Academic Year: (2023 / 2024) **Review date: 12-06-2023**

Department assigned to the subject: Bioengineering Department

Coordinating teacher: SALINAS RODRIGUEZ, BEATRIZ

Type: Electives ECTS Credits : 6.0

Year : Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

It is desirable, but not a requirement, to have a good grounding in:
Chemistry
Physics
Biology

In addition, it is recommended to have a good knowledge of English to enable the student to read reference bibliography.

SKILLS AND LEARNING OUTCOMES

At the end of this course, the student should be able to:
¿ Analyze complex biological processes at the molecular and cellular level in a general and integrated manner.
¿ Use conceptual and technical tools necessary to understand the relationship between molecular and cellular mechanisms of biological functions, being able to apply this knowledge to relevant issues in different fields of Biosciences.
¿ Recognize and interpret the fundamental knowledge about the organization and function of the biological systems of organisms from a molecular and cellular perspective.
¿ Distinguish the physical and chemical bases of cellular processes, as well as apply the main physical, chemical and mathematical tools used to investigate them.
¿ Identify the main current problems and future challenges of the Biosciences.

OBJECTIVES

The course provides an up-to-date overview of the main techniques used in the field of biochemistry and presents how chemistry, physics and biology can be applied to scientific problems in the field of experimental sciences. After this fascinating course, the student will certainly acquire the necessary knowledge to understand the key role of biochemical methodologies in the advancement of scientific development.

DESCRIPTION OF CONTENTS: PROGRAMME

The programme of the biochemical methods course includes the following modules:

I.- The scientific method in biochemical research.
- Scientific articles and journals. Bibliographic search
- General introduction to experimentation in Biochemistry and Molecular Biology.

II.- Isolation of subcellular particles.
- Centrifugation: Types of rotors and centrifuges. Preparative centrifugation (differential and density gradient). Analytical centrifugation.

III.- Basic technology in the biochemistry laboratory.
- Electrophoresis: Basic concepts and general principles. Electrophoretic supports. Staining methods. Gradient electrophoresis. Polyacrylamide gel electrophoresis in the presence of SDS. Isoelectrofocusing Two-dimensional electrophoresis Capillary electrophoresis
- Mass spectrometry: basic concepts. Spectrometer analysis and applications in molecular biology.
- Chromatography: basic concepts and general principles. Chromatographic techniques based on polarity (liquid-solid chromatography, gas-liquid chromatography, liquid-liquid chromatography). Chromatographic techniques based on charge (ion exchange chromatography). Size-based chromatographic techniques (molecular sieving chromatography). Affinity chromatography
- Spectrophotometric techniques: basic concepts and general principles. Chromophores in biochemistry. Molar absorption coefficient. Lambert-Beer's law. Instrumentation: visible and ultraviolet spectroscopy.
- Radiochemical methods for the labelling of macromolecules: atoms and isotopes. Radioactive decay.

Types of radioactive emissions Units of radioactivity Detection and measurement of radioactivity.
- Immunotechnics: Antibodies, antigen-antibody interaction. Monoclonal and polyclonal antibodies. Antibody labelling.
- Identification techniques (blotting): Basic concepts. Transfer (blotting). Southern blot. Northern blot. Western-blot. Dot-blot.

SEMINARS: The seminars, given in smaller groups, will be aimed at :
- Problem solving
- Discussion of experimental assumptions
- Commentary and discussion of some publications especially relevant to the development of some of the biochemistry and molecular biology techniques.

LEARNING ACTIVITIES AND METHODOLOGY

TRAINING ACTIVITIES

Lectures: these are systematic and orderly expository sessions of the subject syllabus and selected problems that exemplify the implementation of the theoretical contents are solved in detail. The objective is for students to acquire the specific competences of each subject. 210 hours, 100% attendance.

Practical classes in the classroom: in these sessions, students work on the applications of the contents of the subjects, including numerical examples, case analysis, data search, directed work, gamification sessions, etc. The objective is to show students how to act. 50 hours, 100% attendance.

Practical laboratory classes and practices with computer media: students will carry out supervised experimental or computational work in specialized laboratories in which they will put into practice the theoretical knowledge acquired in the different subjects and learn to work safely in the laboratory. 150 hours, 100% attendance.

Individual and/or small group tutorials: this is a personalized attention to students, in person and where a professor attends, facilitates and guides one or more students in the training process. They allow the teacher a more individualized follow-up of each student's learning. 20 hours, 100% attendance.

Evaluation tests. 20 hours, 100% attendance.

Group study and work: consists of the preparation of seminars, problems, exercises, readings, data collection and analysis, etc. to be presented or delivered in class by students working in groups, so that they acquire the ability to work as a team and learn through interaction with their peers. 190 hours.

Study and individual autonomous work to develop self-learning skills. Includes the same activities of the group work, but carried out individually. It also includes personal study (preparing exams, complementary readings, doing problems and exercises), which is fundamental for autonomous learning. 240 hours: online tasks using information and communication technologies, in order for students to acquire competencies in these technologies, in addition to those of the subject matter. 50 hours.

Preparation of reports, writing of practical reports (laboratory, field, computer), writing of papers on current issues related to the development and applications of science and technology, etc. 120 hours.

TEACHING METHODOLOGIES

Expository method: oral presentations by the teacher supported, if necessary, with computer material (PowerPoint, videos, etc.). They provide the transmission of knowledge and activation of cognitive processes in the student.

Problem-based learning: development of active learning through problem solving, which confronts students with new situations in which they have to search for information and apply new knowledge to solve problems.

Cooperative learning: fosters the development of autonomous learning through collaboration among peers.

ASSESSMENT SYSTEM

Students are required to read the materials for each chapter before the lectures and seminars. During the seminars there will be interactive discussions with the students.
Scheduled exams will be given periodically, using the first half hour of the session, on the content of the

most recently studied topics. The results of these exams form an important part of the continuous assessment.

Grading:
- Final examination: 60%.
- Continuous assessment: 40% (short exams, lab practicals and hospital visits).

FINAL EXAM: The minimum mark for the final exam must be 4.5 out of 10 to be eligible for continuous assessment.

EXTRAORDINARY EXAM: The grade for students taking the extra-ordinary examination will be
- 100 %
- 40% for the examination and 60% for the continuous assessment if available in the same course.

Prior to the start of the extraordinary examination, the student will be asked to indicate which option he/she prefers.
ACADEMIC CONDUCT: Unless otherwise stated, examinations will be closed-book, with no notes, computers or mobile phones. No academic dishonesty will be tolerated. Any breach of these rules will result in a grade of SUSPENSION.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40