



POLYTECHNIC OF MEĐIMURJE IN ČAKOVEC

COURSE SYLLABUS

ACADEMIC YEAR: 2020/2021

1. GENERAL COURSE INFORMATION

1.1 Course name	Environmental microbiology			
1.2 Study program/s	Undergraduate professional study Sustainable Development			
1.3 Course status (O,E)	0	1.6 Mode of instruction (number of hours)	Lectures	30
1.4 Course code	4062		Exercises	30
1.5 Course abbreviation	EM		Seminars	
1.6 Semester	IV		E-learning	
1.7 ECTS	5	1.7 Place and time of instruction	Premises of the Polytechnic of Međimurje in Čakovec, according to the schedule published on the website	

2. TEACHING STAFF

2.1 Course leader/s-title	mr. sc. Nada Glumac,s. lec.	contact	nglumac@mev.hr
		contact	
2.2 Assistant/s- title		contact	
		contact	
2.3 Instruction held by- title		contact	

3. COURSE DESCRIPTION

3.1 Course goals	Introducing students to the basics of microbiology and the most important groups of microorganisms and explain the importance and role of microorganisms in different ecosystems (soil, water, air, waste) and the use of microorganisms in environmental engineering and everyday life.
3.2 Prerequisites	There are no conditions
3.3 Course outcomes	After successfully completing the course, students will be able to: O1 Interpret basic concepts related to microbiology and understand the importance and role of microorganisms O2 Distinguish the difference in the structure and function of prokaryotic and eukaryotic cells of microorganisms and distinguish the metabolic and biochemical activity O3 Gaining knowledge about the distribution of microorganisms and the role of microorganisms in the environment and the influence of environmental factors O4 Prepare a microscope slide and master the microscopy technique O5 Understand the cultivation of microorganisms in the laboratory and independently perform basic microbiological analyzes of water for human consumption and wastewater O6 Plan air quality management O7 Compare processes related to microbiological biodegradation of waste O8 Understand soil microbiological processes

3.4 Course content	The course provides knowledge about microorganisms, and their huge role in various ecosystems as well as introduction to pathogenic microorganisms that can be transmitted through water or air. Introduction to microbiological methods of isolation of microorganisms important for environmental microbiology.																																																										
3.5 Types of coursework	x	Lectures	x	Exercises		Blended e-learning		Individual activities	x	Laboratory																																																	
	x	Seminars and workshops		Distant learning	x	Field classes		Multimedia and network		Mentorship																																																	
		Other																																																									
3.6 Language of instruction	Croatian/ English																																																										
3.7 Monitoring students' work (enter the number of ECTS credits for each activity so that the total number of ECTS credits is equal to the total ECTS value of the course, 1 ECTS = 30 hours)	2,0	Class attendance	0,5	Seminars		Essay																																																					
		Class activity		Project		Report/paper																																																					
	1,0	Midterm exams	1,0	Practical task		Continuous knowledge check																																																					
	(1,0)	Written exam		Experimental work																																																							
	0,5	Oral exam		Research																																																							
3.8 Assessment and evaluation of students' work during classes and at the final exam	<table border="1"> <thead> <tr> <th>Activity specification</th> <th>Percent %</th> <th>Points</th> </tr> </thead> <tbody> <tr> <td colspan="3" style="text-align: center;">Assessment during instruction</td> </tr> <tr> <td>Attendance</td> <td>5%</td> <td>5</td> </tr> <tr> <td>Class activity</td> <td>5%</td> <td>5</td> </tr> <tr> <td>Seminar/ project/ essay</td> <td>30%</td> <td>30</td> </tr> <tr> <td>Midterm exam 1</td> <td>30%</td> <td>30</td> </tr> <tr> <td>Midterm exam 2</td> <td>30%</td> <td>30</td> </tr> <tr> <td colspan="3" style="text-align: center;"><i>Exam assessment for the students who failed to fulfill all the obligatory requirements during the semester</i></td> </tr> <tr> <td>Written exam</td> <td>60%</td> <td>60</td> </tr> <tr> <td>Total:</td> <td>100%</td> <td>100</td> </tr> </tbody> </table> <p>Written exam The written exam is taken through two Midterm exam.</p> <p>Oral exam A student has the right to publicity during the oral exam. At least one other student must be present in the room. Exam questions must be written down to determine if all outcomes have been verified. The oral exam is mainly used as an upgrade to the written exam.</p>										Activity specification	Percent %	Points	Assessment during instruction			Attendance	5%	5	Class activity	5%	5	Seminar/ project/ essay	30%	30	Midterm exam 1	30%	30	Midterm exam 2	30%	30	<i>Exam assessment for the students who failed to fulfill all the obligatory requirements during the semester</i>			Written exam	60%	60	Total:	100%	100																			
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3.9 Assessment criteria – analysis per learning outcomes	<table border="1"> <thead> <tr> <th colspan="7">Ways of evaluating learning outcomes</th> </tr> <tr> <th></th> <th>Attendance</th> <th>Activity</th> <th>Mid-term exam 1</th> <th>Mid-term exam 2</th> <th>Practical work</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Outcome 1</td> <td></td> <td></td> <td>5</td> <td></td> <td>5</td> <td></td> </tr> <tr> <td>Outcome 2</td> <td></td> <td></td> <td>5</td> <td></td> <td>5</td> <td>10</td> </tr> <tr> <td>Outcome 3</td> <td></td> <td></td> <td>5</td> <td>5</td> <td></td> <td>10</td> </tr> <tr> <td>Outcome 4</td> <td></td> <td></td> <td>5</td> <td></td> <td>10</td> <td>10</td> </tr> <tr> <td>Outcome 5</td> <td></td> <td></td> <td></td> <td></td> <td>10</td> <td>15</td> </tr> </tbody> </table>										Ways of evaluating learning outcomes								Attendance	Activity	Mid-term exam 1	Mid-term exam 2	Practical work	Total	Outcome 1			5		5		Outcome 2			5		5	10	Outcome 3			5	5		10	Outcome 4			5		10	10	Outcome 5					10	15
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Outcome 5					10	15																																																					

