



**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>                   |                          |                |   |
| Environmental Systems                |   | 8504                             |                          |                |   |
| <b>3. Academic Unit</b>              |   |                                  |                          |                |   |
| FORESTRY SCIENCES FACULTY            |   |                                  |                          |                |   |
| <b>4. Academic programme</b>         |   |                                  | <b>5. Level</b>          |                |   |
| Environmental Management Engineering |   |                                  | Higher Bachelor's degree |                |   |
| <b>6. Training Area</b>              |   |                                  |                          |                |   |
| Discipline                           |   |                                  |                          |                |   |
| <b>7. Academy</b>                    |   |                                  |                          |                |   |
| Environmental management             |   |                                  |                          |                |   |
| <b>8. Modality</b>                   |   |                                  |                          |                |   |
| Mandatory                            | X | Course                           | X                        | Attendance     | X |
| Elective                             |   | Course-workshop                  |                          | Non-attendance |   |
|                                      |   | Workshop                         |                          | Mixed          |   |
|                                      |   | Seminar                          |                          |                |   |
|                                      |   | Laboratory, field practice, etc. |                          |                |   |
|                                      |   | Professional Practice            |                          |                |   |
|                                      |   | Academic Stay                    |                          |                |   |
| <b>9. Pre-requirements</b>           |   |                                  |                          |                |   |

| Be registered  |                      |                         |                  |         |
|--|----------------------|-------------------------|------------------|---------|
| 10. Theory hours   | Practice hours       | Independent study hours | Total hours      | Credits |
| 4  | 4                    | 0                       | 6                | 6       |
| 11. Names of the teachers who participated in the development and/or modification of the programme |                      |                         |                  |         |
| Juan Carlos Herrera Cárdenas   |                      |                         |                  |         |
| 12. Date of development  | Date of modification |                         | Date of approval |         |
| 09/02/2016   | 09/02/2017           |                         | 0/03/20017       |         |

| II. LEARNING UNIT SPECIFIC DATA  |
|--|
| 13. Presentation   |
| <p><b>Characterization of the Learning Unit</b></p> <p>The Environmental Systems Learning Unit is transdisciplinary and has been designed to combine the technique and knowledge of Environmental Sciences. The fundamental purpose of this course is to provide students with a coherent perspective on the interrelationships between Environmental Systems, Societies and Sustainability, allowing them to adopt an informed position on the wide range of pressing environmental problems they will face. Students will constantly reflect on environmental problems, developing a well-grounded understanding of the interrelationships between Environmental Systems, rather than a simplistic assessment will be provided with tools to assess the scientific, ethical and socio-political aspects of the various environmental issues .Considering that environmental issues have a local and global scope since we live on planet earth, but we use more resources than it can support acting in an unsustainable way ,for which it is necessary to study the use and management of these resources at different scales This course will have a systemic approach since the very nature of environmental issues demands a holistic treatment ,since in reality an Environmental System works as a whole, on the other hand the traditional reductionist approach of science inevitably tends to ignore, or at least to underestimate this important characteristic. The systemic approach is of vital importance to deal with environmental problems and also in other disciplines such as economics ,geography ,politics and ecology. The concept of sustainability is isotakenupto understand the nature of the interactions between environmental systems and societies, since environmental problems are essentially based on sustainability (economic, social and environmental). It is important to consider that students develop a holistic appreciation of the complexity of environmental issues and their problems, in which the interaction between Environmental Systems, Societies and sustainability is essential.</p> <p><b>Didactic intention.</b></p> <p>The learning unit is organized in 6 modules, grouping the conceptual contents in each of them.</p> <p>The first module allows the student to study and understand The Universe, life, science and Our temporal space coordinates</p> |

The second module provides knowledge about the earth system and its subsystems considering the four environmental principles .

The third module refers to the different approaches to the study of the environmental d the relationship with other disciplines (interdisciplinary, multidisciplinary and transdisciplinary).

The fourth module provides the student with an overview of the Systems Dynamics considering the different types and elements of them based on the General Systems Theory.

The fifth module deals with the Simulation Models Applied to Environmental Systems (blackbox and whitebox models).

