



**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>			
Microbiology		4318			
<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>					
Biological Sciences Chemistry Academy					
<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>					
Have passed: Chemistry, Environmental biology, Ecology and Biochemistry.					

10. Theory hours	Practice hours	Independent study hours	Total hours	Credits
4	0	0	4	4
11. Names of the teachers who participated in the development and/or modification of the programme				
Dra. María Angélica Martell Nevárez				
12. Date of development	Date of modification		Date of approval	
10/10/2013	04/08/2015 10/10/2017		13/12/2015 12/10/2017	

II. LEARNING UNIT SPECIFIC DATA	
13. Presentation	
<p>In the Microbiology Learning Unit is taught in the third semester of the Environmental Management Engineering Education Program and aims that the student is able to understand the importance of microorganisms in the biosphere and the role they play in the balance of different types of ecosystems. The objective of this Learning Unit is that the student acquires the basic knowledge and the microbiological foundations that allow him to relate the physical and chemical components of the different ecosystems and how they influence the microbial composition of the environment; know the biogeochemical cycles and understand the role of microorganisms in each of them; describe which are the main microorganisms present in soil, water and air and explain the role they play in these habitats; apply the knowledge acquired in the analysis of cases, through the collection, comparison and evaluation of information, in order to propose a proposal that allows actions focused on the solution of environmental problems.</p>	
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>- Analysis and synthesis</li> <li>- Oral and written communication skills</li> <li>- Knowledge of a foreign language</li> </ul> <p><b>Personal</b></p> <ul style="list-style-type: none"> <li>- Capability of teamwork</li> </ul> <p><b>Systemic</b></p> <ul style="list-style-type: none"> <li>- Motivation for quality</li> <li>- Ability to apply theoretical knowledge in practice</li> </ul>

<b>Professional competences</b>	<p><b>Disciplines</b></p> <ul style="list-style-type: none"> <li>- Basic general knowledge of environmental engineering</li> <li>- Ability to approach environmental problems in a multidisciplinary way</li> <li>- Qualitative interpretation of data.</li> <li>- Quantitative data interpretation capability</li> </ul>			
<b>General purpose of the course</b>	<p>The student is able to understand, handle and correctly apply the fundamental concepts of Microbiology, which will allow him to understand in a reasonable, analytical and integral way the function of the microorganisms in the different habitats and to know the effects that they generate as well as to identify possible alternatives to solve problems in relation to them.</p>			
<b>15. Joint of axes</b>				
It articulates the environment, ethics, research and social responsibility.				
<b>16. development of the course</b>				
<b>Module 1</b>	Fundamentals of Microbiology			
<b>Intended learning</b>	<b>Learning contents</b>	<b>Learning product(s)</b>	<b>Strategies</b>	<b>Teaching resources and materials</b>
Understand the main concepts of the microbiological area and the importance of the evolution of this science	Basic concepts and background	Glossary of 10 basic concepts related to microbiology. Development of the Tree of Life of Microbiology.	Research in at least 3 bibliographical sources of 10 concepts related to the area of microbiology, group discussion. Investigation of the history of microbiology and its evolution	Computer, internet, White-board, marker for white-board, projector, multimedia presentations, referred bibliography

	Classification of microorganisms: Prokaryotes and Eukaryotes	<ul style="list-style-type: none"> <li>- Activity 1 "Identification of prokaryotic and eukaryotic microorganisms and their structures". (Images).</li> <li>- Laboratory Practice No. 1 "Microscopic differentiation of prokaryotic and eukaryotic microorganisms"</li> <li>- Laboratory Practice No. 2 "Gram stain".</li> <li>- Exam</li> </ul>	Presentation of the topic by the teacher. Reading and analysis to identify the main differences between prokaryotic and eukaryotic microorganisms (Activity 1).	
<b>Module 2</b>	Metabolism and microbial nutrition			
<b>Intended learning</b>	<b>Learning contents</b>	<b>Learning product(s)</b>	<b>Strategies</b>	<b>Teaching resources and materials</b>
Know and classify the microorganisms according to different metabolic aspects and identify based on this their nutritional need for their better use and/or elimination	Energy: Sources and energy exchange	Presentation pptx	<p>There will be an investigation and presentation of the topics. Each team will present a theme.</p> <p>All the teams will carry out the "Fermentation Project" and will deliver a report with the results.</p>	Computer, internet, White-board, marker for White-board projector, multimedia presentations, referred bibliography.
	Metabolism: Anabolism and Catabolism	Presentation pptx		
	Fermentation: Aerobic and Anaerobic	Presentation pptx Project: "Alcoholic and lactic fermentation"		
	Nutrition: <ul style="list-style-type: none"> <li>- Basic concepts.</li> <li>- Nutritional requirements of microorganisms. Macronutrients and micronutrients.</li> </ul>	Presentation pptx		