	Outcome 6				10		15
	Outcome 7				10		10
	Outcome 8				10		10
	Outcome not-related	5	5				10
	Total	5	5	25	35	30	100
	<p>Grading of outcomes (in order to pass the mid-term exam/exam the student must achieve at least 50% points for each learning outcome)</p> <p>Points Grade</p> <p>89 – 100 excellent (5)</p> <p>76 – 88 very good (4)</p> <p>63 – 75 good (3)</p> <p>50 – 62 pass (2)</p> <p>0 – 49 fail (1)</p>						
3.10 Specific features related with taking the course	<p>If a student collects 50% of the points of each outcome, he / she directly takes the exam, provided that he / she has done practical work (exercises). A student cannot access the exam period if he / she has not achieved a min for each exercise. 60% correct answers. Practical work (completed exercises) is taught until the last week of lectures. During the exam, it is possible to orally check the knowledge from practical work (exercises).</p> <p>If a student does not achieve a sufficient number of points on the midterm exam, he / she cannot take the next midterm exam.</p> <p>Once achieved points in intermediate exams for each learning outcome are no longer deleted unless the student decides to correct the result for a particular learning outcome, whereby the points won until then are deleted and newly achieved points for that learning outcome are entered.</p> <p>The final grade is obtained on the exam period and is the sum of points earned during classes.</p> <p>Students who did not take the colloquium access the written part of the exam where all learning outcomes are checked, and are required to have completed exercises before taking the exam.</p>						
3.11 Students obligations	<p>Full-time students are required to attend at least 70% of the total number of hours of lectures and exercises in order to exercise the right to take the exam. Part-time students are required to attend at least 30% of the total number of hours of lectures and exercises in order to exercise the right to take the exam. If the student has not fulfilled all the obligations set by the course, he is obliged to attend the lectures again and meet the conditions for taking the exam.</p> <p>Attendance can be offset by online tuition, organised webinars and added assignments given by teachers. One lesson lasts 45 minutes, and several hours form a teaching unit. Absence from one teaching unit is counted as one absence. Delays and apologies are recorded separately. In that case, if the student missed more than 50% of classes, and has a justifiable reason/apology, the request should be submitted to the Department Council, which then decides on the justification of student absences with the obligatory opinion of the course leader.</p>						
3.12 Written assignments	<p>Seminar papers must be computer written and may have a maximum of 12 text cards (Times New Roman, font 12) from introduction to conclusion, together with pictures, appendices to tables, etc. Seminar papers must have an adequate title page, content, marked pages and literature . The seminar paper should be divided into chapters and contain a list of references and a list of figures and tables and graphs and finally a summary / conclusion in the size of 250 words. The student guarantees the authenticity of the work with his signature. Power Point seminar papers must be presented orally.</p>						