The sixth Module the student will develop a project the at consists in the development of a model to solve an environmental problem. The competency-based approach suggests different learning strategies that promote the development of skills for experimentation, such as: researching the literature,

#### 14. Integral professional competences to develop in the student

|                                 |  |
|---------------------------------|--|
| <b>Generic competences</b>      | <p><b>Instrumental</b></p> <ul style="list-style-type: none"> <li>1 Analysis and synthesis capability</li> <li>2 Capability for oral and written communication</li> <li>4 Information management capability</li> <li>5 Troubleshooting</li> <li>6 Decision making</li> </ul> <p><b>Personal</b></p> <ul style="list-style-type: none"> <li>7 Team work</li> <li>8 Ethical and quality commitment</li> </ul> <p><b>Systemic</b></p> <ul style="list-style-type: none"> <li>9.- Motivation for quality</li> <li>10.- Ability to apply theoretical knowledge in practice</li> </ul> |
| <b>Professional competences</b> | <p>Environmental Quality Management Systems and Audits.- The Professional manages, audits and exercises functions that increase the quality of environmental services, adhering to the technical, ethical and scientific knowledge of the Profession.</p> <p><b>Disciplinary (know)</b></p> <ul style="list-style-type: none"> <li>1.- Basic general knowledge of environmental engineering</li> <li>2.- Ability to approach environmental problems in a multidisciplinary way</li> </ul>  |

|  |   |                            |                   |   |
|--|---|----------------------------|-------------------|---|
|  | 3.- Qualitative data interpretation capability<br>4.- Environmental management systems<br>5.- Quality management systems<br><b>Professionals (know how)</b><br>1.- Design and application of sustainability indicators<br>2.- Design and application of sustainability indicators<br>3.- Preparation, management, monitoring and control of environmental projects  |                            |                   |   |
| <b>General purpose of the course</b>   | <b>General :</b><br>Design environmental systems management projects for the solution of socio-environmental problems, based on the dynamics of systems and environmental simulation models. <ul style="list-style-type: none"><li>Analyse the concept of the universe and its origin, science, the earth and our temporal space coordinates.</li><li>Distinguish the different subsystems of the earth and the four environmental principles</li><li>Proposes methodologies for the solution of environmental problems, based on the different approaches of the study of the environment and environmental sciences.</li><li>Analyses the general theory of systems for the solution of socio-environmental and sustainability problems.</li><li>Organize the different components of a systems modelling.</li><li>Develops a project of environmental systems.</li></ul> |                            |                   |   |
| <b>15. Joint of axes</b>   |   |                            |                   |   |
| The learning unit articulates social responsibility and commitment to the preservation of the environment; with the environmental quality management systems and audits, as well as with the consultancy and evaluation of the environmental impact. In order to grant the student the competences for the analysis and evaluation of environmental systems. |   |                            |                   |   |
| <b>16. development of the course</b>   |   |                            |                   |   |
| <b>Module 1</b>  | The Human Being and the Environment   |                            |                   |   |
| <b>Intended learning</b>   | <b>Learning contents</b>  | <b>Learning product(s)</b> | <b>Strategies</b> | <b>Teaching resources and materials</b> |

|   |  |   |  |   |
|---|--|---|--|---|
| Analyse the concept of the universe and its origin, science, the earth and our temporal space coordinates | <ul style="list-style-type: none"> <li>• The Universe, science and our temporal space coordinates.</li> <li>• Temporal and spatial structure of the land.</li> <li>• Life: characterization and origins</li> </ul>                   | <ul style="list-style-type: none"> <li>• Preparation of an essay on the HOME Documentary</li> <li>• Presentation of the different theories about the origin of life.</li> </ul> | <p>Discussion Forum 1.<br/>What is the Universe?<br/>Origin and evolution</p> <p>Discussion Forum 2<br/>What is life?<br/>Resolution of tasks.<br/>Collaborative learning</p>              | <ul style="list-style-type: none"> <li>• Anthology</li> <li>• Class presentations</li> <li>• Video projection</li> <li>• Articles</li> <li>• Virtual classroom</li> </ul> |
| <b>Module 2</b>   | The Environment as a System  |   |  |   |
| <b>Intended learning</b>  | <b>Learning contents</b>   | <b>Learning product(s)</b>  | <b>Strategies</b>  | <b>Teaching resources and materials</b>   |
| Understanding environment as a System   | <ul style="list-style-type: none"> <li>• Earth as a system.</li> <li>• The subsystems of the earth</li> <li>• The GAIA hypothesis</li> <li>• Think globally and act locally.</li> <li>• The four Environmental Principles</li> </ul> | <p>Conceptual map about the earth system and its subsystems.</p> <ul style="list-style-type: none"> <li>• Development of a questionnaire</li> </ul>                             | <p>Discussion Forum 3.<br/>What is the earth system?</p> <p>Discussion Forum 4<br/>What does it mean to think locally and act globally?<br/>Learning based on the resolution of tasks.</p> | <p>Anthology</p> <ul style="list-style-type: none"> <li>• Class presentations</li> <li>• Video projection</li> <li>• Articles</li> <li>• Virtual classroom</li> </ul>     |
| <b>Module 3</b>   | Interdisciplinary Approach of Environmental Sciences.  |   |  |   |

