



MODULE SPECIFICATION

Module code	
Module title in Polish	Usuwanie i unieszkodliwianie odpadów
Module title in English	Solid Waste Disposal and Treatment
Module running from the academic year	2016/2017

A. MODULE IN THE CONTEXT OF THE PROGRAMME OF STUDY

Field of study	Environmental Engineering
Level of qualification	first cycle (first cycle, second cycle)
Programme type	academic (academic/practical)
Mode of study	full-time (full-time/part-time)
Specialism	Sanitary Supply, Treatment of Wastewater and Solid Waste
Organisational unit responsible for module delivery	Division of Waste Management
Module co-ordinator	Prof. Maria Żygadło
Approved by:	Prof. Maria Żygadło

B. MODULE OVERVIEW

Module type	core module (core/programme-specific/elective HES*)
Module status	compulsory module (compulsory/optional)
Language of module delivery	Polish/English
Semester in the programme of study in which the module is taught	semester 6
Semester in the academic year in which the module is taught	summer semester (winter semester/summer semester)
Pre-requisites	None (module code/module title, where appropriate)
Examination required	Yes
ECTS credits	5

* elective HES – elective modules in the Humanities and Economic and Social Sciences



Politechnika Świętokrzyska

WYDZIAŁ INŻYNIERII ŚRODOWISKA, GEOMATYKI I ENERGETYKI

Mode of instruction	lectures	classes	laboratories	project	others
Total hours per semester	15			45	



C. LEARNING OUTCOMES AND ASSESSMENT METHODS

Module aims	The aim of the module is to familiarise students with the sources of generating waste; the classification, recycling, and reclamation of recycled raw materials on the basis of binding legal state. Another aim is to acquaint students with the fundamentals of managing communal waste (biological and thermal methods) drawing attention to neutralisation methods at landfills.
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Module outcome code	Module learning outcomes	Mode of instruction (l/c/lab/p/ others)	Corresponding programme outcome code	Corresponding discipline-specific outcome code
W_01	A student knows the principles of waste management (together with the methods of waste neutralisation).	l/p	IS_W09	T1A_W04 T1A_W05 T1A_W06 T1A_W07
W_02	A student can select materials to make technical protections at a landfill.	l/p	IS_W06	T1A_W03 T1A_W07 T1A_W05
W_03	A student is capable of indicating optimal recycling methods of waste according to their characteristics.	l	IS_W15	T1A_W06
W_04	A student is able to characterise emission types of the objects of processing and neutralising waste (a student can also explain its impact on the environment).	l/p	IS_W16	T1A_W03 T1A_W05 T1A_W07 T1A_W08
W_05	A student knows the processes applied to process and neutralise waste with biological methods.	w	IS_W07	T1A_W03 T1A_W08
U_01	A student can analyse and estimate the effects of inappropriate waste management.	l/p	IS_U09	T1A_U01 T1A_U04 T1A_U10
U_02	A student can plan appropriate waste management.	l	IS_U17	T1A_U04 T1A_U10 T1A_U12 T1A_U14
U_03	A student can design a landfill.	l/p	IS_U03	T1A_U03
U_04	A student is aware of the necessity to apply indispensable technical protection at landfills.	l/p	IS_U14	T1A_U07 T1A_U10 T1A_U15
U_05	A student can co-operate in a larger team.	p	IS_U03	T1A_U02 T1A_U08
U_06	A student can verify a technical state of waste processing object; a student can operate waste processing installations.	l/p	IS_U15	T1A_U03 T1A_U07 T1A_U08 T1A_U09 T1A_U10 T1A_U11, T1A_U13, T1A_U14, T1A_U15,
K_01	A student has acquired competences during teamwork.	p	IS_K01	T1A_K03
K_02	A student is able to present his/her results during project defence.	p	IS_K02	T1A_K02 T1A_K05
K_03	A student is orientated in terms of modern technological solutions.	l/p	IS_K09	T1A_K02

Module content:



- Topics to be covered in the lectures

No.	Topics to be covered in the lectures	Module outcome code
1.	The sources of generating waste. The division of waste. General characteristics. The classification of waste. Legal status. Waste with respect to the environment. Quantitative and qualitative characteristics of waste. Accumulation indicators. Test methods. The aim of testing waste.	W_01 U_02 K_03
2.	Waste collection. The principles of selective collection. Product life cycle. The idea of waste recycling. The hierarchy of waste management. Benefits resulting from recycling. Refuse lorry fleet. Reload stations.	W_05, W_04 U_02 K_03
3.	Modern technologies of making landfills. Legal fundamentals; EU directives and national legislation. Environmental protection against effluents. Drainage concerning water and effluents at landfills. The systems of sealing landfills.	W_01 U_02 K_03
4.	Closing and reclamation concerning landfills. The stages of reclamation. Reclamations directions. Auxiliary objects at a landfill. Exploiting landfills. Landfill monitoring.	W_02, U_03 U_04 U_06 K_03
5.	Composting communal waste. The processes taking place in composted waste. Optimal composting conditions. Composting systems.	W_01, U_03 K_03
6.	The examples of technical solutions concerning composting plants. Single-degree composting. Two-stage composting. MUT-DANO technology. HERHOF technology. The production of vermicompost.	W_05 U_02 K_03
7.	The fundamentals of thermal methods of neutralising waste. The division of thermal methods. The characteristics of waste according to thermal neutralisation. Waste combustion on grates.	W_04 U_02 K_03
8.	The examples of operating installations. Exhaust gas treatment. Emission standards. Energy reclamation from waste. RDF alternative fuels (their classification). The conditions of utilisation in industrial installations. Waste combustion in cement furnaces.	W_04 U_02 U_06 K_03