3.13 Required reading	1.	Stilinović, B., Hrenović, J., 2009: Practicum in microbiology. Kugler. Textbooks of the University of Zagreb. Zagreb
	2.	Hajsig, D., Naglič, T., Madić, J., Gamulin, S., 1992: General microbiology and immunology with the basics of epizootiology. Školska knjiga Zagreb
	3.	Duraković, S. Redžepović, S., 2003: Introduction to general microbiology. Kugler
	4.	Duraković, S., Duraković, L., 2008: Manual for work in a microbiological laboratory, Zagreb
	5.	Hajsig, D., Delaš, F., 2016: Exercise Manual in General Microbiology. Recedo digital j.d.o.o. Zagreb.
3.14 Additional reading	1.	Viličić. D., 2003: Phytoplankton in the marine ecological system. School book Zagreb.
	2.	Hurst, C.J., 1997: Manual of Environmental Microbiology, ASM Press and Sinauer Associates, New York.
	3.	Maier, RM., Pepper, IL., Gerba, C.P., 2008: Environmental Microbiology, 2nd., Elsevier Science, San Diego.

4 ADDITIONAL COURSE INFORMATION

4.1 Quality control	The quality of the program, teaching process, teaching skills and level of mastery of the material will be established by conducting a written evaluation based on questionnaires, and in other standardised ways and in accordance with the by-laws of the Polytechnic of Međimurje in Čakovec.
4.2 Contact the teacher	Students can contact the teacher during the office hours and during classes, while for short questions and explanations they can contact him/her any day during working hours by coming in person or by landline. It is also possible to ask questions by e-mail, which will be answered in 48 hours at the latest. It is desirable for students to come as often as possible for any possible questions during the teacher's office hours.
4.3 Information about the course	It is the obligation of each student to be regularly informed about the course. All notifications about the classes or possible postponement of classes will be posted on the bulletin board and on the website of the Polytechnic at least 24 hours in advance.
4.4 Course contribution to the study program	<p>Manage water, air, soil, waste and energy in a sustainable way</p> <p>Propose a program for the remediation of polluted soil, water and air while adhering to the principles of sustainable development</p> <p>Formulate simple problems in the field of environmental protection in order to solve them by applying the principles of sustainable development</p>

5. ANALYSIS OF COURSE TOPICS (the number of hours is equal to the number of lectures and exercises of the course)

LECTURES				
Hours	Topic and description	Method	Learning outcomes	Course outcome
		<ul style="list-style-type: none"> Direct teaching (lecture, instruction, pp presentation) Discovery learning (individual, lead, discussion) Group learning 		

		<ul style="list-style-type: none"> • Case study • Field classes... 		
1.	Introductory introduction to the course and detailed syllabus, historical development of microbiology	Lecture, pp presentation	Understand the role and importance of microorganisms in the environment	O1
2.	General microbiology (Bacteriology)	Lecture, pp presentation	Define the morphology of bacteria, know the role and structure of all cellular parts of bacteria, define the prokaryotic cell	O2
3.	Viruses and fungi	Lecture, pp presentation	Understand the structure and organization and properties, describe the eukaryotic cell, distinguish the basic morphological characteristics of yeasts and molds	O1 O2
4.	Protozoa and algae, Phylogenetic tree, Biochemical circulation of important biogenic elements.	Lecture, pp presentation	Identify the type of microorganisms and their consequences for the environment, list the characteristics and important groups of protozoa, Gaining knowledge about the importance of microorganisms in the circulation of biogenic elements	O1 O5
5.	Microbial communities, bacterial metabolism	Lecture, pp presentation	Understand the interrelationships of microbial communities, distinguish the metabolic and biochemical activity of microorganisms	O3

