MODULE SPECIFICATION

Module code	
Module title in Polish	**Oczyszczanie ścieków 2**
Module title in English	**Wastewater Treatment 2**
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	Water Supply, Treatment of Wastewater and Solid Waste, Sanitary Pipelines and Systems
Organisational unit responsible for module delivery	Department of Water and Wastewater Engineering
Module co-ordinator	Lidia Bartkiewicz, PhD, Eng. Magdalena Dańczuk, PhD, Eng
Approved by:	Lidia Dąbek, PhD hab., Professor of the Kielce University of Technology

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	No (Yes/No)
ECTS credits	4

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

Mode of instruction	lectures	classes	laboratories	project	others
Total hours per semester	15E			30	

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C. LEARNING OUTCOMES AND ASSESSMENT METHODS

Module aims	The module covers mechanical, biological, and chemical processes which are indispensable to obtain treated sewage with the required quality by the Polish legislation (while removing them to receivers, i.e. surface water or soil. The scope of the lectures includes local sewage treatment systems with biological deposition as well as active deposition adjusted to remove carbon, carbon and nitrogen, nitrogen and phosphorus compounds.

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 methods of anaerobic active deposit, anaerobic and aerobic of sewage deposit stabilisation (together with technological parameters of devices for the realisation of these processes).	l	IŚ_W06 IŚ_W07 IŚ_W09	T1A_W01 T1A_W03 T1A_W04 T1A_W05 T1A_W06 T1A_W07 T1A_W08
W_02	A student knows the methods of chemical precipitation of phosphorus, the principles of realisation of mechanical devices and of aerating sewage applied in sewage treatment plants.	l	IŚ_W06 IŚ_W07 IŚ_W09	T1A_W01 T1A_W03 T1A_W04 T1A_W05 T1A_W06 T1A_W07 T1A_W08
W_03	A student is familiar with the MBR technology; a student can also determine the directions of technological changes as regards sewage treatment over the last 10 years.	l	IŚ_W06 IŚ_W07 IŚ_W09	T1A_W01 T1A_W03 T1A_W04 T1A_W05 T1A_W06 T1A_W07 T1A_W08
W_04	A student knows the methods of designing devices for sewage treatment.	l/p	IŚ_W06 IŚ_W09 IŚ_W11 IŚ_W15	T1A_W03 T1A_W04 T1A_W05 T1A_W06 T1A_W07
W_05	A student knows the fundamentals of operation as regards the simulators of active deposit and its utilisation in designing sewage treatment plants.	l	IŚ_W07 IŚ_W09	T1A_W01 T1A_W03 T1A_W04 T1A_W05 T1A_W06 T1A_W07 T1A_W08
W_06	A student has fundamental knowledge on the exploitation of sewage treatment (together with the changes and neutralising sewage deposits.	l	IŚ_W09 IŚ_W16 IŚ_W18	T1A_W02 T1A_W03

				T1A_W04 T1A_W05 T1A_W06 T1A_W07 T1A_W08
U_01	A student is able to design a simple technological system based on biological deposits.	p	IŚ_U02 IŚ_U03 IŚ_U15 IŚ_U16 IŚ_U25	T1A_U01 T1A_U02 T1A_U03 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U10 T1A_U14 T1A_U15
U_02	A student is able to select device for mechanical sewage treatment on the basis of design flow.	l/p	IŚ_U02 IŚ_U03 IŚ_U12 IŚ_U15 IŚ_U16	T1A_U01 T1A_U02 T1A_U03 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U10 T1A_U11 T1A_U13 T1A_U14 T1A_U15 T1A_U16
U_03	A student can provide dimensions concerning simple system for sewage aeration.	l	IŚ_U02 IŚ_U03 IŚ_U15 IŚ_U19	T1A_U01 T1A_U02 T1A_U03 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U10 T1A_U11 T1A_U13 T1A_U14 T1A_U15 T1A_U16
U_04	A student is capable of providing dimensions as regards biological deposits of reducing carbon compounds as well as deposit for nitrification.	p	IŚ_U02 IŚ_U03 IŚ_U15 IŚ_U16	T1A_U01 T1A_U02 T1A_U03

				T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U10 T1A_U11 T1A_U13 T1A_U14 T1A_U15 T1A_U16
U_05	A student is able to provide dimensions of secondary settling tanks. A student can also make a profile along a sewage track.	p	IŚ_U02 IŚ_U03 IŚ_U15 IŚ_U16	T1A_U01 T1A_U02 T1A_U03 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U10 T1A_U11 T1A_U13 T1A_U14 T1A_U15 T1A_U16
K_01	A student can solve a simple engineering assignment following the principles of professional ethics.	p	IŚ_K01 IŚ_K08	T1A_K03 T1A_K05
K_02	A student is aware of increasing professional qualifications individually.	l/p	IŚ_K03	T1A_K01 T1A_K02 T1A_K04
K_03	A student is aware of the responsibility for the realised engineering activities.	p	IŚ_K02 IŚ_K05	T1A_K02 T1A_K03 T1A_K04 T1A_K05

Module content:

1. Topics to be covered in the lectures

No.	Topics	Module outcome code
1	Sewage deposits management at a sewage treatment plant. The types of deposits and basic processes of processing and neutralising them.	W_01 W_06 K_02
2	Aerobic active deposit. Fermenters for generating gaseous fatty acids. UASB reactors. Constructional solutions and design principles.	W_01 W_04 U_02

