



DEGREE CURRICULUM
INSTRUMENTAL TECHNIQS

Coordination: ERAS JOLI, JORDI

Academic year 2019-20

Subject's general information

Subject name	INSTRUMENTAL TECHNICS				
Code	101617				
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION				
Typology	Degree	Course	Character	Modality	
	Bachelor's Degree in Biotechnology	2	COMPULSORY	Attendance-based	
Course number of credits (ECTS)	6				
Type of activity, credits, and groups	Activity type	PRALAB		PRAULA	TEORIA
	Number of credits	2	2	1	3
	Number of groups	6	8	2	1
Coordination	ERAS JOLI, JORDI				
Department	CHEMISTRY				
Important information on data processing	Consult this link for more information.				

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
CANELA XANDRI, ANNA	anna.canela@udl.cat	1,6	
CEQUIER MANCIÑEIRAS, ENRIQUE	enrique.cequier@udl.cat	3,5	
COMPANYS FERRAN, ENCARNACIÓN	encarna.companys@udl.cat	1,2	
COSOVANU , DIANA GABRIELA	diana.cosovanu@udl.cat	1,2	
ERAS JOLI, JORDI	jordi.eras@udl.cat	8,7	
GATIUS CORTIELLA, FERNANDO	fernando.gatius@udl.cat	1,2	
VILARÓ JORDANA, FRANCISCA	francesca.vilaro@udl.cat	3,6	

Learning objectives

The student, when passing the subject, must be able to:

- Know the procedures for acquisition, storage and preparation of the sample for each instrumental technique.
- Know the basics of current instrumental techniques, applications and limitations.
- Be able to correctly interpret the information provided by each instrumental technique.
- Learn to put into practice specific analyzes and know how to apply statistical and computer calculations to provide a reliable result.
- Know the basic processes of an instrumental analysis laboratory and the existence of computer programs and portals related to instrumental analysis.
- Acquire a criterion of choice of the most appropriate analytical technique.
- Achieve the scientific foundation sufficient to adapt to any technique or emerging method.

Competences

General competences

The graduate in Biotechnology must:

- Be able to seek and use selectively the sources of information necessary to reach the training objectives.
- Interpret scientific-technical information with a critical sense, and be able to make presentations based on this information.
- Be able to make comprehensible written and oral reports about the work carried out, with justification based on the theoretical and practical knowledge obtained (UdL strategic competence).
- Work as a team, with a multidisciplinary vision and with the capacity to make a rational and effective distribution of tasks among the members of the team.
- Use information and communication tools and techniques for data analysis and the preparation of oral and written reports and other training and professional activities (UdL Strategic Competence)
- Know and use the scientific and technical vocabulary proper to the different fields of Biotechnology.
- Work in the laboratory applying quality and good practice criteria.
- Use the scientific method to analyze data and design experimental strategies with biotechnological applications.
- Be able to develop a professional activity in accordance with the regulations of safety and respect for the environment and with ethical criteria.
- Acquire selection criteria for the most appropriate analytical techniques for each practical case.

Specific competences (according to the Plan of Studies document)

- Be able to use experimental techniques for analysis at the molecular, cellular and physiological level.
- Know and know how to apply techniques for the analysis of molecular structures and for the detection and quantification of metabolites and macromolecules.
- Know and know how to apply the techniques of hysterical analysis and interpretation of the results.
- Be able to design the protocol of a specific biotechnology process with the practical requirements necessary to carry it out and its assessment parameters.
- Know how to operate and be trained to work in a biotechnology laboratory.

Subject contents

ITEM 1. INTRODUCTION TO INSTRUMENTAL ANALYSIS. The analytical process. Parameters of analytical quality. Standards and Calibration Methods. Analysis of majority components, minority, traces and ultratracas. Resolution of quantification problems by calibration with standards

ITEM 2. GENERAL TECHNIQUES. Organization of the instrumental laboratory. Record of samples and data. Material and analytical reagents. Measures of mass and volume. Preparation of samples. Elimination of interferents. Extraction, centrifugation and ultracentrifugation.

SUBJECT 3. SPECTROSCOPIC TECHNIQUES. Electromagnetic radiation Waves Absorption and emission of the radiation. Spectra Lasers Classification of instrumental methods according to physical foundation. Quantitative Spectroscopy. Law of Lambert-Beer. Non-spectroscopic optical methods. Polarimetry and refractometry.

TOPIC 4. ATOMIC SPECTROSCOPES. Theory of atomic absorption and emission spectroscopies. Flame absorption spectroscopy. Flame atomization Atomization in graphite oven. Atomic emission spectroscopy. Flame atomization Atomization in plasma. Atomic fluorescence spectroscopy.

