



**Universidad Juárez del Estado de Durango**  
**Facultad de Ciencias Forestales**



*Learning Unit Programme*  
*With an integral professional competences approach*

**I. LEARNING UNIT GENERAL DATA**

<b>1. learning Unit Name</b>		<b>2. Code</b>			
Air pollution		8496			
<b>3. Academic Unit</b>					
FORESTRY SCIENCES FACULTY					
<b>4. Academic programme</b>		<b>5. Level</b>			
Environmental Management Engineering		Higher			
<b>6. Training Area</b>					
Disciplinary					
<b>7. Academy</b>					
Environmental engineer					
<b>8. Modality</b>					
Mandatory	x	Course	x	Attendance	x
Elective		Course-workshop		Non-attendance	
		Workshop		Mixed	
		Seminar			
		Laboratory, field practice, etc.	x		
		Professional Practice			
		Academic Stay			
<b>9. Pre-requirements</b>					
Have studied and approved the following Learning Units: Mathematics, Chemistry, Physics, Statistical Methods, Thermodynamics, Statistical					

Sampling and Environmental Legislation, and critical and creative thinking skills, reading and writing.				
<b>10. Theory hours</b>	<b>Practice hours</b>	<b>Independent study hours</b>	<b>Total hours</b>	<b>Credits</b>
4	1	0	5	5
<b>11. Names of the teachers who participated in the development and/or modification of the programme</b>				
Dr. Luis Armando e la Peña Arellano/M.C. Sandra Viviana Jáquez Matas.				
<b>12. Date of development</b>	<b>Date of modification</b>		<b>Date of approval</b>	
09/08/2013	07/07/2017		Waiting approval	

<b>II. LEARNING UNIT SPECIFIC DATA</b>
<b>13. Presentation</b>
<p>The Air Pollution Learning Unit (UA) is of an integrating nature with most of the previous knowledge acquired by the student in the basic UAs and some disciplines, being also the predecessor of the terminal area. It is important to point out that in this UA the theoretical-practical bases are established for the development of technologies, their adaptation or innovation, referring to the control, prevention and treatment of air pollutants and air quality.</p> <p>In each module of this UA it is sought that the student of Environmental Management Engineering acquires the integral professional competences that allow him to identify the main atmospheric pollutants to establish the main techniques of monitoring and analysis, as well as to know the main characteristics of the atmosphere as means of transport and dispersion of atmospheric pollutants to implement control technologies and reduction of emissions generated by fixed sources. In addition, an integrating and application activity is established in the last module of this UA with the aim of developing in the students the labour competencies necessary for their professionalization.</p> <p>The aim is to start from concrete, everyday experiences, so that the student becomes accustomed to recognizing the physical, chemical and climatic phenomena around them and not only talk about them in the classroom. It is important to offer different scenarios, whether built, artificial, virtual or natural.</p> <p>In the course of the programmed activities, it is very important that the student learn to value the activities he / she carries out and understand that he / she is building his / her future work and consequently act in a professional manner; likewise, appreciate the importance of knowledge and work habits; develop precision and curiosity, punctuality, enthusiasm and interest, tenacity, flexibility and autonomy.</p>

14. Integral professional competences to develop in the student	
Generic competences	<p>Instrumental:</p> <ul style="list-style-type: none"> <li>• Analysis and synthesis.</li> <li>• Oral and written communication skills.</li> <li>• Knowledge of a foreign language.</li> <li>• Ability to manage information.</li> <li>• Personal</li> <li>• Capability for teamwork.</li> <li>• Ethical and quality commitment.</li> </ul> <p>Systemic:</p> <ul style="list-style-type: none"> <li>• Motivation for quality.</li> <li>• Ability to apply theoretical knowledge in practice.</li> <li>• Ability to communicate with people who are not experts in the subject.</li> </ul>
Professional competences	<ul style="list-style-type: none"> <li>• Ability to address environmental problems in a multidisciplinary manner.</li> <li>• Environmental management systems.</li> <li>• Development, management, monitoring and control of environmental projects.</li> <li>• Air quality and purification of atmospheric emissions.</li> <li>• Manage and implement quality programs and projects.</li> </ul>
General purpose of the course	The student is able to understand, analyse and apply the fundamental concepts about atmospheric pollutants and their relationship with meteorology, monitoring techniques, the application of software to the dispersion of atmospheric pollutants and the main processes and control equipment existing for the treatment of gaseous effluents.
15. Joint of axes	
The learning unit articulates the environment, social responsibility and research so that students develop viable projects within a sustainable framework.	
16. development of the course	
Module 1	Introduction to atmospheric pollution.

