MODULE SPECIFICATION

Module code	
Module title in Polish	*Chemia Sanitarna*
Module title in English	**Chemistry for Sanitary Engineering**
Module running from the academic year	2017/2018

A. MODULE IN THE CONTEXT OF THE PROGRAMME OF STUDY

Field of study	Environmental Engineering First-cycle full-time programme
Level of qualification	1st degree (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
Organisational unit responsible for module delivery	Department of Water and Wastewater Technology
Module co-ordinator	Jarosław Gawdzik, PhD hab.
Approved by:	Lidia Dąbek, PhD hab., Professor of the University

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 3
Semester in the academic year in which the module is taught	winter semester (winter semester/summer semester)
Pre-requisites	None (module code/module title, where appropriate)
Examination required	(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	15		45		

Politechnika Świętokrzyska
al. Tysiąclecia Państwa Polskiego 7; 25-314 Kielce
tel.: 41 34 24 850, fax: 41 34 42 860
e-mail: wisge@tu.kielce.pl

C. LEARNING OUTCOMES AND ASSESSMENT METHODS

Module aims	The aim of the module is to acquaint students with the types of contamination present in water and sewage, the processes of their transformations, and the issues connected with water and sewage analysis. The acquired knowledge is utilised by students during modelling and optimisation of unit processes applied both during drinking water as well as sewage treatment.

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 has fundamental knowledge of chemistry.	l/l	IŚ_W01	T1A_W01 T1A_W02
W_02	A student is knowledgeable about basic biological and chemical processes taking place in the aqueous environment.	l/l	IŚ_W07	T1A_W01 T1A_W03 T1A_W08
W_03	A student knows basic connections between the phenomena occurring in nature and anthropogenic pressure.	l/l	IŚ_W16	T1A_W03 T1A_W05 T1A_W07 T1A_W08
U_01	A student can obtain information from the literature on the subject and other sources.	l	IŚ_U01 IŚ_U06	T1A_U01 T1A_U02 T1A_U03 T1A_U04 T1A_U05 T1A_U06 T1A_U08 T1A_U09
U_02	A student can work individually and in a team.	l	IŚ_U02	T1A_U01 T1A_U05 T1A_U07
U_03	A student can conduct an experiment which facilitates assessing the quality of water and sewage (a student can also interpret research results).	l	IŚ_U08 IŚ_U26	T1A_U08 T1A_U09 T1A_U11 T1A_U15
U_04	A student can correctly interpret the links between the activity of a man and the nature of phenomena occurring in the environment.	l/l	IŚ_U09	T1A_U01 T1A_U04 T1A_U10
K_01	A student is capable of formulating conclusions and describing the results of the obtained work. A student is also responsible for the reliability of the obtained results.	l	IŚ_K02 IŚ_K07	T1A_K02 T1A_K05 T1A_K07
K_02	A student is aware of technical progress and the necessity of implementing modern water analysis systems.	l/l	IŚ_K09	T1A_K02
K_03	A student understands the necessity of passing knowledge as regards water and sewage chemistry to the society.	l	IŚ_K06	T1A_K06 T1A_K07

Module content:

1. Topics to be covered in the lectures

No.	Topics	Module outcome code
1.	The characteristics of the natural environment, environment elements. The tasks of sanitary chemistry in environmental protection and renovation. Examining the factors of anthropogenic impact in environmental components. The effects of environmental pollution with physical, chemical, and biological factors.	W_01 W_03 U_01
2.	The contamination of natural waters. Poland's water balance. The effects of a man's interference into biological balance of waters. Quality norms concerning water.	W_01 W_02 U_01 U_04 K_03
3.	Sorption capability of pollutants in soil. Migration of pollutants to surface water. Oil-based substances in soil environment. The role of water in nature. Natural processes occurring in water. The process of self-purification of water in natural conditions. The effects of disturbing ecological balance.	W_01 W_02 W_03 U_04 K_03
4.	The description of properties concerning water particles. Discussing the features of water particles in the physical, chemical, environmental, and climatological aspect.	W_01 W_02 U_01
5.	Solving gases in water (absorption). The solubility of gases from atmospheric air in natural waters. The role of oxygen in natural waters. The significance of oxygen for biological life. The significance of oxygen for the processes of water purification and sewage treatment.	W_01 W_02 W_03
6.	The solubility of solid bodies in water and sewage. The effects of deposition of deposits and salt hydrolysis on the quality of water. The occurrence of heavy metals in water and sewage. The utilisation of the precipitation process in the technologies of water as well as sewage purification processes (to remove metals in the form of sulphides and hydrooxides. Alternative methods of removing metals from waters.	W_01 W_02 W_03 U_01 U_04 K_02
7.	Water solutions. Water hardness. The acidity and alkalinity of water. Carbon-calcium equilibrium. Water corrosivity.	W_01 W_02 U_01
8.	The equilibrium of solutions of two solvents not mixing with each other; the fundamentals of extraction, the utilisation of the sewage removal technology in analytical methods.	W_01 W_02 U_01
9.	Driving force of chemical reactions. The rate of biochemical reactions. Biochemical oxygen demand (reaction rate constant). Interpreting reaction kinetics in the biochemical oxygen demand process.	W_01 W_02 W_03 U_01 U_04
10.	The fundamentals of the osmosis and dialysis process (their utilisation in the sewage treatment technology. Sample applications.	W_01 U_01 U_04 K_02
11.	Interphase surface. Interactions at phase boundaries. Water stability. Metal corrosion in the atmospheric and aqueous environment as well as in soil.	W_01 W_02 U_01
12.	Ionic exchange. The fundamentals of sorption processes. Their utilisation in the technologies of treating the elements of the natural environment.	W_01 W_02

