Universidad Juárez del Estado de Durango

Facultad de Ciencias Forestales

Learning Unit Programme

With an integral professional competences approach

I. LEARNING UNIT GENERAL DATA

1. learning Unit Name				**2. Code**	
Instrumental Analysis				**4333**	
3. Academic Unit					
FORESTRY SCIENCES FACULTY					
4. Academic programme				**5. Level**	
Environmental Management Engineering				**Higher**	
6. Training Area					
Discipline					
7. Academy					
Biological Sciences Chemistry Academy					
8. Modality					
Mandatory	**X**	**Course**	**X**	**Attendance**	**X**
Elective		**Course-workshop**		**Non-attendance**	
		Workshop		**Mixed**	
		Seminar			
		Laboratory, field practice, etc.	**X**		
		Professional Practice			
		Academic Stay			
9. Pre-requirements					
Have pass: Take and pass: Chemistry, Physics, Research Methodology, Biochemistry, Biotechnology and Physic-chemistry.					

10. Theory hours	Practice hours	Independent study hours	Total hours	Credits
3	2	0	5	5

11. Names of the teachers who participated in the development and/or modification of the programme
D.C. Georgina Ixtaccihuatl Ojeda Mijares

12. Date of development	Date of modification	Date of approval
23/02/2015		20/12/2016

II.LEARNING UNIT SPECIFIC DATA	
13. Presentation	
The Instrumental Analysis Learning Unit reveals to the student the existence of diverse analytical methods, their classification, foundation, advantages, disadvantages and specific characteristics, which allows them to use the analytical capability of instrumental methods to suggest or choose the appropriate instrumental method for a problem analytic in particular. The Instrumental Analysis also provides the possibility of evaluating the property or quantity of the chemical system to be measured, the physicochemical principles on which the measurement is based, the generation of a suitable signal for the type of transducer and its processing to convert it into a form adequate reading on the computer; besides knowing the potentialities and weaknesses of each method. When taking this Learning Unit the student acquires the skills to use the physicochemical principles during the measurement, the use of equipment or apparatus to optimize the techniques and achieve accuracy, accuracy considering the sensitivity of the method. In the Environmental Management Engineering Study Plan, the Instrumental Analysis Learning Unit is support of other Learning Units such as Water Pollution, Water Quality and Treatment, Air Pollution, Pollution Process Management, Solid Waste Management, Pollution of Soil, and Toxic Waste Management. It is also related to Learning Units such as Mathematics, Physics, Chemistry, Physic-chemistry, among others.	
14. Integral professional competences to develop in the student	
Generic competences	Instrumental Analysis and synthesis capability Problem solving Personal decision making Personal Teamwork Ethical and quality commitment Systemic

	Motivation for quality Ability to apply theoretical knowledge in practice
Professional competences	Disciplinary Ability to integrate experimental evidences with theoretical knowledge. Capability for qualitative interpretation of data Capability for quantitative interpretation of data Professionals Preparation, management, monitoring and control of environmental projects Planning and management of waste disposal and control
General purpose of the course	The student develops skills to use Instrumental Analysis methods that are carried out fundamentally through the use of laboratory instruments and interpret the data and / or reports generated by the application of these methods
15. Joint of axes	
16. Development of the course	

Module 1	Electromagnetic spectrum			
Intended learning	Learning contents	Learning product(s)	Strategies	Teaching resources and materials
Describe the EEM, its different regions and characteristics, the importance of the visible region, define the basic concepts related to	The EEM and its characteristics	Performs the search and printing of different representations of the EEM with its regions, often wavelength and energy.	Documentary research: - encourage activities of search, selection and analysis of information in different sources - presentation of the corresponding topic	-common classroom materials -FSF library -Central University Library -e-literature -Computer equipment
	Basic concepts related to electromagnetic waves	Make a document defining concepts such as Frequency, Wavelength, Energy, Crest, Valley, Node, Wave, Plane of Propagation, etc.		

electromagnetic waves and list and explain the different Theories on the Nature of Light	Theories about the Nature of Light, its creator and its main characteristics	Make a conceptual map with the Theories about the Nature of light and its main characteristics	- in the plenary discusses the different representations of the EEM. - written exam	
	Regions of the EEM and their characteristics	Make a chart with the characteristics of the Visible region and its importance.		
		Make a Team presentation in PP of the region that is designated and exposes it to the group.		
Module 2	**Optical methods**			
Intended learning	**Learning contents**	**Learning product(s)**	**Strategies**	**Teaching resources and materials**
Identify the Optical Methods used in the Instrumental Analysis and distinguish their characteristics to classify them, describe their characteristics and cases in which they can be used	Introduction and basic concepts	Make a conceptual map with the classification of the Optical Methods indicating the characteristics on which its classification is based	Collaborative work and documentary research: - promote search activities, selection and analysis of information in different sources - debate on spectroscopic and non-spectroscopic methods - written examination	-common classroom materials -FSF library -Central University Library -e-literature -Computer equipment
	Spectroscopic methods			
	Non-spectroscopic method			
	Identify the different Spectroscopic Methods	Make a comparative table between techniques based on radiation absorption and techniques based on radiation emission		
	Identify the different non-spectroscopic	Prepare a summary of the Techniques based on the dispersion of radiation (turbidimetry and nephelometry)		