Intended learning	Learning contents	Learning product(s)	Strategies	Teaching resources and materials
<b>Know, understand and apply the foundations and characteristics of the atmosphere, its structure and composition, as well as the basic principles of meteorology, the main sources of emission of atmospheric pollutants; all in relation to the current regulations regarding air quality. Know the types and categorization of sources of air pollution.</b>	1.1 Basic concepts.	<ul style="list-style-type: none"> <li>• PowerPoint presentation and video.</li> <li>• Search in different information sources the components and characteristics of the atmosphere and its layers. Supporting your search with videos or documentaries about the components of the atmosphere.</li> <li>• Make a catalogue of terms and concepts with real examples referring to meteorological parameters.</li> <li>• Review exercises in class.</li> <li>• Build, from real data from meteorological databases of the state or your institution, a rose of the winds.</li> </ul>	<ul style="list-style-type: none"> <li>• Learning based on reading and analysis about the origin and concepts of air pollution and its main branches.</li> <li>• Teacher presentation.</li> <li>• Knowledge studies with questions in notebook.</li> <li>• Use of specialized software.</li> </ul>	<ul style="list-style-type: none"> <li>• Computer equipment.</li> <li>• Video projector.</li> <li>• Multimedia presentations.</li> <li>• Material of the proposed Bibliography.</li> </ul>
	1.2 The atmosphere: Composition and types of pollutants.			
	1.3 Air pollution: Causes and effects.			
	1.4 Sources of contamination.			
	1.5 Meteorology of air pollution.			

Module 2	Monitoring and measurement of atmospheric pollutants.			
Intended learning	Learning contents	Learning product(s)	Strategies	Teaching resources and materials
Know the concept of monitoring and understand the objective of this. Acquire and apply knowledge of the techniques and / or methods to learn to perform monitoring of the different types of emission sources; according to the current regulations. Know the criteria to establish a monitoring network.	2.1 Concepts of Air Quality.	<ul style="list-style-type: none"><li>• Presentation of IMECA.</li><li>• Conduct a study of monitoring networks in Mexico and in the city. And from your location.</li><li>• Carry out a group exhibition of measurement and analysis techniques.</li><li>• Carry out practice of measurement and behavior of pollutants criteria in the city.</li><li>• Problem resolution.</li></ul>	<ul style="list-style-type: none"><li>• Learning based on presentation by the student.</li><li>• Problem solving in a group and individual way.</li><li>• Teacher presentation.</li><li>• Internship.</li><li>• Visit to air quality monitoring booth.</li><li>• Use of specialized software.</li></ul>	<ul style="list-style-type: none"><li>• Computer equipment.</li><li>• Video projector.</li><li>• Multimedia presentations.</li><li>• Material of the proposed Bibliography.</li></ul>
	2.2 Monitoring of air quality.			
	2.3 Measurement of atmospheric pollutants.			
	2.4 Analysis of pollutants.			
	2.5 Analysis and interpretation of air quality data with Software.			
Module 3	Transport and dispersion of atmospheric pollutants.			
Intended learning	Learning contents	Learning product(s)	Strategies	Teaching resources and materials
Understand, analyse the theoretical foundations and mathematically calculate how air	3.1 Basic concepts	<ul style="list-style-type: none"><li>• Make a conceptual or mental map about parameters involved in the dispersion of cont.</li></ul>	<ul style="list-style-type: none"><li>• Learning based on presentation by the student.</li><li>• Roundtable discussion.</li></ul>	<ul style="list-style-type: none"><li>• Computer equipment.</li><li>• Video projector.</li></ul>

