

Basic Sciences **Division**

Department of Chemistry

Spectroscopic Analysis Workshop



CUCEI



1.- GENERAL INFORMATION

Learning unit: Spectroscopic Analysis Workshop		Department: Chemistry		Course format Workshop
Prerequisites(P) Fundamentals of Spectroscopy	Corequisites (CO) None	Ascribed academy Academy of Analytical instrumentation	Module M3 Analysis and Characterization	
Type Open optional	Theory hours 0 hours	Practice hours 2 hours per week	Total hours 34 hrs.	Credits 2
Degrees in which this class is taught:				
B.S in Chemistry		B.S in Chemical Engineering	B.S. in Bio-Pharmaceutical Chemistry	

2.- GENERIC COMPETENCIES

Problem solving
-Synthesis and analysis.
- Team work.
-Computer skills
-Managing information
-Oral and written production
-Discerning and decision making

Specific competencies:

- Autonomous development of the acquired knowledge.
- Ability to apply acquired knowledge to specific and complex situations.
- Autonomy and teamwork
- Ability to solve problems that imply interpreting individual and combined spectroscopic signals.

3.- SPECIFIC CHARACTERISTICS OF THE COMPETENCY

Knowledge	Students
	• Understand the fundamentals of the main structural spectroscopic and non-spectroscopic techniques and their related signals. • Know some advanced structural techniques and understand them both in theory and in practice.



Skills	• Interpret structural spectroscopic and non-spectroscopic signals to clarify chemical structures of organic and inorganic compounds. • Relate these signals to get an accurate structural result. • Handle spectroscopic databases in order to make comparisons. • Handle software to edit and polish spectroscopic and structural signals.
Aptitudes	• Identify and solve problems through hypotheses and the application of the necessary principles analytically and synthetically. • Relate the knowledge of different areas and apply it in every day and professional situations. • Develop study habits and manage their own learning. • State solutions to specific theoretical and practical problems where the acquired knowledge is involved.
Values	• Develop and exercise values such as responsibility, honesty, tolerance, respect, solidarity, willingness and positive attitude towards individual and group work.

4.- TRANSVERSAL COMPETENCIES

☒	Foreign Language (English)
☒	Critical, analytical and synthetic thinking. a
☒	Oral and written expression
☒	Professional ethics
☐	Administration of human and material resources
☐	Leadership and sustainability
☒	Creativity, innovation and entrepreneurship
☐	Other

5.- COURSE CONTENT OF THE LEARNING UNIT

Unit 1: Foundations

1.1. Review of the basic spectroscopic techniques.

1.1.1. UV-Vis.

1.1.2. IR and Raman spectroscopies.

1.1.3. ¹H-NMR and ¹³C-NMR spectroscopies

1.2. Review of the structural non- spectroscopic techniques

1.2.1. Mass spectrometry (MS).

1.2.2. X- Ray diffraction (XRD).

1.3. Additional structural techniques.



- 1.3.1. Heteronuclear magnetic resonance. (X-NMR).
1.3.2. Bidimensional nuclear magnetic resonance. (2D-NMR).
1.3.3. Other advanced structural techniques.

Unit 2: Integration of structural techniques.

6.- ASSESSMENT

☒ Numeric grade



7.- GRADING CRITERIA OF THE LEARNING UNIT

Indicator of evaluation	Percentage
Departmental exams	20
Partial exam	40
Homework	10
Research activities	15
Practice reports	0
Class participation	0
Research seminar	15

8.- REQUIRED MATERIAL (for students)

☒ Calculator

☒ Periodic table

☐ Lab coat

☐ Text book

☐ Workbook

☐ Tables of spectroscopic data, laptop or tablet.