| Intended learning   | Learning contents  | Learning product(s)  | Strategies   | Teaching resources and materials  |
|---|--|--|--|---|
| It proposes methodologies for the solution of environmental problems, based on the different approaches of the study of the environment and environmental sciences. | <ul style="list-style-type: none"> <li>• Environment</li> <li>• Approaches to the study of the Environment</li> <li>• Relationship of the Environment with other disciplines</li> </ul> Environmental Science Interdisciplinary, multidisciplinary and transdisciplinary | <ul style="list-style-type: none"> <li>• Make a comparative table of the different components of the environment.</li> <li>• Collaborative work. About Environmental Science.</li> </ul> | Discussion Forum 5.<br>What is the environment?<br>Discussion Forum 6<br>What is Interdisciplinary and transdisciplinary?<br>Learning based on the | <ul style="list-style-type: none"> <li>• Anthology</li> <li>• Class presentations</li> <li>• Video projection</li> <li>• Articles</li> <li>• Virtual classroom resolution of tasks.</li> </ul> Collaborative learning |
| <b>Module 4</b>   | Dynamics of Environmental Systems.   |  |  |   |
| Intended learning   | Learning contents  | Learning product(s)  | Strategies   | Teaching resources and materials  |

|  |  |   |   |   |
|--|--|---|---|---|
| Analyses the general theory of systems for the solution of socio-environmental and sustainability problems | <p>General systems theory.</p> <ul style="list-style-type: none"> <li>• Elements of the systems</li> <li>• Types of systems.</li> <li>• 1st and 2nd Law of Thermodynamics</li> </ul> | <p>Case Study applying the General Systems Theory.</p> <p>Describe the components and characteristics of open and closed systems.</p> <p>Case Studies applying the first and second Law of Thermodynamics</p> | <p>Discussion forum 7<br/>What is a system?</p> <p>Discussion forum 8<br/>Learning Based on Study and Case Analysis</p> | <ul style="list-style-type: none"> <li>• Anthology</li> <li>• Class presentations</li> <li>• Video projection</li> <li>• Articles</li> <li>• Virtual classroom</li> </ul> |
| <b>Module 5</b>  | Simulation models applied to environmental systems.  |   |   |   |

| Intended learning  | Learning contents  | Learning product(s)  | Strategies   | Teaching resources and materials  |
|--|--|--|--|---|
| Organize the different components of a systems modelling | <ul style="list-style-type: none"> <li>• Modelling a system</li> <li>• Different types of models</li> <li>• Static and dynamic models</li> <li>• Black box and white box models</li> <li>• Environmental System</li> </ul> | Case study (modelling a system).<br>Case study (examples of black box and white box models). | Discussion Forum 9.<br>What is environmental simulation?<br>Discussion Forum 10.<br>What is an environmental model | <ul style="list-style-type: none"> <li>• Anthology</li> <li>• Class presentations</li> <li>• Video projection</li> <li>• Articles</li> <li>• Virtual classroom</li> </ul> |
| <b>Module 6</b>  | Environmental Systems Project  |  |  |   |
| Intended learning  | Learning contents  | Learning product(s)  | Strategies   | Teaching resources and materials  |
| Develop a project of environmental system                | Elements of a project.<br>Presentation<br>Introduction<br>Goals<br>Methodology<br>Results  | Project of Environmental Systems Model to a case of Environmental Risk                       | Project Based Learning   | <ul style="list-style-type: none"> <li>• Anthology</li> <li>• Class presentations</li> <li>• Video projection</li> <li>• Articles</li> <li>• Virtual classroom</li> </ul> |
| <b>17. Performance assessment:</b>                       |  |  |  |   |
| <b>Performance evidence(s)</b>                           | <b>Performance criteria</b>  |  | <b>Application scopes</b>  | <b>percentage</b>   |



|  |  |  |                                |
|--|--|--|--------------------------------|
| <ul style="list-style-type: none"> <li>• Learning activities</li> <li>• Presentations</li> <li>• Diagnosis</li> <li>• Draft</li> </ul> | Contain the requested according to the instructions <ul style="list-style-type: none"> <li>• Congruence of the preliminary project</li> <li>• Quality in the Presentation</li> <li>• Relevance.</li> </ul> | <ul style="list-style-type: none"> <li>• Institutional</li> <li>• Local</li> <li>• Regional</li> <li>• National</li> </ul> | 25%<br>- 25%<br>- 25%<br>- 25% |
|--|--|--|--------------------------------|

