



POLYTECHNIC OF MEĐIMURJE IN ČAKOVEC

COURSE SYLLABUS

ACADEMIC YEAR: 2020/2021

1. GENERAL COURSE INFORMATION

1.1 Course name	Landfills			
1.2 Study program/s	Undergraduate professional study Sustainable Development			
1.3 Course status (O,E)	O	1.6 Mode of instruction (number of hours)	Lectures	15
1.4 Course code	4071		Exercises	30
1.5 Course abbreviation	00		Seminars	-
1.6 Semester	5.		E-learning	Merlin
1.7 ECTS	4	1.7 Place and time of instruction	The 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	Goran Sabol, pred.	contact	goran.sabol@mev.hr
		contact	
2.2 Assistant/s- title		contact	
		contact	
2.3 Instruction held by-title		contact	

3. COURSE DESCRIPTION

3.1 Course goals	Get acquainted with the construction of the landfill, the structure and processes that take place in the body of the landfill, as well as the activities necessary for the rehabilitation of the landfill after closure.										
3.2 Prerequisites	There are no prerequisites										
3.3 Course outcomes	After successfully completing the course, students will be able to:										
	I1	Identify waste by generation, type and physical-mechanical and chemical properties - R4									
	I2	Assess the criteria for landfill selection - R5									
	I3	Analyze the structure and processes of landfills - R5									
	I4	Propose principles and technologies of recycling and disposal of certain types of waste on given examples - R6									
	I5	Develop a landfill safety system and conduct a cost-effectiveness analysis of waste disposal - R6									
	I6	Interpret and analyze the results of landfill monitoring - R5									
3.4 Course content	Introduction to the basic concept of sustainable waste management, classification and technologies for waste disposal.										
3.5 Types of coursework	X	Lectures	X	Exercises		Blended e-learning	X	Individual activities		Laboratory	
		Seminars and workshops		Distant learning		Field classes		Multimedia and network		Mentorship	
		Other									
3.6 Language of instruction	Croatian/English										
	1,5	Class attendance	1,0	Seminars				Essay			

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)		Class activity		Project		Report/paper																																	
		Midterm exams		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>2,5%</td> <td>2,5</td> </tr> <tr> <td>Class activity</td> <td>2,5%</td> <td>2,5</td> </tr> <tr> <td>Seminar/ project/ essay</td> <td>10%</td> <td>10</td> </tr> <tr> <td>Midterm exam 1</td> <td>42%</td> <td>42</td> </tr> <tr> <td>Midterm exam 2</td> <td>43%</td> <td>43</td> </tr> <tr> <td colspan="3" style="text-align: center;"><i>Exam assessment for the students who failed to fulfil all the obligatory requirements during the semester</i></td> </tr> <tr> <td>Written exam</td> <td>50%</td> <td>50</td> </tr> <tr> <td>Oral exam</td> <td>50%</td> <td>50</td> </tr> <tr> <td>Total:</td> <td>100%</td> <td>100</td> </tr> </tbody> </table>						Activity specification	Percent %	Points	Assessment during instruction			Attendance	2,5%	2,5	Class activity	2,5%	2,5	Seminar/ project/ essay	10%	10	Midterm exam 1	42%	42	Midterm exam 2	43%	43	<i>Exam assessment for the students who failed to fulfil all the obligatory requirements during the semester</i>			Written exam	50%	50	Oral exam	50%	50	Total:	100%	100
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3.9 Assessment criteria – analysis per learning outcomes	Ways of evaluating learning outcomes																																						
		Attendance	Activity	Mid-term exam 1	Mid-term exam 2	Practical work	Total																																
	Outcome 1			10			10																																
	Outcome 2			10	15		25																																
	Outcome 3			22			22																																
	Outcome 4				23		23																																
	Outcome 5				5		5																																
	Outcome 6			2,5	5		7,5																																
	Outcome not-related	2,5		2,5	2,5		7,5																																
	Total	2,5		47	50,5		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 the student collects 50% of the points of each outcome directly access orally exam. If a student does not achieve a sufficient number of points on the midterm exam, he cannot take the next midterm exam.</p> <p>Once won points in intermediate exams for each learning outcome are no longer deleted unless the student decides to correct the result for each learning outcome, whereby the points won until then are deleted and newly achieved points for that learning outcome are entered. A student cannot access the exam period if he / she has not submitted and presented seminar paper. The final grade is obtained on the oral part of the exam.</p> <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.</p>																																						

	<p>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. 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>								
3.11 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. Attendance can be offset by online consultations, organized 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 the event that a student is absent from more than 50% of classes, and has a justifiable reason / apology, a 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, table appendices, 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.</p>								
3.13 Required reading	<table border="1"> <tr> <td>1.</td> <td>Strategija gospodarenja otpadom Republike Hrvatske</td> </tr> <tr> <td>2.</td> <td>D. Kiš, S. Kalambura: Gospodarenje otpadom I, Poljoprivredni fakultet u Osijeku, 2018.</td> </tr> <tr> <td>3.</td> <td>Orešković, M., Radaković, S., Jeričević, S., Maričić, Ž. (2002), Ocjena izvodljivosti sanacije neuređenih odlagališta, Zbornik radova "VII. međunarodni simpozij Gospodarenje otpadom Zagreb 2002, 395-412.</td> </tr> <tr> <td>4.</td> <td>Sanacija odlagališta komunalnog otpada do 1. srpnja 2003. godine realnost ili utopija, Zbornik radova "VII. međunarodni simpozij Gospodarenje otpadom Zagreb 2002", 571-576, Ikšić, A. (2007.)</td> </tr> </table>	1.	Strategija gospodarenja otpadom Republike Hrvatske	2.	D. Kiš, S. Kalambura: Gospodarenje otpadom I, Poljoprivredni fakultet u Osijeku, 2018.	3.	Orešković, M., Radaković, S., Jeričević, S., Maričić, Ž. (2002), Ocjena izvodljivosti sanacije neuređenih odlagališta, Zbornik radova "VII. međunarodni simpozij Gospodarenje otpadom Zagreb 2002, 395-412.	4.	Sanacija odlagališta komunalnog otpada do 1. srpnja 2003. godine realnost ili utopija, Zbornik radova "VII. međunarodni simpozij Gospodarenje otpadom Zagreb 2002", 571-576, Ikšić, A. (2007.)
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4 ADDITIONAL COURSE INFORMATION									
4.1 Quality control	<p>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.</p>								