		K_02
13.	Colloids (their characteristics, division, and properties). Reference the environment elements. The stabilisation and destabilisation of colloids. Utilising knowledge on colloids in the water and sewage treatment technology.	W_01 W_02 U_01 K_02
14.	The division of water. The indicators characterising water quality. Physical and chemical indicators. The most important inorganic water contaminants. The characteristics of hazards.	W_01 U_01 U_04 K_03
15.	Water contamination with organic compounds. The characteristics of hazards. Hummus compounds in the soil and aqueous environment.	W_02 W_03 U_04 K_03

Module content:

2. Topics to be covered in the laboratories

No.	Topics	Module outcome code
1.	Orientation class. Information on the conditions concerning obtaining a credit. OHS principles. Students' duties during laboratory class assignments and after completing them. Familiarising students with the laboratory equipment.	W_01
2.	Physical tests concerning water. Conductivity. Opacity. Colour. Scent.	W_01 W_02 U_02 U_03 K_01
3.	Water chemical tests. Dissolved, mineral, and ethereal bodies. Acidity, alkalinity.	W_01 W_02 U_02 U_03 K_01
4.	Calculating CO_2 (free, aggressive, and adjacent). Assessing the corrosivity of water. Water hardness.	W_01 W_02 U_02 U_03 K_01
5.	Marking iron (II) and iron (III). The methods of marking chlorides.	W_01 W_02 U_02 U_03 K_01
6.	Marking sulphides with the scales method.	W_01 W_02 U_02 U_03 K_01
7.	Nitrides. Marking ammonium nitrogen. Marking nitrate (III) and nitrate (V) nitrogen.	W_01 W_02 U_02 U_03 K_01
8.	Dissolved oxygen. BOD_5, water oxidisability. Chemical oxygen demand of water.	W_01 W_02 W_03 U_02 U_03 K_01
9.	Residual useful chlorium. Marking residua useful chloride with the	W_01 W_02

	iodemetric method. Marking the residual free and bonded chlorine with the use of methyloorange and potassium bromide.	U_02 U_03 K_01
10.	Marking the contents of nickel and cobalt in the soil and aqueous environment with the colorometric methods as well as with the method of atomic absorption.	W_01 W_02 U_02 U_03 K_01 K_02
11.	Chemical examination of sewage. Marking orthophosphates with the molybdenium method.	W_01 W_02 U_02 U_03 K_01
12.	Marking anion-active detergents.	W_01 W_02 U_02 U_03 K_01
13.	Taking the samples of sewage and sewage deposits.	W_01 W_02 U_02 U_03 K_01
14.	Control sewage tests. Total organic carbon.	W_01 W_02 W_03 U_02 U_03 U_04 K_02
15.	Marking nitrogen compounds in sewage.	U_02 U_03 U_04 K_01 K_02

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 and a test
W_02	An examination and a test
W_03	An examination and a test
U_01	An examination
U_02	A test
U_03	A test
U_04	An examination and a test
K_01	A test
K_02	An examination and a test
K_03	An examination

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	**45**
4	Contact hours: attendance at office hours (2-3 appointments per semester)	**3**
5	Contact hours: participation in project-based classes	
6	Contact hours: meetings with a project module leader	
7	Contact hours: attendance at an examination	**4**
8		
9	**Number of contact hours**	***67 (total)***
10	**Number of ECTS credits for contact hours** *(1 ECTS credit =25-30 hours of study time)*	**2.7**
11	Private study hours: background reading for lectures	**10**
12	Private study hours: preparation for classes	
13	Private study hours: preparation for tests	
14	Private study hours: preparation for laboratories	**2**
15	Private study hours: writing reports	**2**
16	Private study hours: preparation for a final test in laboratories	**4**
17	Private study hours: preparation of a project/a design specification	
18	Private study hours: preparation for an examination	**15**
19		
20	**Number of private study hours**	***33 (total)***
21	**Number of ECTS credits for private study hours** *(1 ECTS credit =25-30 hours of study time)*	**1.3**
22	**Total study time**	**100**
23	**Total ECTS credits for the module** *(1 ECTS credit =25-30 hours of study time)*	**4.0**
24	**Number of practice-based hours** *Total practice-based hours*	**53**
25	**Number of ECTS credits for practice-based hours** *(1 ECTS credit =25-30 hours of study time)*	**2.1**

E. READING LIST

References	1. Gary W vanLoon, Stephen J.Duffy: „Environmental Chemistry", Oxford Univesity Press 2010. 2.Tom G. Spiro, Kathleen L. Purvis-Roberts, and William M. Stigliani:"Chemistry of the Environment", 3rd Edition, August 2011 by University Science Books 3. Gray N.F.: „Water Technology: An Introduction for Environmental Scientists and Engineers, 3rd Edition", Butterworth-Heinemann, 2010. 4. Shun Dar Lin, C. Lee: "Water and Wastewater Calculations Manual " McGraw Hill Professional, 2007.

Module website	

Politechnika Świętokrzyska
al. Tysiąclecia Państwa Polskiego 7; 25-314 Kielce
tel.: 41 34 24 850, fax: 41 34 42 860
e-mail: wisge@tu.kielce.pl