<p><b>pollutants are transported and dispersed.</b>  <b>Manage software for the simulation of the dispersion of pollutants from fixed sources. Know the characteristics of the plum and apply calculation bases to size the chimneys (fixed sources).</b>  <b>Perform pollutant related calculations.</b></p>		<ul style="list-style-type: none"> <li>• Problem resolution.</li> <li>• Problem solving with specialized software.</li> <li>• Written evaluation.</li> </ul>	<ul style="list-style-type: none"> <li>• Problem solving in a group and individual way.</li> <li>• Teacher presentation.</li> <li>• Internship.</li> <li>• Field trip.</li> <li>• Use of specialized software.</li> <li>• Knowledge evaluation.</li> </ul>	<ul style="list-style-type: none"> <li>• Multimedia presentations.</li> <li>• Material of the proposed Bibliography.</li> </ul>
<b>Module 4</b>	Case study.			
<b>Intended learning</b>	<b>Learning contents</b>	<b>Learning product(s)</b>	<b>Strategies</b>	<b>Teaching resources and materials</b>
<p><b>Apply the knowledge acquired in the development of the case study; characteristics of the pollutants, causes and effects, sources</b></p>	4.1 Statement of the problem.	<p>Learning product Form work teams to analyse an environmental problem in terms of air quality in your locality or region and propose alternative solutions:  Describe the atmospheric the pollutant.  Describe their main sources of emission.  Describe the main effects of the pollutant</p>	<ul style="list-style-type: none"> <li>• Learning based on presentation by the student.</li> <li>• Roundtable discussion.</li> <li>• Problem solving in a</li> </ul>	<ul style="list-style-type: none"> <li>• Computer equipment.</li> <li>• Video projector.</li> <li>• Multimedia presentations.</li> </ul>

<b>of emission, methods of monitoring and analysis, means of transport and diffusion and main methods of control.</b>	4.2 development of the case.	on the environment. Review the regulations applicable to the pollutant. Describe the measurement methods and contaminant analysis techniques conditions without and with pollution.	group and individual way. • Teacher presentation. • Internship.	• Material of the proposed Bibliography.
	4.3 Obtaining results and Conclusions.			
	4.4 Presentation of the project.			

#### 17. Performance assessment:

Performance evidence(s)	Performance criteria	Application scopes	percentage
<ul style="list-style-type: none"> <li>Investigation.</li> <li>Essays.</li> <li>Conceptual maps.</li> <li>Exercises in class.</li> <li>Problem resolution.</li> <li>Project reports.</li> <li>Power Point presentations.</li> <li>Concept report.</li> <li>Laboratory practices report</li> <li>Evaluation</li> </ul>	<ul style="list-style-type: none"> <li><b>Quality (Presentation):</b> Objective of the work, numbering of the page, individual conclusion, bibliography.</li> <li><b>Congruence (content sequence).</b></li> <li><b>Relevance (information regarding the requested topics).</b></li> </ul>	<ul style="list-style-type: none"> <li><b>Social, business sector,</b></li> <li><b>Governmental: local, regional, national and international.</b></li> </ul>	<p><b>Module 1:</b> <b>Summative evaluation:</b></p> <p><b>Diagnostic test (10%).</b> <b>Tasks and exercises (35%);</b> <b>(Task 1, presentation and video 5%, Exercise in class, layers of the atmosphere, questions 10%, Task 2, Catalogue 20%).</b> <b>Project evaluation wind rose (35%)</b> <b>Evidence Portfolio (10%)</b></p> <p><b>Formative evaluation:</b></p>

