UNIVERSIDAD FRANCISCO DE VITORIA
VINCE IN BONO MALUM

Teachers' guide – summary sheet

Initial Identification details:

Title:	Degree in Biotechnology (Plan 2009)
Faculty/School:	Bio-Health Sciences
Course subject:	**Basic Instrumental Techniques**
Type (3):	Obligatory
Credits ECTS:	6
Year / Semester (4):	2nd Year-3rd Semester
Code (1):	2024
Subject (2):	Instrumental techniques
Module (2):	Experimental Methods in Biotechnology
Language (5):	Spanish
Total number of hours undertaken by pupil (6):	150

Brief description of the course (7):

As in all areas of science, advances in knowledge are linked to technological development.
The study of living organisms from a molecular perspective must happen in parallel to its working methods, which are often specific to this scientific activity.
The methods themselves of biotechnology are very diverse but it is possible to focus in a first phase in those who by their fundamental nature are essential tools for biotechnologists.
This course consists of two main blocks. The first section examines the foundations and applications of techniques aimed at the isolation of biopolymers, chromatography, electrophoresis and centrifugation. With the second consideration must cover techniques for the detection and quantification of biological compound, use of radioactive isotopes, ultraviolet-visible absorption and fluorescence emission.
Creativity and ability to make proposals for experimental study of bio-molecules and biological agents requires a strong background in theoretical foundations of the fundamental techniques and their management in the laboratory.

Prior Knowledge (8):

That pertaining to the degree.

General objective (9):

The overall objective of this course is that students learn the physical-chemical basis of instrumental techniques commonly used in a biotechnology laboratory.
In addition, to acquire the ability and skill to ask and to adapt the use of the techniques discussed in the resolution of key problems in daily practice of biotechnologists.

Skills / Abilities:

General (10):

Acquire a solid technological and humanistic training necessary for the development of professional activity.
Promoting the restlessness for knowledge as a key tool in the process of personal and professional growth of students.
Develop the ability to search, assimilation, analysis, synthesis and information relationship.
Know the principles and basic tenets of the experimental sciences and humanities
Develop skills of oral and written communication.
Understand the principles and fundamental laws of physics, mathematics, chemistry and biology as the basis of the mental structure of biotechnologist.
Acquire the skills required for experimental work: implementation, collection of results and drawing conclusions, understanding the limitations of the experimental approach.
Ability to work as a team and to manage groups.
Acquiring the ability to think analytically, synthetically, reflectively, critically, theoretically and practically.
Capacity for problem solving and decision making.
Knowing how to plan time effectively.
Develop the capacity and commitment of own learning and personal development.

Specific (10):

Understanding physical and mathematical foundation of basic instrumental techniques used in biotechnology laboratory experimentation.
Know how to design and implement adequately an experimental protocol from the knowledge of different subjects.
Develop criteria for problem solving and decision making at both the professional and personal level.
Cultivate an attitude of intellectual curiosity and quest for truth in all areas of life.
Develop habits of rigorous thought.
Analyze and synthesize ideas and main contents of all kinds of texts, to discover the theories contained in them and the issues raised, and to judge critically about their form and content.
Know how to apply theoretical knowledge to problem solving and case studies related to various subjects.

Brief index to subjects (12):

ITEM 1. Chromatography. Introduction. Classification. Paper chromatography and thin: a description of the technique. Support. Application. Development. Detection. Column chromatography: description of technique. Support. Application. Development. Detection. Column efficiency. Band broadening. Kinetic variables. Optimization. Size exclusion chromatography: description of technique. Support. Application. Development. Detection. Ion exchange chromatography: description of technique. Support. Application. Development. Detection. Hydrophobic chromatography: description of technique. Support. Application. Development. Detection. Affinity Chromatography:

Description of the technique. Support. Application. Development. Detection. Hydroxyapatite chromatography. High resolution liquid chromatography, HPLC.

ITEM 2. Electrophoretic techniques. Introduction and methodology. Electrophoresis types: free and zonal. Basic equipment. Paper electrophoresis. Applications. Protein electrophoresis. Characteristics and surface preparation. Non-denaturing electrophoresis. Denaturing electrophoresis. Dimensional electrophoresis. Detection methods. Densitometric quantification. Electro-transfer of proteins (Western blotting). Immuno-detection. Electrophoresis of nucleic acids. Characteristics and surface preparation. Non-denaturing electrophoresis. Denaturing electrophoresis. Poly-acrylamide gel electrophoresis. Pulsed-field gel electrophoresis. Capillary electrophoresis. Characteristics and surface preparation. Electro-endósmico flow. Applications.

ITEM 3. Centrifugation. Subcellular fractionation techniques. Theory of centrifugation. Centrifugation techniques. Differential centrifugation. Gradient centrifugation, zonal and isopycnic. Instrumentation: Centrifuges and rotors. Choice of means of centrifugation. Training and density gradient analysis. Practical applications. Subcellular fractionation. Determination of sedimentation coefficient. Determination of complexes. Centrifugation of DNA.

