Name of the module/subject Environmental Chemistry Environmental Chemistry Field of study Environmental Engineering First-cycle Studies Profile of study (general academic, practical) (DTaK) Form of study (full-time, part-time) Cycle of study: Form of study (full-time, part-time) Formal: trabela kruszelincka, PhD Formal: trabela kruszelincka (PhD) Formal: trabela kruszelincka (P			STUDY MODULE DE	SCRIPTION FORM				
Field of study       Profile of study       Year /Semester         Elective path/specialty       -       Profile of study       1/1         Subject of fera dir:       Course (computsory, elective)       1/1         Subject of fera dir:       Poilsh       Obligatory         Cycle of study:       Form of study (full-time, part-time)       No. of credits         Execture:       30       Classes:       15       Laboratory:       -       Project/seminars:       -       4         Education areas and fields of science and art       (university-wide, from another field)       (brak)       ECT3 distribution (number and %)         Education areas and fields of science and art       Eable and the study program (Basic, major, other)       (university-wide, from another field)       (brak)         Education areas and fields of science and art       Eable and Kruszeninkka Bput poznan pl tel. +48 608 021 656       Foculty of Civil and Environmental Engineering Berdychowo 4, 60-965 Poznan'       Foculty of Civil and Environmental Engineering Berdychowo 4, 60-965 Poznan'         1       Knowledge       The knowledge of chemistry at the high school level, the basic level       1         2       Skills       The solving of equations and systems of algebraic equations, the formulation of the chemical and physic-chemical problems in mathematics languages, solve the simple differential and logarithmic equations       3								
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and %)         Responsible for subject / lecturer:         Izabela Kruszelnicka PhD         email: e-mail: izabela.kruszelnicka@put.poznan.pl         tel. +48 608 021 656         Wydział Faculty of Civil and Environmental Engineering         Berdychowo 4, 60-965 Poznań         Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge         2       Skills         3       Social         competencies         Assumptions and objectives of the course:         The aim of the education in the context of this course is to strengthen and broaden the students knowledge of the basic areas of chemistry necessary for further study environmental engineering. The students will have knowledge of the basic areas of chemistry necessary for further study environmental engineering. The students will have knowledge of the basic areas of chemistry necessary for further study environmental engineering. The students will have knowledge of the basic areas of chemistry necessary for further study environmental engineering. The students will have knowledge of the structures and physical chemistry.         Study outcomes and reference to the educational results for a field of study         1. The student knows the basic concepts and laws of chemistry - [K_W01, K_W03, [2.W07, [3.W07, [3.W07, [4.W03, K_W07]]         2. Skills       Interstand the importance of chemical reactions. They will be write based on interace of chemical requilibrium and kinetics of the processes. During the course students will have knowledge of the basi	Educati		\ /	(	,			
Izabela Kruszelnicka PhD       Izabela Kruszelnicka, PhD         email: z-mail: izabela, kruszelnicka@put, poznan, pl       Izabela Kruszelnicka@put, poznan, pl         tel. +48 608 021 656       Wydział Facutty of Civil and Environmental Engineering       Bacutty of Civil and Environmental Engineering         Berdychowo 4, 60-965 Poznań       Facutty of Civil and Environmental Engineering       Barduty of Civil and Environmental Engineering         Prerequisites in terms of knowledge, skills and social competencies:       The knowledge of chemistry at the high school level, the basic level         2       Skills       The solving of equations and systems of algebraic equations, the formulation of the chemical and physico-chemical problems in mathematics languages, solve the simple differential and logarithmic equations         3       Social competencies         The awareness of the need to constantly update and supplement knowledge of the basic areas of chemistry necessary for further study environmental engineering. The students will have knowledge of the structures and properties of chemical compounds and chemical reactions. They will learn about the factors affecting their reactivity. The students undue taboratory experiments and analyzing the results for a field of study         Study outcomes and reference to the educational results for a field of study         Knowledge:         1       The student knows the basic concepts and laws of chemistry - [K_W01, K_W03, ]         2       Skills         3       Social compounds and chemical reactions. The studen	Education	on areas and tields of sci	ence ano art					
email: e-mail: izabela.kruszelnicka @put.poznan.pl       email: izabela.kruszenicka @put.poznan.pl         tel. +48 608 021 656       tel. +48 608 021 656         Wydział Faculty of Civil and Environmental Engineering       Berdychowo 4, 60-965 Poznań         Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge         2       Skills         3       Cocial competencies         3       Social competencies         4       The solving of equations and systems of algebraic equations, the formulation of the chemical and physico-chemical problems in mathematics languages, solve the simple differential and logarithmic equations         3       Social competencies       The awareness of the need to constantly update and supplement knowledge of the basic areas of chemistry necessary for further study environmental engineering. The students klil have knowledge of the basic areas of chemistry necessary for further study environmental engineering. The students will have knowledge of the students will botain the ability to design and conduct laboratory experiments and analyzing the results. The students will botain the ability to design and conduct laboratory experiments and analyzing the results for a field of study         Knowledge:       1. The student knows the basic concepts and laws of chemistry - [K_W01, K_W03, ]         2. The student knows the basic concepts and laws of chemistry - [K_W01, K_W03, Sruv07, ]         3. The student knows the pasic domestion of the upperties of the substance depending on the type of bonds present in the intra-	Resp	Responsible for subject / lecturer: Responsible for subject / lecturer:						