Pravilnik

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	I1 - Interpret information, ideas, problems and solutions to professional and general audiences I3 - Use foreign languages in professional communication and use of professional literature I4 - Advocate an ethical approach to work and to associates in project teams I8 - Interdisciplinary to solve engineering problems of sustainable development I9 - Plan a circular economy in accordance with the legal framework in the Republic of Croatia I10 - Interpret European Union legislation in the field of sustainable development I23 - Manage water, air, soil, waste and energy in a sustainable way I26 - Formulate simple problems in the field of environmental protection in order to solve them by applying the principles of sustainable development I27 - Assess potential risks to the environment and cooperate in the preparation of environmental studies and studies on the impact of the project on the environment

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
1.	Introduction to the course - classification of waste according to physical-mechanical and chemical characteristics	Presentation, PP presentation	Identify waste	I1
2.	Principles and technology of recycling and disposal of certain types of waste	Presentation, PP presentation	Identify technology and disposal methods depending on the type of waste	I1, I4
3.	Crushing, grading, sorting, concentration and aggregation	Presentation, PP presentation	Classify waste treatment machines	I4
4.	Use of abandoned surface mines and waste disposal pits: Criteria for landfill selection	Presentation, PP presentation	Identify and select an adequate location for the landfill	I2
5.	Treatment of certain types of waste before disposal	Presentation, PP presentation	Identify a specific type of waste and choose the method of treatment	I4
6.	Category of landfills (legal landfills, landfills in the process of	Presentation, PP presentation	Identify the category of landfill	I2

	legalization, official, contractual, illegal landfills)			
7.	Landfill leachate (chemical composition, toxic effects and treatment methods)	Presentation, PP presentation	Explain the types and composition of leachate	I3
8.	Surface landfills	Presentation, PP presentation	Explain the structure and type of landfill	I3
9.	Underground landfills	Presentation, PP presentation	Explain the structure and type of landfill	I3
10.	Planning, design, use and closure of landfills	Presentation, PP presentation	Describe the actions during the planning, design, use and closure of the landfill	I3
11.	Construction of a landfill	Presentation, PP presentation	Explain the construction process	I3
12.	Landfill stability - use of geosynthetics, geomembranes and geotextiles	Presentation, PP presentation	Recognize and distinguish certain types of geosynthetics	I3
13.	Basic sealing layers and types of cover, drainage systems and the problem of leachate and landfill gas generation	Presentation, PP presentation	Explain the structure and function of individual layers of landfills	I3
14.	Landfill safety assessment. Activities during operation and after remediation of landfills. Cost-effectiveness analysis.	Presentation, PP presentation	Understand the actions during the operation and remediation of the landfill and perform a cost-effectiveness analysis	I5
15.	Landfill monitoring	Presentation, PP presentation	Interpret the results	I6
EXERCISES/ SEMINARS				
Hours	Topic and description	Method	Learning outcomes	Course outcome
1. 2.	Study of concrete examples from practice related to waste classification	Examples, discussion	Interpret the example	I1
3. 4.	Study of concrete examples from practice related to technologies of recycling and disposal of certain types of waste	Examples, discussion	Interpret the example	I1, I4
5. 6.	Study of concrete examples from practice related to crushing, grading, sorting, concentration and aggregation	Examples, discussion	Interpret the example	I4

7. 8.	Study of concrete examples from practice related to landfill selection criteria	Examples, discussion	Interpret the example	12
9. 10.	Study of concrete examples from practice related to waste treatment	Examples, discussion	Interpret the example	14
11. 12.	Study of concrete examples from practice related to the category of landfills	Examples, discussion	Interpret the example	12
13. 14.	Study of concrete examples from practice related to leachate from the landfill body	Examples, discussion	Interpret the example	13
15. 16.	Study of concrete examples from practice related to surface landfills	Examples, discussion	Interpret the example	13
17. 18.	Study of concrete examples from practice related to underground landfills	Examples, discussion	Interpret the example	13
19. 20.	Study of concrete examples from practice related to landfill planning, design and closure	Examples, discussion	Interpret the example	13
21. 22.	Study of concrete examples from practice related to the construction of landfills	Examples, discussion	Interpret the example	13
23. 24.	Study of concrete examples from practice related to the application and installation of geosynthetics	Examples, discussion	Interpret the example	13
25. 26.	Study of concrete examples from practice related to sealing layers and drainage of gases from landfills	Examples, discussion	Interpret the example	13
27. 28.	Study of concrete examples from practice related to actions during the operation of a landfill	Examples, discussion	Interpret the example	15
29. 30.	Study of concrete examples from practice related to landfill monitoring	Examples, discussion	Interpret the example	16