6.	Microbiology of groundwater and water for human consumption	Lecture, pp presentation	Recognize the impact of iron bacteria on water quality for human consumption, pipelines, pumps and well capacity	03
7.	Microbiology of surface and wastewater	Lecture, pp presentation	Introduce microorganisms of wastewater, activated sludge, nitrifying and denitrifying bacteria	03
8.	Midterm exam 1			
9.	Air microbiology	Lecture, pp presentation	Explain the spread of microorganisms through the air, learn about air sampling techniques, learn to plan air quality management	06
10.	Solid waste landfills	Lecture, pp presentation	Interpret the processes of aerobic and anaerobic decomposition with the help of microorganisms, know the difference between bioreactor and conventional landfills	07
11.	Biofilms and bioremediation	Lecture, pp presentation	Understand and describe the process of biofilm formation, give examples of benefits and harms of biofilms in the environment, understand the process of bioremediation	03
12.	Soil microbiology	Lecture, pp presentation	Get to know soil microbial	08

			communities and plant microorganisms, understand metabolic microorganisms in soil	
13.	Bioterrorism	Lecture, pp presentation	Identify the most significant and pathogenic microorganisms that can endanger human health and the environment	O3
14.	Biosensors	Lecture pp presentation	Explain the function of biosensors in ecology	O3
15.	Midterm exam 2			
EXERCISES/ SEMINARS				
Hours	Topic and description	Method <ul style="list-style-type: none"> • Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion) • Group learning • Case study • Field classes... 	Learning outcomes	Course outcome
1.	Exercise 1, introduction to equipment and accessories in the microbiological laboratory	Laboratory exercises	Recognize and know the purpose of the equipment	O3 O5
2.	Exercise 2, make a microscopic specimen and microscopy	Laboratory exercises	Master the technique of microscopy and distinguish members of different groups on the basis of native preparations	O5
3.	Exercise 3, staining of microscopic slides	Laboratory exercises	Independently develop and apply a suitable staining method for individual microbial groups	O5

4.	Exercise 4, to classify microorganisms on the basis of colored microscopic preparations	Laboratory exercises	Distinguish morphological and tinctorial properties of microorganisms	O1 O5
5.	Exercise 5, Preparation of nutrient media	Laboratory exercises	Understand the preparation and types of nutrient media for the cultivation of microorganisms	O4 O5
6.	Exercise 6, water sampling for human consumption	Laboratory exercises	Master the technique of sampling water for human consumption and measure the parameters	O5
7.	Exercise 7 microbiological analysis of water	Laboratory exercises	Independently perform microbiological analysis of water	O5
8.	Exercise 8, determination of coliform bacteria in water	Laboratory exercises	Identify coliform bacteria	O5
9.	Exercise 9, determining the total number of bacteria in the water	Laboratory exercises	Determine the total number of bacteria in the water	O5
10.	Determine the total number of bacteria in the water	Laboratory exercises	Practically perform two methods for determining the physiological properties of microorganisms	O5
11.	Exercise 11, determining the number of molds in the air	Laboratory exercises	Differentiate between quantitative and qualitative microbiological analysis of air	O6
12.	Exercise 12, preparation of packaging for microbiological analyzes	Laboratory exercises	Determine the packaging for different microbiological	O5 O6 O7

			analyzes (soil, waste, water, air)	
13.	Exercise 13, application of commercial ready-made tests in microbiology	Laboratory exercises	Be able to apply final tests in the identification of microorganisms	O5 O6 O7
14.	Exercise 14, taking microbiological fingerprints of surfaces	Laboratory exercises	Master the technique of taking swabs and interpret the results	O5 O6 O7
15.	Exercise 15 control of nutrient media for the cultivation of microorganisms	Laboratory exercises	Know the parameters and method of control of nutrient media for the cultivation of microorganisms	O5