Berdychowo 4, 60-965 Poznań         Berdychowo 4, 60-965 Poznań           Prerequisites in terms of knowledge, skills and social competencies:         Image: Competencies in terms of knowledge, skills and social competencies:           1         Knowledge         The knowledge of chemistry at the high school level, the basic level           2         Skills         The solving of equations and systems of algebraic equations, the formulation of the chemical and physico-chemical problems in mathematics languages, solve the simple differential and logarithmic equations           3         Social competencies         The awareness of the need to constantly update and supplement knowledge and skills.           Assumptions and objectives of the course:         The awareness of the need to constantly update and supplement knowledge of the basic areas of chemistry necessary for further study environmental engineering. The students will have knowledge of the basic areas of chemistry necessary for further study environmental equilibrium and kinetics of the processes. During the course students will botain the ability to design and conduct laboratory experiments and analyzing the results. The students will be write based on literature about the problems in the basic and physical chemistry.           Study outcomes and reference to the educational results for a field of study           Knowledge:           1. The student knows the basic concepts and laws of chemistry - [K_W01, K_W03, ]           2. The student has knowledge of the properties of the inorganic compounds and the thermodynamic parameters of the chemical reactions. The student whow the types of the inorganic compounds and the the	email: e-mail: izabela.kruszelnicka@put.poznan.pl			email: izabela.kruszenicka@put.poznan.pl				
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<ul> <li>Knowledge:</li> <li>1. The student knows the basic concepts and laws of chemistry - [K_W01, K_W03, ]</li> <li>2. The student has knowledge of the properties of the substance depending on the type of bonds present in the intra- and intermolecular reactions. The student know the types of the inorganic compounds and the thermodynamic parameters of the chemical reaction. The student understand the impact of concentration, temperature and catalyst on the rate of chemical reactions - [K_W01, K_W03]</li> <li>3. The student knows the principles and methods of computational chemistry (chemical laws, formulas and chemical equations, concepts: the concentration of solutions and reactions in solutions) - [K_W01, K_W03, K_W07 ]</li> <li>4. The student knows and understands the chemical phenomena occurring in the environment - [K_W01, K_W03, K_W07, ]</li> <li>5. The student has knowledge of the ways and methods of prevention and reduction of the chemical contaminants in the environment - [K_W05, K_W06, K_W07]</li> </ul>	The aim of the education in the context of this course is to strengthen and broaden the students knowledge of the basic areas of chemistry necessary for further study environmental engineering. The students will have knowledge of the structures and properties of chemical compounds and chemical reactions. They will learn about the factors affecting their reactivity. The students understanding the importance of chemical equilibrium and kinetics of the processes. During the course students will obtain the ability to design and conduct laboratory experiments and analyzing the results. The students will be write based on literature about the problems in the basic and physical chemistry.							
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<ol> <li>The student has knowledge of the properties of the substance depending on the type of bonds present in the intra- and intermolecular reactions. The student know the types of the inorganic compounds and the thermodynamic parameters of the chemical reaction. The student understand the impact of concentration, temperature and catalyst on the rate of chemical reactions - [K_W01, K_W03]</li> <li>The student knows the principles and methods of computational chemistry (chemical laws, formulas and chemical equations, concepts: the concentration of solutions and reactions in solutions) - [K_W01, K_W03, K_W07 ]</li> <li>The student knows and understands the chemical phenomena occurring in the environment - [K_W01, K_W03, K_W07, ]</li> <li>The student has knowledge of the ways and methods of prevention and reduction of the chemical contaminants in the environment - [K_W05, K_W06, K_W07]</li> </ol>	Know	/ledge:						
equations, concepts: the concentration of solutions and reactions in solutions) - [K_W01, K_W03, K_W07 ] 4. The student knows and understands the chemical phenomena occurring in the environment - [K_W01, K_W03, K_W07, ] 5. The student has knowledge of the ways and methods of prevention and reduction of the chemical contaminants in the environment - [K_W05, K_W06, K_W07]	<ol> <li>The student knows the basic concepts and laws of chemistry - [K_W01, K_W03, ]</li> <li>The student has knowledge of the properties of the substance depending on the type of bonds present in the intra- and intermolecular reactions. The student know the types of the inorganic compounds and the thermodynamic parameters of the chemical reaction. The student understand the impact of concentration, temperature and catalyst on the rate of chemical reactions - [K_W01, K_W03]</li> </ol>							
5. The student has knowledge of the ways and methods of prevention and reduction of the chemical contaminants in the environment - [K_W05, K_W06, K_W07]	equation	ons, concepts: the cor	centration of solutions and reaction	s in solutions) - [K_W01, K_W	03, K_W07 ]			
	5. The	student has knowledg	ge of the ways and methods of preve					
		-	00, N_W07]					
	U.U.I.C	-						