#### 18. Evaluation criteria:

| Criterion                   | Value  |
|-----------------------------|--|
| <b>Formative Evaluation</b> | 20% Responsibility, commitment, tolerance, ethics, values, participation   |
| <b>Summative evaluation</b> | 50% The development and presentation of the products   |
| <b>Self-evaluation</b>      | 10% The student values their performance, compares it with the established and determines what objectives met successfully |
| <b>Co-evaluation</b>        | 10% Students value their peers and apply the values of respect, tolerance and honesty.                                     |
| <b>Heteroevaluation</b>     | 10% Students value the work of the teacher and the teacher values the students   |
| <b>Criteria summation</b>   | 100%   |

#### 19. accreditation

The Learning Unit is accredited, if the student presents the evidences of performance with sufficiency. The minimum qualification to be accredited is a 6.0 includes the attendance (minimum with 80%), the qualification of the learning activities, and participation in the Discussion Forums

#### 20. Information sources

Basic

|  |   |
|--|---|
| <b>Complementary</b>   | <p>Allbay M. (2010) Basicsof EnvironmentalScience. 2nd Edition. Routledge isanimprintofthe Taylor &amp; Francis Group</p> <p>Arnold, M y Osorio, F. (1998). Introducción a los Conceptos Basicos de la Teoría General de Sistemas. Departamento de Antropología. Universidad de Chile.</p> <p>Bertalanffy, L. V. (1976). Teoría General de los Sistemas. Fondo de Cultura Económica</p> <p>Bertogly J.O (2010).- Introducción a la Dinámica de Sistemas. Editorial Limusa. Archivo PDF consultado en internet. 20/01/2016</p> <p>Lopez, V.M. (2006) Sustentabilidad y Desarrollo</p> <p>Melendez H.I (2006) La Dinámica de Sistemas Complejos en las Ciencias de la Tierra. Complexsy stems dynamic in The Earth and Environment Sciences. México, D.F.: Fondo de Cultura Económica.</p> <p>Montes C (2007)Del desarrollo sostenible a los servicios de los ecosistemas Asociación Española de Ecología Terrestre.</p> <p>Odum, E. ;GARY, W. (2006) Fundamentos de Ecología. Thompson Editores. S.A. de C.V.</p> <p>Organización del Bachillerato Internacional, 2008. Programa del Diploma. Guía de Sistemas Ambientales y Sociedades. Versión en español del documento publicado en enero de 2008 con el título Environmental Systems and Societies guide</p> <p>Tyer M.J. (2007). Ciencia Ambiental. Desarrollo Sostenible un Enfoque Integral. Quinta Edición Thompson Editores, México. Octava Edición.</p> <p>Tyler M.J. (2002). Ciencia Ambiental. Preservemos la Tierra. Quinta</p> |
| <b>21. Profile for the teacher who imparts this learning unit</b>  |   |
| <ul style="list-style-type: none"> <li>• Have a Bachelor's degree, preferably a Master's or Phd,</li> <li>• Basic knowledge about the discipline: Forest Science Engineering, Agronomist Specialist in Forestry, Environmental Engineer.</li> <li>• Be a certified teacher by the CONOCER</li> <li>• Professional university experience as a teacher in front of a group</li> <li>• Ability to work in team.</li> <li>• Knowledge about the Educational Program of Engineer in Environmental Management with focus on Competencies.</li> <li>• Knowledge of the Educational Model of the UJED.</li> <li>• Have completed the Diploma in Competences for the New Educational Model of the UED.</li> <li>• Have completed the Diploma in Tutorials.</li> </ul> |   |

- Develop the ability to coordinate and work as a team; guide the work of the student and empower him autonomy, cooperative work and decision making.
- Show flexibility in the follow-up of the training process and encourage interaction among students. Take into account the knowledge of students as a starting point and as an obstacle to the construction of new knowledge.
- Develop learning activities that promote the application of the concepts, models and methodologies that are being learned in the development of the Learning Unit
- Promote metacognition activities. Before the execution of an activity, indicate or identify the type of intellectual process that was performed: an identification of patterns, an analysis, a synthesis, the creation of a heuristic, etc.
- Propose problems that allow the student to integrate the contents of the subject and between different subjects, for their analysis and solution
- Promote activities of search, selection and analysis of information in different sources
- Relate the contents of this learning unit with the rest of the Educational Program to develop an interdisciplinary vision in the student.
- Encourage the development of intellectual abilities related to reading, writing and oral expression.