	methods	**Make a comparative table of Techniques based on the refraction of radiation (refraction and interferometry)**		
		Make a synoptic chart of techniques based on X-ray diffraction		
		Create a conceptual map of the Techniques based on optical rotation (polarimetry and circular dichroism)		
Module 3	**Chromatographic and Electroanalytical Methods**			
Intended learning	**Learning contents**	**Learning product(s)**	**Strategies**	**Teaching resources and materials**
Identify the Chromatographic Methods and the Electroanalytical Methods used in the Instrumental Analysis and distinguish their characteristics to classify them, describe their characteristics and cases in which they can be used	**Introduction, physicochemical aspects and classification of Chromatographic Methods**	**Prepare a conceptual map of the Chromatographic Methods and their characteristics**	**Collaborative work and documentary research:** **- promote activities of search, selection and analysis of information in different sources** **- written examination**	**-Common materials of the Classroom** **-Library of the FSF** **-Central University Library** **-e-literature** **-Computer equipment** **-Internet** **-Web pages**
	Introduction, foundation, types of electrodes, characteristics and instrumentation of the Potentiometric Methods	**Make a mental map with the foundation, the different types of electrodes and the instrumentation of the Potentiometric Methods**		

	Introduction, foundation, systems and instrumentation of the Conductimetric Methods	**Make a synoptic table with the main aspects of the Conductimetric Methods**		

17. Performance assessment:

Performance evidence(s)	Performance criteria	Application scopes	percentage
chart with the characteristics of the Visible region and its importance	**rubric instrument determined for each product, with the indicators of - quality - sufficiency - congruence - coherence**	**- local - regional - nacional - internacional**	**7**
document defining concepts such as Frequency, Wavelength, Energy, Crest, Valley, Node, Wave, Plane of Propagation, etc.			**7**
conceptual map with the Theories about the Nature of light and its main characteristics			**8**
presentation by team in PP of the region that is designated and exposed to the group			**8**
conceptual map with the classification of the Optical Methods indicating the characteristics on which its classification is based	**rubric instrument determined for each product, with the indicators of - quality - sufficiency - congruence - coherence**	**- local - regional - nacional - -internacional**	**5**
Comparative table between techniques based on radiation absorption and techniques based on radiation emission			**5**
Summary of the Techniques based on the dispersion of radiation (turbidimetry and nephelometry			**5**
Comparative chart of Techniques based on the refraction of radiation (refraction and interferometry)			**5**
synoptic chart of techniques based on X-ray diffraction.			**5**

Concept map of Techniques based on optical rotation (polarimetry and circular dichroism			**5**
Conceptual map of Chromatographic Methods and their characteristics	**rubric instrument determined for each product, with the indicators of - quality - sufficiency - congruence - coherence**	**- local - regional - nacional - -internacional**	**10**
mental map with the foundation, the different types of electrodes and the instrumentation of the Potentiometric Methods			**10**
Table with the main aspects of the Conductimetric Methods			**10**

18. Evaluation criteria:

Criterion	Value
Formative Evaluation	**10% values (respect, responsibility and honesty) 10% attitudes (participation, organization, perseverance and personal presentation) 5% skills (to listen, leadership, for written communication, to gather information) 30% evidence of performance (indicated in point 17 of this Program, for each of the three Modules)**
Summative evaluation	**20% written exam**
Criteria summation	**100%**

19. Accreditation

The Learning Unit is accredited, if the student presents all the evidences of performance, if the attendance to the course is greater than 80%, and if the sum of evaluation criteria is 60 or greater

20. Information sources

Basic	**- Skoog, D. A., Holler, J. H., Nieman, T. A. "Principios de Análisis Instrumental", 5a Edición. McGraw Hill. Madrid, España. 2001. - Rubinson, K. A., Rubinson, J. F. "Análisis Instrumental". Pearson Educación, S.A. Madrid, España, 2001. - Skoog.-HollerNieman, Análisis Instrumental, quinta edición, Mc Graw Hill, 2001.**

	- Christian, Gary D. “Analytical Chemistry”, 6th Edition. John Wiley and Sons. Hoboken, USA. 2003. - Meyers, Robert A. "Encyclopedia of Analytical Chemistry, Applications, Theory, and Instrumentation". John Wiley & Sons, Incorporated. Hoboken, USA. 2000. - Harris, D., Análisis Químico Cuantitativo. 6ª. Edición. Ed.l Reverte S.A. 2010. España.
Complementary	- Christy, A. A., Ozaki, Y., Gregoriou, V. G. “Modern Fourier Transform Infrared Spectroscopy”. Comprehensive Analytical Chemistry Ser., Vol. 35. Elsevier Science. New York, USA. 2001. - Handley, Alan J., Adlard, Edward, Eds. “Gas Chromatographic Techniques and Applications”. Sheffield Analytical Chemistry Ser., Vol. 5. Sheffield Academic Press, Ltd. Sheffield, GBR. 2001. - Cazes, Jack. “Encyclopedia of Chromatography”. Marcel Dekker Inc. New York, USA. 2001.

21. Profile for the teacher who imparts this learning unit

-Have a bachelor's degree in Forest Sciences, Environmental Management, Chemistry, Ecology, Biology, or related area.
- Preferably with a Master's or Doctorate degree.
- Professional university experience as a teacher in front of a group.
- Availability to work in a team
- Availability to work in the competence-based model