	<ul style="list-style-type: none"> <li>- Growth factors</li> <li>- The physical and chemical environment: pH, temperature, water activity, carbon and nitrogen sources, oxygen</li> </ul>			
	<ul style="list-style-type: none"> <li>- Culture media: Classification of culture media.</li> <li>- Design of culture media.</li> </ul>	Presentation pptx Laboratory Practice No. 3 "Preparation of culture media". Laboratory Practice No. 4 "Isolation of microorganisms". Exam		
<b>Module 3</b>	Microbial kinetics			
<b>Intended learning</b>	<b>Learning contents</b>	<b>Learning product(s)</b>	<b>Strategies</b>	<b>Teaching resources and materials</b>
Know the general characteristics of microbial growth and the factors that can intervene in their behaviour.	Microbial growth: Growth rate, generation time, duplication frequency, number of generations, microbial growth curve	Crossword	Presentation of the topics by the teacher and at the conclusion crosswords will be delivered to solve them individually	Computer, internet, White-board, marker for White-board projector, multimedia presentations, referred bibliography.
	Effect of external factors on microbial growth	Crossword		
	Methods of cell and population growth counting: Direct and indirect methods	Laboratory Practice No. 5 "Identification of microorganisms by biochemical tests".		

		Laboratory Practice No. 6 "Microbial kinetics" Exam		
<b>Module 4</b>	Biogeochemical cycles			
<b>Intended learning</b>	<b>Learning contents</b>	<b>Learning product(s)</b>	<b>Strategies</b>	<b>Teaching resources and materials</b>
Distinguishes the role of microorganisms in biogeochemical cycles and identifies alternatives for their application	<ul style="list-style-type: none"> <li>- Carbon</li> <li>- Oxygen</li> <li>- Nitrogen</li> <li>- Sulphur</li> <li>- Phosphorus</li> <li>- Iron</li> </ul>	Model and presentation	Consultation and presentation of the topics. Each team will present a model of the corresponding cycle and make a full explanation about it.	Computer, internet, White-board, marker for White-board projector, multimedia presentations, referred bibliography.
<b>Module 5</b>	Microbiota of natural ecosystems			
<b>Intended learning</b>	<b>Learning contents</b>	<b>Learning product(s)</b>	<b>Strategies</b>	<b>Teaching resources and materials</b>
Identify and understand the different types of microorganisms involved in the various ecosystems, their interactions and	<p>Water microbiology</p> <p>Soil microbiology</p> <p>Air microbiology</p> <p>Microbial interactions</p>	Team research work on microbiota of the different ecosystems.	Investigation of the various natural ecosystems and the effects of microorganisms on them. Electronic delivery of work	Computer, internet, White-board, marker for White-board projector, multimedia presentations, referred bibliography.

the effects they can cause.				
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**17. Performance assessment:**

Performance evidence(s)	Performance criteria	Application scopes	percentage
<ul style="list-style-type: none"> <li>- Glossary of concepts</li> <li>- Mental maps</li> <li>- Summary</li> <li>- Presentation pptx</li> <li>- Conceptual map</li> <li>- Laboratory practices</li> <li>- Model</li> <li>- Research work</li> </ul>	<ul style="list-style-type: none"> <li>- Punctuality</li> <li>- Quality (Presentation): Cover, objective of the work, numbering of the page, individual conclusion, bibliography</li> <li>- Congruence (content sequence)</li> <li>- Relevance (information regarding the requested topics)</li> <li>- Spelling</li> </ul>	Social, business, governmental, local, regional, national and international.	<ul style="list-style-type: none"> <li>- Formative evaluation 60%</li> <li>- Summative evaluation 20%</li> <li>- Self-evaluation 5%</li> <li>- Co-evaluation 10%</li> <li>- Heteroevaluation 5%</li> </ul>