ITEM 4. Spectroscopy, ultraviolet-visible absorption.
Theoretical foundation. Electronic transitions. Chromophore concept. Lambert-Beer equation. Absorption spectrum. Equipment. Spectro-photometry of proteins. Spectro-photometry of nucleic acids. Colorimetry. Turbidimetric. Kinetic measurements. Application to enzyme assays. Difference spectroscopy. Monitoring fast reactions. Absorption of polarized light.

ITEM 5. Fluorescence spectroscopy theoretical basis. Emission spectra excitation spectra. Spectro-fluorimeter. Measures of concentration. The phenomenon of deactivation (Quenching) fluorescence. Energy transfer processes. Intrinsic and extrinsic fluoro-phores. Fluorescence protein. Fluorescence of nucleic acids. Fluorescence anisotropy

ITEM 6. Introduction isotope techniques: atomic nucleus. Elementary particles. Nuclear disintegrations. Stability of the atomic nucleus. Measurement of radioactivity. Accountants. Biological applications of isotope techniques. Dissolution of radioactive compounds. Identification of unknown volumes. Determination of intracellular concentrations. Enzyme assays and transport. Radioactive tracers. Markings. Autoradiography. Image detectors.

ITEM 7. Labs

Teaching Activities (13) (Approximate % as a function of total credits, considering solely those activities where the student's presence is required and that these represent between 30% and 40%)

Theory classes:	64%
Practical Classes:	11%
Workshops/Labs/Presentations:	22%
Others:	3%
Total:	100%

Evaluation system:

Examinations:	64%
Assistance and participation:	21%
Course work:	15%
Others:	0%
Total:	100%

Specifics of evaluation (14):

1. At mid-semester the student will be assessed through a midterm exam on the first part of the course. The examination will be eliminatory of material when the student earns a score equal to or greater than 7 out of 10.
2. Resolution of the practical work will be assessed individually or in groups throughout the teaching period of the course, assessing, therefore, attendance and class participation.
3. Evaluation will be made of the presentation of scientific research work related to the field.
4. The practical work done in the laboratory will be assessed.

Basic bibliography (15):

García Segura, JM., Gavilanes, JG., Martínez del Pozo, A., Montero, F., Oñaderra, M. y Vivanco, F. (1996). *Técnicas Instrumentales de Análisis en Bioquímica*. Síntesis, Madrid.
Freifelder, D. (1992). *Physical Biochemistry: Aplications to Biochemistry and Molecular Biology.* W.H. Freeman & Co., Barcelona.
Cooper, TC. (1986). *Instrumentos y Técnicas de Bioquímica*. Reverté, Barcelona.
Boyer, RF. (1993). *Modern Experimental Biochemistry*. The Benjamin/Cummings Publishing Company, San Francisco.
Skoog, DA., Holler, FJ. y Nieman TA. (2001). *Principios de Análisis Instrumental.* McGraw-Hill/ Interamericana, Madrid.
Brown, SB. (1980). *An Introduction to Spectroscopy for Biochemists*. Academic Press.
Billington, D., Jayson, GG. and Maltby, PJ. (1992). *Radioisotopes*. Bios Scientific Publishers, Oxford.
Ford, TC. and Graham, JM. (1991). *An Introduction to Centrifugation*. Bios Scientific Publishers, Oxford.
Sambrook, J., Fritsch, EF., Maniatis, T. (1989). *Molecular Cloning. A Laboratory Manual*. Cold Spring Harbor Laboratory Press, New York.
Wilson, K. and Walker, J. (2000). *Principles and Techniques of Practical Biochemistry*. 5th ed. Cambridge University Press, Cambridge.
Dabrio, MV., Blanch, GP., Cifuentes, A., Díez-Masa, JC., Frutos, M., Herraiz, M., Martínez Castro, I., Sanz Perucha, J. (2000). *Cromatografía y electroforesis en columna.* Springer-Verlag Ibérica, Barcelona.

(1) Code of the course
(2) Description as per the Verified Memorandum
(3) May be either: Basic Teaching, Obligatory, Optional, External Practices, or Final Degree Work.
(4) May be either: First Year - 1st semester and (or) 2nd semester; Second Year - 3rd semester and (or) 4th semester; Third Year - 5th semester and (or) 6th semester; Fourth Year – 7th semester and (or) 8th semester.
(5) The language in which the course will be taught
(6) The total number of hours that the student will dedicate to the course. Being approximately twenty-five hours for each ECTS, accounting for all activities.
(7) Between three and five phrases that summarize the description of the course.
(8) Corresponds to those recommendations to aid taking the course. A brief recommendation is written. If they are not required, one specifies “those corresponding to the degree”.
(9) Set out the general objective of the course, writing a sole objective.
(10) The skills as set out in the Verified Memorandum along with the abbreviations corresponding to each of them
(11) One can add various other skills that are not in the Verified Memorandum and which the teacher deems relevant
(12) The main thematic blocks of the course
(13) In this case neither tutorials nor evaluations are included. Only those activities where the student is present.
(14) Explain the process of evaluation that has been set out previously in percentages with three brief phrases
(15) Three to ten references should be detailed.

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