THEME 5. MOLECULAR SPECTROSCOPIES. Theory of Molecular Spectroscopy. Molecular absorption spectroscopy. Molecular absorption in the ultraviolet-visible region (UV-Vis). Molecular absorption in the infrared region (IR). Medium infrared absorption, FTIR. Interpretation of medium infrared spectrum (FTIR). Absorption in the far infrared. Near infrared absorption, NIR Spectroscopy. Molecular emission spectroscopy. Fluorescence Phosphorescence Raman dispersion spectrophotometry.

THEME 6. NUCLEAR MAGNETIC RESSONANCE SPECTRUMSCOPE (NMR). Fundamentos físicos de la espectroscopia de RMN. Chemical displacement. Shielding ¹H NMR ¹³C NMR. Other nuclei (³¹P, ¹⁹F, ¹⁵N) Exercise interpretation of NMR spectra.

SUBJECT 7. SEPARATORY TECHNIQUES. Theory of chromatographic separations. General description Classification of chromatographic techniques. Chromatographic parameters. Retention time Coefficient of distribution. Resolution Qualitative analysis. Quantitative analysis. Liquid chromatography, CL. Thin-layer chromatography (CCP). Rf. Column chromatography (CC). High resolution liquid chromatography, HPLC and UPLC. Gas chromatography, CG. Two-dimensional chromatography. Theory of electrophoretic separations. Gel

INSTRUMENTAL TECHNIQUES 2019-20

electrophoresis. Capillary electrophoresis. Problems of chromatography. Calculation of response factors.

UNIT 8. MASS SPECTROMETRY. Theory of mass spectrometry. Mass spectrums Coupled systems. Interfaces, ionization techniques and analyzers. Sequential Mass Spectroscopy MS-MS. Isotopic relations. Too exact. Analysis of macromolecules and elemental analysis by mass spectroscopy. Identification of compounds with spectroscopic techniques

Practical activities (Orientative. They may change for others, if deemed appropriate)

PRACTICE 1. Determination of calcium in lactic serum for atomic emission spectroscopy with induction-coupled plasma (ICP-AES).

PRACTICE 2. Quantification of chlorophyll in vegetable tissue by UV-Vis spectroscopy.

PRACTICE 3. Quantification of the majority of cereal products for NIR. FTIR spectroscopy. Purity of commercial caffeine and salicylate of methyl.

PRACTICE 4. Structural elucidation of drugs by NMR. Study of the catalyst efficiency of enzymes in fungal and commercial enzyme micelles

PRACTICE 5. Determination of the acetic profile of saponifiable lipids from a sample of bacteria and fungi by CG-FID.

PRACTICE 6. Determination of vitamins in commercial pharmaceutical preparations for HPLC with PDA and fluorescence detection

Methodology

Type of activity	Description	Presence activity student		Non-contact activity student
		Objectives	Hours	Student work
Master class	Master class (Classroom. Large group)	Explanation of the main concepts	30	Study: Knowing, understanding and synth
Seminar	Participatory class (Medium group)	Conducting discussion or application activities	10	Solving problems. Discuss
Laboratory	Practical of Laboratory (Medium group)	Execution of the practice: Understand phenomena, measure ...	20	Study and make memory
Totals			60	

Development plan

PROFESSOR DATA:

NAME: Jordi Eras Joli. DEPARTMENT: Chemistry

OFFICE: Main Ed. (A). Ground floor 0.06.4

PHONE: 973 702589 MAIL: eras@quimica.udl.cat

OFFICE HOURS: Friday from 10:30 a.m. to 12:30 p.m. Afternoons from 5pm to 6pm. Also to be agreed by e-mail. IMPORTANT: If it is through the CV always check the box:

Send as copy

Send a copy to the email address (es) of the recipients

VIRTUAL CAMPUS: Program and Bibliography. Theory. Problems. Practices. Exams Notes.

LANGUAGE: Catalan

SHEET: It is not mandatory to deliver it.

MOBILE PHONE: Its use is NOT ALLOWED in class sessions. Nor leave the classroom to make use.

Academic data:

CLASSES OF THEORY AND SEMINARS

- Attendance from the first day is recommended to theory classes and seminars, since the evaluation of the theory part will be based, mainly, on the one derived from the explanations provided to class hours. The topics will be presented with PowerPoint slides and will be available in pdf format in the CV.

- The seminars classes will mainly deal with numerical exercises, spectrum resolution and case studies.

PRACTICES

- Attendance at all laboratory practices is mandatory and it is essential to present the report of all laboratory practices to pass the subject. The unjustified non-attendance means not being able to attend the exams.

Internship group changes are not allowed without the permission of the Degree Coordinator.