**18. Evaluation criteria:**

Criterion	Value
<b>Formative Evaluation</b>	60% Exercises, presentations, internship reports, lab practices are considered.
<b>Summative evaluation</b>	20% The exam grade is considered.
<b>Criteria summation</b>	<b>80%</b>

**19. accreditation**

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.

## 20. Information sources

### Basic

- Atlas R.M. y Bartha R., (2002). Ecología microbiana y Microbiología ambiental. 4ª ed., Addison Wesley.
- Bitton G., Wiley-Liss, (2005). Wastewater Microbiology. 2ª ed. New York.
- Hurst, Knudsen, McInerney, Stetzenbach y Walter, (1997). Manual of Environmental Microbiology. ASM Press, Washington.
- Ingraham J.L. y Ingraham C.A., (1998). Introducción a la Microbiología. Reverté, Barcelona.
- Madigan M.T., Martinko J.M., Dunlap P.V. y Clark D.P., (2009). Brock: Biología de los Microorganismos. 12ª Ed. Pearsons Addison Wesley Madrid.
- Marín I., Sanz J.L. y Amils R., (2005). Biotecnología y Medio ambiente. Ed. Ephemera.
- Pelczar M.J., Chan Jr., E.C.S. y Krieg N.R., (1993). Microbiology. Concepts and applications. McGraw-Hill, N.Y.
- Prescott L.M., Harley J.P. y Klein D.A. (2004). Microbiología. 5ª Ed. McGraw-Hill. Interamericana. Madrid.
- Stanier R.Y., Ingraham J.L., Wheelis M.L. y Painter P.R. (1989). Microbiología. 2ª ed. Ed. Reverté, S.A., Barcelona.
- Prescott L.M., Harley J.P. y Klein D.A., (2004). Microbiología. 5ª ed. McGraw-Hill Interamericana. Madrid.
- Tortora G.J., Funke B.R. y Case C.L., (2007). Introducción a la Microbiología. 9ª ed. Ed. Panamericana, Buenos Aires ([www.medicapanamericana.com/microbiologia/tortora](http://www.medicapanamericana.com/microbiologia/tortora)).
- Willey, J., Sherwood, L. Y Woolverton, C. Prescott, Harley and Klein, (2007). Microbiology. 7th Ed. McGraw-Hill Companies, N.Y.

### Complementary

- American Public Health Association. (1995). Standard Methods for the Examination of Water and Wastewater. Washington, U.S.A.
- Atlas R.M., Microbiology. Fundamentals and applications (1990). Continental Editorial Company, S.A., Mexico
- (Principles of Microbiology, Mosby. (1995).
- Grant W.D. y Long P.E., (1989). Microbiología Ambiental. Ed. Acribia, S.A.
- Koneman, E.W., Allen S.D., Janda W.M., Schreckenberger P.C. and Win W.C. (2003). Diagnóstico Microbiológico-Texto y Atlas Color, Ed. Médico Panamericana. 5ª Ed.
- Maier, R.M., Pepper, I.L. y Gerba, C.P. (2000). Environmental Microbiology. Academic Press. San Diego, Ca.
- Manacorda, A.M., Cuadros D.P. (2005). Manual Práctico de Microbiología. Cátedra de Microbiología Ambiental I. <http://essa.uncoma.edu.ar/catedras.html>.



## 21. Profile for the teacher who imparts this learning unit

- University Degree with Master's or Doctorate in Chemistry, Biochemistry, Molecular Biology or related area.
- Professional university experience as a professor in the area.
- Teaching experience with the management of the chair with large groups.
- Laboratory experience
- Good interpersonal and communication relationships.
- Ability to work in a team.
- Ability to work under pressure.