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9.-SPECIFIC CONTENT BY LEARNING UNITS

Content unit	Generic competency of the content unit	Topics	Class hours	Professor activities	Student activities	Bibliography
Unit 1 Foundations	Students... -Understand the fundamentals of the main structural spectroscopic and non-spectroscopic techniques and their related signals.	1.1. Review of the basic spectroscopic techniques. 1.1.1. UV-Vis. 1.1.2. IR and Raman spectroscopies. 1.1.3. ¹ H-NMR and ¹³ C-NMR spectroscopies	14 h	Professor... ...lectures. ...evaluates the homework exercises and provides feedback.	Students... -do homework and solves exercises about the topics of this unit. -learn autonomously and study constantly.	Donald L. Pavia, Gary M. Lampman, George S. Kriz, James R. Vyvyan 2015. <i>Introduction to Spectroscopy</i> . Fifth Edition. Cengage Learning. USA.
	Know some advanced structural techniques and understand them both in theory and in practice. . -Know some advanced structural	1.2. Review of the structural non-spectroscopic techniques 1.2.1. Mass spectrometry (MS). 1.2.2. X- Ray diffraction (XRD).	6 h	...designs didactic activities to review and verify the acquisition of the concepts of the unit. ... evaluates continuously.	- play an essential role by finding answering the questions of the professor.	L.D.S. Yadav. 2005 <i>Organic Spectroscopy</i> . First Edition. Springer- Science + Business Media Dordrecht, Manfred Hesse, Herbert Meier, Bernd Zeeh, 2005. <i>Métodos Espectroscópicos en</i>



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	techniques and understand them both in theory and in practice. -Interpret structural spectroscopic and non-spectroscopic signals to clarify chemical structures of organic and inorganic compounds.	1.3. Additional structural techniques. 1.3.1. Heteronuclear magnetic resonance. (X-NMR). 1.3.2. Bidimensional nuclear magnetic resonance. (2D-NMR). 1.3.3. Other advanced structural techniques. .	6 h	...motivates.		<i>Química Orgánica.</i> Second Edition. Síntesis. Spain. Ralph L. Shriner, Christine K.F. Hermann, Terence C. Morrill, David Y. Curtin, Reynold C. Fuson. (2013). <i>Identificación Sistemática de Compuestos Orgánicos.</i> Second edition. Limusa Wiley. Mexico.
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Unit 2 Integration of Structural techniques.	-Relate these signals to get an accurate structural result. -Handle spectroscopic databases in order to make comparisons. -Handle software to edit and polish spectroscopic and structural signals.	Problem solving with specific data and spectroscopic and structural signals combined.	8 hours	Professor... ...lectures. ...evaluates the homework exercises and provides feedback. ...designs didactic activities to review and verify the acquisition of the concepts of the unit. ... evaluates continuously. ...motivates.	Students... -do homework and solves exercises about the topics of this unit. -learn autonomously and study constantly. - play an essential role by finding answering the questions of the professor.	Donald L. Pavia, Gary M. Lampman, George S. Kriz, James R. Vyvyan 2015. <i>Introduction to Spectroscopy</i> . Fifth Edition. Cengage Learning. USA,. L.D.S. Yadav. 2005 <i>Organic Spectroscopy</i> . First Edition. Springer Science + Business Media Dordrecht, Manfred Hesse, Herbert Meier, Bernd Zeeh, 2005. <i>Métodos Espectroscópicos en Química Orgánica</i> . Second Edition. Síntesis. Spain. B.D. Mistry. (2009) A <i>Handbook of Spectroscopic Data. Chemistry</i> (UV, IR, PMR, ¹³ CNMR and Mass Spectroscopy)". First
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edition. Oxford Book
Company. India.



10.-PROFESSOR'S PROFILE

Bachelor, Master or Doctorate degree in Chemistry.
Specific knowledge in spectroscopy and structural techniques of analysis and characterization.
Teaching experience in instrumental analytical chemistry and spectroscopy.

11.-AUTHOR OF THE LEARNING UNIT

Fernando Vega Pineda

12.-MODIFICATION AND UPDATE

February, 2017