1. The student is able to obtain information on the chemical subjects from the literature, databases and other sources  $-[K\_U01]$ 

2. The student is able to perceive the relationship between the structure of the substance and its physical and chemical properties; The student can balance reaction equations with redox reactions. He is able to calculations molar and percentage concentration, determination of pH, distinguishes between the basic types of bonds in the molecules. -  $[K_U01, K_U04, K_U11]$ 

3. The student is able to practically apply the knowledge gained in the description of basic chemical methods for the removing chemical pollutants from the environment. - [K\_U01, K\_U03 K\_U04, K\_U08, K\_U09, ]

### Social competencies:

1. The student understands the need for teamwork in solving theoretical and practical problems - [K\_K03, K\_K04]

2. The student is aware that knowledge of chemistry is necessary in order to properly solve the problems in the profession of the environmental engineer - [K05. K\_K07K\_]

3. The student sees the need for systematic deepening and broadening its competence - [K\_K01]

## Assessment methods of study outcomes

Lecture

? 1-piece written final exam time of 45 minutes, the exam includes checking skills (1 task), and knowledge test (3 questions); ? In addition, continuous assessment for all classes (rewarding activity).

Classes

? 2 mini-written tests during the semester;

? Final written test;

? In addition, continuous assessment for all classes (rewarding activity).

The possibility of obtaining additional points for the activity in the classroom, especially for:

? reporting any confusion conducting

? propose other ways of solving problems;

? assistance in the improving teaching materials;

? identifying opportunities to improve the teaching process.

?

Grading Scale:

Number of points rating 3,0-2,8 very good (A) 2,7- 2,5 good plus (B) 2,4 2,2 good (C) 2,1 1,9 sufficient plus (D)

1.8 1.6 satisfactory (E)

below 1.6 insufficient (F)

## **Course description**

The Lecture

Basic definitions and laws of chemistry. Elementary particles. Construction of atoms and molecules. Chemical elements. The periodic table of elements. The valence bond theory and the theory of molecular orbitals. The chemical bonds. Electronegativity and polarity. Intermolecular interaction. The chemical reactions and chemical equations. The rate of chemical reactions, the effect of concentration and temperature. Chemical equilibrium. Redox reactions. Electrolytes, dissociation, pH. Solutions and their properties. Fundamentals of electrochemistry: electrochemical series of the metals, galvanic cell, electrolysis. Outline of organic chemistry. Selected groups of organic compounds: hydrocarbons, alcohols, organic acids, amines, thiols, polymers.

#### Classes

Calculations based on the chemical formula of the compound. molar and procentage concentration, mixing, dilution and increasing the concentration of the solutions. Equilibria in aqueous electrolyte solutions: electrolytic dissociation, the degree of dissociation, ionic product of water, the hydrogen ion exponent - pH. redox reactions

### Basic bibliography:

1. Szperliński Z., Chemia w ochronie i inżynierii środowiska, tomy 1-3, Oficyna Wydawnicza PW, W-wa 2002

2. Sienko M.J., Plane R.A., Chemia ? podstawy i zastosowania, WNT, W-wa, 1999.

3. Whittaker A.G., Mount A.R., Heal M.R., Krótkie wykłady, Chemia fizyczna, PWN S.A., W-wa 2003.

# Additional bibliography:

- 1. Cox P.A., Krótkie wykłady. Chemia nieorganiczna, PWN S.A., W-wa 2003.
- 2. Cox P.A. Krótkie wykłady. Chemia organiczna, PWN S.A., W-wa 2003
- 3. Dojlido J.R.: Chemia wód powierzchniowych, Wydawnictwo Ekonomia i Środowisko, Białystok, 1995
- 4. Lee J.D., Zwięzła chemia nieorganiczna, PWN, W-wa, 1994.
- 5. Pauling L., Pauling P., Chemia, PWN, W-wa, 1997

# Result of average student's workload

. Participation in classes . Participation in consultations related to the implementation of classes		Time (working hours)
1. Participation in lectures		30
2. Participation in classes	15	
3. Participation in consultations related to the implementation of cla	6	
4. Preparing for the end credits of the classes	28	
5. Preparing for the end credits of the lectures	51	
Student's wo	rkload	
Source of workload	hours	ECTS
Total workload	125	5
Contact hours	51	2
Practical activities	15	1