- Topics to be covered in the classes

Project class number	Topics to be covered in the project - classes	Reference to teaching results for a module
1-2 2	Discussing the requirements and conditions which concern obtaining a credit. Output data concerning a project assignment. The conditions of landfill location. The forms of waste disposal. Project maps of a given location.	W_01 U_04 U_05
3	The interaction with the landfill structure. The impact of a landfill on the environment.	W_04 U_01 U_03 U_04 K_01
4	Calculating landfill area (drawing particular attention to a variant system of waste management).	W_02 U_03 K_01
5-6	The sources of effluents at landfills (composition and amount). Calculating the amount of effluents. The methods of minimising the amount of effluents. Effluent management at a landfill (calculating a holding tank; effluent drainage). Drawing installations for collecting effluents. Landfill area drainage.	W_02 U_03 U_04



7	Designing the sealing of a landfill basin.	W_02 U_03 U_04
8	Biogas management at a landfill (the source of biogas, the amount of the occurring biogas; the principles and methods of collecting biogas; the methods of utilising biogas: drawing installations collecting biogas).	W_04 U_03 U_04
9	The principles of correct landfill exploitation. The fundamentals of OHS during the functioning of the landfill.	W_01
10	Calculating the period of landfill exploitation. Terrain balance. Auxiliary objects: the point of vehicle wheel disinfection; the state of registration and control of the transported waste; social and service building; a technical building; a landfill square for insulation layers; insulating green area; terrain fence; warehouse for fuels; land development.	W_04 U_03
11	Water and soil management at a landfill. Technical equipment of a landfill; the equipment and machines at a landfill (equipment selection criteria). Designing surface landfill sealing. The methods of extending the period of landfill exploitation.	W_01 W_04 U_03 U_04
12	Landfill monitoring (system principles and elements).	W_04 U_03 U_04
13	Basic principles of land reclamation and managing the area of communal waste landfill on completion of its exploitation.	W_01 U_03 U_04
14	An ecological overview of landfills (realisation principles and aims).	W_04, K_03 U_04
15.	Defending project assignments.	W_01, K_02, U_06

Assessment methods

Module outcome code	Assessment methods <i>(Method of assessment; for module skills – reference to specific project, laboratory and similar tasks)</i>
W_01	A written examination on the lectures and a project
W_02	A written examination on the lectures and a project
W_03	A written examination on the lectures
W_04	A written examination on the lectures and a project
W_05	A written examination on the lectures
U_01	An examination, completing a project of a landfill (project assessment and defence)
U_02	A written examination on the lectures
U_03	A written examination on the lectures and a project
U_04	A written examination on the lectures and a project
U_05	A project
U_06	A written examination on the lectures and a project
K_01	Assessing a student's involvement during the classes, defending projects
K_02	Assessing a student's involvement during the classes, defending projects
K_03	A written examination on the lectures and a project



D. STUDENT LEARNING ACTIVITIES

ECTS summary		
	Type of learning activity	Study time/ credits
1	Contact hours: participation in lectures	15
2	Contact hours: participation in classes	-
3	Contact hours: participation in laboratories	-
4	Contact hours: attendance at office hours (2-3 appointments per semester)	3
5	Contact hours: participation in project-based classes	45
6	Contact hours: meetings with a project module leader	8
7	Contact hours: attendance at an examination	4
8		
9	Number of contact hours	75 <i>(total)</i>
10	Number of ECTS credits for contact hours <i>(1 ECTS credit = 25-30 hours of study time)</i>	3,0
11	Private study hours: background reading for lectures	15
12	Private study hours: preparation for classes	
13	Private study hours: preparation for tests	5
14	Private study hours: preparation for laboratories	
15	Private study hours: writing reports	
16	Private study hours: preparation for a final test in laboratories	
17	Private study hours: preparation of a project/a design specification	15
18	Private study hours: preparation for an examination	15
19		
20	Number of private study hours	50 <i>(total)</i>
21	Number of ECTS credits for private study hours <i>(1 ECTS credit = 25-30 hours of study time)</i>	2,0
22	Total study time	125
23	Total ECTS credits for the module <i>(1 ECTS credit = 25-30 hours of study time)</i>	5
24	Number of practice-based hours <i>Total practice-based hours</i>	68
25	Number of ECTS credits for practice-based hours <i>(1 ECTS credit = 25-30 hours of study time)</i>	2,72

E. READING LIST

References	<ol style="list-style-type: none"> Williams P.T., Waste treatment and disposal, John Wiley & Sons, 2005, 2 nd ed., Christensen Th.H. ed., Solid waste technology and management, Chichester, Blackwell Publishing, John Wiley & Sons, Ltd., Pub.Cop., 2011, vol 1, Christensen Th.H. ed., Solid waste technology and management, Chichester, Blackwell Publishing, John Wiley & Sons, Ltd., Pub.Cop., 2011, vol 2 Worrell W.A., Vesilind P.A., Solid waste engineering, CENGAGE Learning, 2 nd ed. USA 2012.
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	<p>5. Waste: A Handbook for Management, Ed. Letcher T., Vallero D.A., Elsevier, USA, 2011</p> <p>6. Żygadło M. , Principles of waste management and treatment - ed. Politechnika Świętokrzyska , 2015.</p> <p>7. Carroll A.R., Geofuels, Energy and the Earth, ed. Cambridge University Press, 2015</p> <p>8. Buxton G., Alternative Energy Technologies, ed., Robert Morris University, Taylor & Francis Group, 2015</p>
Module website	<p>9. LandGEM model http://www.epa.gov/ttn/catc/, Żygadło M. , Principles of waste management and treatment - Problems in practice, www.tu.kielce.pl/moodle .</p>