox. W.H. Freeman and Company, cop. New York. 2013

2. Introduction to protein structure / Carl Branden, John Tooze . - 2nd ed. New York : Garland, cop. 1999

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3. Proteins: structures and molecular properties / Thomas E. Creighton . - 2nd ed. New York : W. H. Freeman, cop.1994

4. Spectroscopy for the Biological Sciences. Gordon G. Hammes. Wiley-Interscience. John Wiley & Sons, Inc. New Jersey, 2005.

5. Science at the nanoscale: an introductory textbook. Chin Wee Shong, Sow Chorng Haur, Andrew TS Wee. Pan Stanford Publishing Singapore. 2010.

6. Introduction to Surface Plasmon Resonance. Anna J. Tudos and Richard B.M. Schasfoort. Chapter 1, pag.1-13. Handbook of Surface Plasmon Resonance. Ed. RSC Publishing. 2008