

Academic Year: (2024 / 2025)

Review date: 15-07-2024

Department assigned to the subject: Bioengineering Department

Coordinating teacher: CHACON SOLANO, ESTEBAN GONZALO

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Cell and Molecular Biology

SKILLS AND LEARNING OUTCOMES

RA1: Acquire knowledge and understanding of the basic general fundamentals of engineering and biomedical sciences.

RA2: Be able to solve basic engineering and biomedical science problems through a process of analysis, identifying the problem, establishing different methods of resolution, selecting the most appropriate one and its correct implementation.

CB1: Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.

CB2: Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.

CG1: Adequate knowledge and skills to analyse and synthesise basic problems related to engineering and biomedical sciences, solve them and communicate them efficiently.

CG3: Knowledge of basic scientific and technical subjects that enables them to learn new methods and technologies, as well as providing them with great versatility to adapt to new situations.

CG4: Ability to solve problems with initiative, decision-making, creativity, and to communicate and transmit knowledge, skills and abilities, understanding the ethical, social and professional responsibility of the biomedical engineer's activity. Capacity for leadership, innovation and entrepreneurial spirit.

CG8: Ability to solve mathematical, physical, chemical and biochemical problems that may arise in biomedical engineering.

CG13: Knowledge of the fundamental principles of molecular, cellular, structural and biochemical biology applied to human beings.

ECRT5: Ability to solve basic biochemistry problems that may arise in biomedicine.

CT1: Ability to communicate knowledge orally and in writing to both specialised and non-specialised audiences.

OBJECTIVES

A Biomedical Engineer needs to integrate knowledge from different fields in order to analyze and solve problems in biology and medicine to provide an overall enhancement of health care.

The human body is an elegant device that requires inputs for sustained operation. The processes responsible for that input rely on proteins, the leitmotiv of biochemistry and the ultimate cell micro-machines. Students will partake of the excitement of understanding the complex problems of biochemistry.

After being introduced to the fundamentals of Cell and Molecular Biology, Biochemistry students will become acquainted with multiple protein and enzyme functions. Students will get familiar with various state-of-the-art methodologies to analyze proteins and their modifications. We will make a strong emphasis on the malfunction of proteins as the leading cause of disease and on the ways to study and tackle these problems. Students will be led through the subject text books and journal papers

promoting interactive scientific discussion and team work.

DESCRIPTION OF CONTENTS: PROGRAMME

Proteins act both as building blocks and molecular machines orchestrating cell and tissue function. Our Biochemistry course will cover a variety of normal and pathological protein functions in processes such as metabolism, cell signaling, cancer and others.

1. Introduction
2. Enzymes
3. Protein analysis I
4. Protein analysis II
5. Metabolic routes I
6. Metabolic routes II
7. Metabolic routes III. Biosynthetic and degradation pathways
8. Signal Transduction
9. Signal Transduction
10. Cancer
11. Clinical biochemistry I
12. Clinical biochemistry II (diabetes and obesity).

LABORATORY EXPERIMENTS

- a. protein extraction quantification and analysis
- b. electrophoresis
- c. western blot analysis
- d. enzyme kinetics

LEARNING ACTIVITIES AND METHODOLOGY

The program will be divided into master (lectures) and discussion/problem classes and, laboratory. Students may be required to read assigned chapters/articles, or solve problems before the corresponding classes. For specific subjects there may be invited lectures given by prestigious professionals in the field. In the discussion and problems sections, relevant scientific articles and problems will be presented and discussed by the students and the teaching team.

In the laboratory classes, students divided in small groups will perform the described experiments with the help of a supervisor and Lab guide prepared by the teaching team. Students will be required to pass an exam at the end of the practices.

ASSESSMENT SYSTEM

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

TEACHING METHODOLOGY

Teaching methodology will be mainly based on lectures, seminars and practical sessions. Students are required to read assigned documentation before lectures and seminars. Lectures will be used by the teachers to stress and clarify some difficult or interesting points from the corresponding lesson, previously prepared by the student.

Grading will be based on continuous evaluation (including two continuous evaluation tests, attendance to laboratory and lab exam) and a final exam covering the whole subject. Help sessions and tutorial classes will be held prior to the final exam upon students request.

Attendance to lectures is not compulsory. However, failure to attend any exam or submit the exercises before the deadline will result in a mark of 0 in the corresponding continuous evaluation block (see below). The practical sessions will consist on laboratory work (one week) and a written test at the end of the week. The attendance to 80% of practical sessions is mandatory.

GRADING:

Total score: 10 points

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

Continuous evaluation: 4 points out of 10

Final exam: 6 points out of 10

CONTINUOUS EVALUATION: It accounts for up to 40% of the final score of the subject (4 points of the TOTAL SCORE), and includes two components:

1) Short-exams (2/3 of the continuous evaluation mark): These exams will take place mostly during lectures, and will be advertised at least one week in advance. Results of these exams will constitute two thirds of the continuous evaluation (2,66 points of THE TOTAL SCORE).

2) Laboratory (1/3 of the continuous evaluation mark: 1,33 points of the TOTAL SCORE): written laboratory test (1.33 points).

Attendance to at least 80% of the practical sessions is mandatory; otherwise the score will be 0 in this item.

FINAL EXAM: The final exam will cover the whole subject and will account for the 60 % of the final score. The minimum score in the final exam to pass the subject is 4.5 over 10, notwithstanding the mark obtained in continuous evaluation.

EXTRAORDINARY EXAM: The mark for students attending any extraordinary examination will be the maximum between:

- 100% exam.
- 60% exam and 40% continuous evaluation if it is available in the same course.

ACADEMIC CONDUCT: Unless specified all exams will be closed-book, closed-notes, no PC or mobile phone, or anything else other than a writing implement and the exam itself. Plagiarism, cheating or other acts of academic dishonesty will not be tolerated. Any infractions whatsoever will result in a failing grade.

BASIC BIBLIOGRAPHY

- Alberts- Johnson- Lews- Raff- Roberts- Walter Molecular Biology Of The Cell 5th Edition, Cold Spring Harbor, 2009
- Colleen Smith, Allan Marks, Michael A Lieberman. Marks Basic Medical Biochemistry: A Clinical Approach, ISBN: 0781721458 Publisher: Lippincott Williams & Wilkins, 2nd Edition, 2004
- David L. Nelson, Michael M. Cox Lehninger principles of biochemistry , New York : W. H. Freeman and Company , 6ª edición
- David L. Nelson, Michael M. Cox Lehninger principles of biochemistry , New York : W. H. Freeman and Company , seventh edition, 2017
- Thomas M. Devlin Textbook of Biochemistry with Clinical Correlations, John Wiley & Sons , 6th Edition

ADDITIONAL BIBLIOGRAPHY

- Paul Engel Pain-free biochemistry: an essential guide for the health sciences, John Wiley and Sons, 2009