<p>instrument,</p> <ul style="list-style-type: none"> <li>• presentations, self-assessment</li> <li>• and peer evaluation.</li> </ul>			<p><b>Participation (5%) Aptitudes and values (5%)</b>  <b>Total: 100%</b></p> <p><b>Module 2:</b>  <b>Summative evaluation:</b></p> <p><b>Presentation and research Sinaica (5%)</b>  <b>IMECA (presentation and exercise) 10%</b>  <b>Presentation and research Pollutants Criterion (15%) Graphs Contaminants Criterion (30%)</b>  <b>Problem Ozone (10%)</b>  <b>Portfolio of Evidence (15%)</b></p> <p><b>Formative evaluation:</b>  <b>Participation (10%) Aptitudes and values (5%)</b>  <b>Total: 100%</b></p> <p><b>Module 3:</b>  <b>Summative evaluation:</b></p> <p><b>Bhopal problem (30%)</b>  <b>Problem Gaussian Model (40%)</b>  <b>Portfolio of Evidence (15%)</b></p>
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			<p><b>Formative evaluation:</b>  <b>Participation (10%) Aptitudes and values (5%)</b></p> <p><b>Total: 100%</b></p> <p><b>Module 4:</b>  <b>Summative evaluation:</b></p> <p><b>Case study (70%)</b>  <b>Portfolio of Evidence (15%)</b></p> <p><b>Formative evaluation:</b>  <b>Participation (10%) Aptitudes and values (5%)</b>  <b>Total: 100%</b></p> <p><b>In the final evaluation of the semester is included in the final grade:</b>  <b>Summary for Selfassessment (10%)</b>  <b>Issuance of value judgments in Co-evaluation (5%) Issuance of value judgments in Heteroevaluation (5%).</b></p>
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<b>18. Evaluation criteria:</b>	
<b>Criterion</b>	<b>Value</b>
<b>Formative Evaluation</b>	15% participation, skills and values. 10% Self-evaluation, 5 % Hetero evaluation, 5 % Coe evaluation.
<b>Summative evaluation</b>	65% the products and activities requested during the course, indicated above.
<b>Criteria summation</b>	100%
<b>19. accreditation</b>	
The accreditation of the learning unit is aligned with the provisions of the regulations of the Forestry Sciences Faculty. It is necessary to approve with a minimum of 6.0. The student who has obtained a minimum final average of 8.5 (eight point five) and 80% attendance, will be exempt from presenting ordinary exam, can present if he wishes, in order to improve their qualification.	
<b>20. Information sources</b>	
<b>Basic</b>	<ol style="list-style-type: none"> <li>1. Albert, L. A... Basic course in toxicology, Mexico D.F: Pan American Centre for Human Ecology and Health. PAHO, WHO, Noriega Editors. 1988.</li> <li>2. De Never, N. Engineering of air pollution control. Mexico: Mc Graw-Hill-Interamericana 1998.</li> <li>3. Elson, D. Air pollution, Madrid Spain: Chair. 1990.</li> <li>4. Henry, J. G, and Heinke, G. W. () Environmental Engineering, Mexico, D. F: Prentice Hall .. 1999.</li> <li>5. General Law of Ecological Equilibrium and Environmental Protection. Delma 1999.</li> <li>6. Mugica, A. V and Figueroa L. J. Environmental Pollution Causes and effects. Mexico, D. F: Autonomous Metropolitan University. Nineteen ninety six.</li> <li>7. Official Mexican Standards (NOM's).</li> <li>8. Seoanez, C. M. Treaty of climatology applied to environmental engineering. Barcelona, Spain: Mundi press. 1998.</li> <li>9. Wadenn, R. A and Scheff, P. A. Indoor air pollution. Mexico, D. F: Limusa. 1987.</li> <li>10. Wark, K and Warner C. F. Air pollution. Mexico, D.F: Limusa. 2001.</li> <li>11. De Neves, Noel. Air Polution Control Engineering. McGraw-Hill 1995.</li> </ol>

Complementary	<ol style="list-style-type: none"> <li>1. Jeremy Colls. Air Pollution. Second edition. Ed. Spon press. ISBN 0-203-47602-6 Master e-book. 2002.</li> <li>2. Nicholas P. Cheremisinoff. Handbook of Air Pollution Prevention and Control. Butterworth-Heinemann is an imprint of Elsevier Science. ISBN 0-7506-7499-7. 2002.</li> <li>3. Kenneth C. Schiffner. Air Pollution Control Equipment Selection Guide. Lewis Publishers, ISBN 1-58716-069-2. 2002.</li> <li>4. Karl B. Schnelle Jr., Charles A. Brown, P.E. Air Pollution Control Technology Handbook. CRC Press. ISBN 0-8493-9588-7. 2002.</li> <li>5. Martha J. Boss and Dennis W. Day. Air Sampling Industrial Hygiene Engineering. Lewis Publishers. ISBN 1-56670-417-0. (2001).</li> </ol>
21. Profile for the teacher who imparts this learning unit	
<ul style="list-style-type: none"> <li>• University Degree with Master's or Doctorate in Environmental Engineering or related area.</li> <li>• Professional experience in air quality studies.</li> <li>• Teaching experience with the management of the chair with large groups of students.</li> <li>• Have systematically evaluated student performance and developed teaching strategies to promote a more active learning environment.</li> <li>• Have provided tutorials to students in aspects related to the subject area for the achievement of an effective educational updating.</li> <li>• Proactivity. Flexibility in working hours. Responsibility. Organization. Excellent interpersonal and communication relationships.</li> </ul> <p>Demonstrated ability to work in a team. Ability to work under pressure. Oriented to results. Management of computer packages.</p>	