- It is mandatory to go to the laboratory with a long, closed and long-sleeved white coat. Footwear closed, will not be allowed to enter the laboratory with sandals. Safety glasses and gloves mandatory use. Notebook and pen to take notes.

- Two practice reports must be submitted, with deadlines for delivery

- The report can be presented together with the practice partner.

- The report must be delivered by sending it through the Virtual Campus in pdf or doc format. Each practice must be sent separately to each of the teachers who have directed the practices.

- The report should include: the objective of the practice, experimental observations, calculations, results, conclusions and answer to possible questions of the script.

DO NOT COPY THE PRACTICE SCRIPT.

It does not need to be very extensive, but it must contain the essential and done with a computer.

- The practice scripts will be posted on the virtual campus, but on the day of practice each student will also have a copy of the practice script to consult. The same copy should serve all three groups, therefore, it cannot be scratched or worn.

EVALUATION

- In the evaluation of the subject, the whole set of teaching will be taken into account. The theory and seminars part will evaluate, mainly, with the exams. These will consist of questions corresponding to the theoretical explanations in theory classes and seminars, questions about the scientific articles that will be proposed and questions about the practice sessions in relation to the foundation, experimental development, the results and the final conclusions of the practice. The exercises proposed in the theory classes and seminars will also be evaluated.

The active attitude in the set of activities of the subject (appropriate questions, comments, general interest) will be taken into account.

The evaluation of the practice sessions will be carried out assessing the corresponding report and the attitude when carrying out the practice.

- A partial exam will be done in the month of March or April. Aprove¹ means having provisionally approved that part of the subject and the June exam would only go with the second part. In case of suspending the first part, in June there will be an exam that includes the first and second part. In the recovery exam he only goes with the whole subject.

IMPORTANT:

To have passed the subject is a necessary condition, but not unique, having passed or both partial exams or the entire exam.

In relation to the final grade of a call, the marks corresponding to the evaluations of the activities in the seminars and laboratory will only be taken into account if the theory note is exceeded by a minimum of 5.

Evaluation

Theory	Seminar	Laboratory
50 %	30 %	20 %

Bibliography

Basic

- Randazzo A. (2018). *Guía Práctica para la Interpretación de Espectros de RMN (1ª Ed.)*, Loghia Publishing. Nápoles.
- Harris D.C. (2006), *Análisi Química Cuantitativa (6ª Ed)*, Reverté, Barcelona.
- Skoog D.A., Holler, F.J., Nieman T.A. (2001), *Principios de Análisis Instrumental, (5ª Ed) McGraw-Hill / Interamericana, Madrid.*
- Skoog D.A., West D.M., Holler F.J., Crouch S.R. (2005), *Fundamentos de Química Analítica, (8ª Ed) Thomson, Madrid.*
- Rubinson J.F., Rubinson K.A. (2001), *Análisis instrumental*, Prentice Hall, Madrid.
- Harvey D. (2002), *Química analítica moderna*, McGraw-Hill / Interamericana, Madrid.

Complementary

- A.O.A.C. (2006), *Official Methods of Analysis, Association of Official Analytical Chemists International (18th Ed)*. Williams Horwitz (Ed).
- Stoeppler M. (Ed) (1997), *Sampling and Sample Preparation*, Springer-Verlag, Berlin, Heidelberg.
- Miller J.C., Miller J.N. (2002), *Estadística y Quimiometría para Química Analítica, (4a Ed)*, Ed Prentice Hall, Madrid.
- Ebdon L, Evans E.H., Fisher A., Hill S.J. (1998), *An Introduction to Analytical Atomic Spectrometry*, Wiley.
- Cullen M. (Ed) (2004), *Atomic Spectroscopy in Elemental Analysis*, CRC Press.
- Freeman R. (2003), *Magnetic Resonance in chemistry and medicine*, Oxford University Press, Oxford.
- Hobokenn J. (2006), *Principles of Mass Spectrometry applied to biomolecules*. Wiley-Interscience.

Adaptations to the contents due to COVID-19

The same as the initial contents, but abbreviated with respect to theory topics 6 to 8. Practices 3 to 6 are replaced by the discussion of scientific articles related to the topics of practice.

Adaptations to the methodology due to COVID-19

Both theory sessions and problem seminars on these topics and discussion of practical articles will be conducted via video conferencing with the UdL's CV system.

Adaptations to the evaluation due to COVID-19

The content of the first and second evaluations and the final recovery will be for the whole of the subject taught until then.

The exams will be carried out on the indicated calendar and telematically through the UdL CV Test and questionnaires.

The new percentages relative to each part will be: Theory: 40%. Problems: 30%. Practices 1 and 2: 15%. Discussion articles: 15%