		K_02
3	Chemical dephosphatation. Theoretical fundamentals, diagrams, and exploitation parameters. Mixing tanks and their equipment.	W_02 K_02
4	Sewage aeration systems. Diffuser types. The principles of selecting blowers. Pumping sewage and deposits. The guidelines concerning the selection of pumps.	W_02 U_03 K_02
5	Sewage purification at biological ponds and hydrobotanical treatment.	W_04 U_02 K_02
6	Development directions of modern sewage treatment technologies. Hybrid processes and MBR membrane reactors.	W_03 W_04 W_05 U_03 K_02
7-8	The types of hindrances occurring in sewage treatment plants.	W_06 K_02

2. Topics to be covered in the classes
3. Topics to be covered in the laboratories

4. Topics to be covered in the project

No.	Topics	Module outcome code
1	Issuing students with project assignments. Introduction to project classes. The required treatment process and its impact on the receiver. The highest permissible concentration of BZT_5, general contents and N_{og} according to habitat equivalent.	U_01 K_01 K_02 K_03
2	Discussing the requirements concerning project acceptance. General issues (the location and technology selection). Preparing development plans of sewage treatment plant premises on the basis of the accepted technological diagrams.	U_01 K_01 K_02 K_03
3	Auxiliary objects at sewage treatment plant premises. Basic requirements as regards the Civil Engineering Act (the decision of development conditions and management, the required agreements, water and soil conditions).	U_01 K_01 K_02 K_03
4	Balancing the quality and quantity in sewage mix inflow to a sewage treatment plant.	U_01 K_01 K_02 K_03
5	A project of a mechanical part of a sewage treatment plant: dimensioning and selection of trusses.	W_04 U_02 K_01 K_02 K_03
6	A project of a mechanical part of a sewage treatment plant: selecting pumps for raw sewage, selecting a desander.	W_04 U_02 K_01 K_02 K_03
7	Primary settling tanks. A project of the Imhoff settling tank (dimensioning a flow part).	W_04 U_05 K_01 K_02 K_03
8	A project of the Imhoff settling tank (dimensioning the fermentation chamber).	W_04

		U_05 K_01 K_02 K_03
9	Dimensioning a biological deposit for reducing carbon compounds.	W_04 U_01 U_04 K_01 K_02 K_03
10	Dimensioning a biological deposit for reducing nitrogen compounds (nitrification). Single-step and two-step systems.	W_04 U_01 K_01 K_02 K_03
11	Calculations and dimensioning secondary settling tanks after biological deposits.	W_04 U_05 K_01 K_02 K_03
12	Selecting and dimensioning deposit pumping plant.	W_04 U_02 K_01 K_02 K_03
13	The principles of preparing a profile after the sewage path/track.	W_04 U_02 K_01 K_02 K_03
14	A topographical plan of terrain development.	U_01 K_01 K_02 K_03

Assessment methods

Module outcome code	**Assessment methods** *(Method of assessment; for module skills − reference to specific project, laboratory and similar tasks)*
W_01	An examination
W_02	An examination
W_03	An examination
W_04	An examination and a project
W_05	An examination
W_06	An examination
U_01	A project
U_02	An examination and a project
U_03	An examination
U_04	A project
U_05	A project
K_01	A project
K_02	An examination and a project
K_03	A project

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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)	**2**
5	Contact hours: participation in project-based classes	**30**
6	Contact hours: meetings with a project module leader	**2**
7	Contact hours: attendance at an examination	**2**
8		
9	**Number of contact hours**	**51** *(total)*
10	**Number of ECTS credits for contact hours** *(1 ECTS credit =25-30 hours of study time)*	**2,04**
11	Private study hours: background reading for lectures	**14**
12	Private study hours: preparation for classes	
13	Private study hours: preparation for tests	
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	**25**
18	Private study hours: preparation for an examination	**10**
19		
20	**Number of private study hours**	**49** *(total)*
21	**Number of ECTS credits for private study hours** *(1 ECTS credit =25-30 hours of study time)*	**1,44**
22	**Total study time**	**100**
23	**Total ECTS credits for the module** *(1 ECTS credit =25-30 hours of study time)*	**4**
24	**Number of practice-based hours** *Total practice-based hours*	**57**
25	**Number of ECTS credits for practice-based hours** *(1 ECTS credit =25-30 hours of study time)*	**2,28**

E. READING LIST

References	Metcalf & Eddy , George Tchobanoglous , H. David Stensel Ryujiro Tsuchihashi , Franklin Burton *Wastewater Engineering: Treatment and Resource* , McGraw-Hill Education, Boston, 2013 Ronald L. Droste , *Theory and practice of water and wastewater treatment*, New York, John Wiley & Sons, 1997 Frank R. Spellman, *Mathematics Manual for Water and Wastewater Treatment Plant Operators, Second Edition: Wastewater Treatment Operations: Math Concepts and*

	Calculations, CRC Press, 2014 *Ronald W. Crites, E. Joe Middlebrooks, Robert K. Bastian,* Natural Wastewater Treatment Systems, Second Edition*, CRC Press, 2014* *Rumana Riffat ,* Fundamentals of Wastewater Treatment and Engineering, *CRC Press, 2012* D. G. Rao, R. Senthilkumar, J. Anthony Byrne, S. Feroz, *Wastewater Treatment: Advanced Processes and Technologies,* CRC Press, 2012
Module website	