

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Water and Wastewater Chemistry</b>		Code <b>1010102211010130167</b>
Field of study <b>Environmental Engineering Second-cycle</b>	Profile of study (general academic, practical) <b>(brak)</b>	Year /Semester <b>1 / 1</b>
Elective path/specialty <b>Water Supply, Water and Soil Protection</b>	Subject offered in: <b>Polish</b>	Course (compulsory, elective) <b>obligatory</b>
Cycle of study: <b>Second-cycle studies</b>	Form of study (full-time, part-time) <b>full-time</b>	
No. of hours Lecture: <b>30</b> Classes: <b>30</b> Laboratory: <b>15</b> Project/seminars: <b>-</b>		No. of credits <b>5</b>
Status of the course in the study program (Basic, major, other) <b>(brak)</b>		(university-wide, from another field) <b>(brak)</b>
Education areas and fields of science and art <b>technical sciences</b> <b>Technical sciences</b>		ECTS distribution (number and %) <b>5 100%</b> <b>5 100%</b>
<b>Responsible for subject / lecturer:</b> dr inż. Dobrochna Ginter-Kramarczyk email: dobrochna.ginter-kramarczyk@put.poznan.pl tel. 616653662 Faculty of Civil and Environmental Engineering ul. Berdychowo 4, 61-118 Poznań		<b>Responsible for subject / lecturer:</b> dr inż. Izabela Kruszelnicka email: izabela.kruszelnicka@put.poznan.pl tel. 616653662 Faculty of Civil and Environmental Engineering ul. Berdychowo 4, 61-118 Poznań
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
1	<b>Knowledge</b>	The scope of scientific knowledge (geography, biology, chemistry, physics) at the level of engineering studies and knowledge of the subject on the basic issues of physical-chemical water treatment and water pollution and waste from literature, databases and other carefully selected sources.
2	<b>Skills</b>	A student identifies and describes the limiting factors in the aquatic environment. He/She is able to distinguish and characterize aquatic ecosystems. He/She is able to identify the causes and effects of various aquatic pollutants and their impact on human health.
3	<b>Social competencies</b>	Awareness of the need for the continuous updating and supplementing knowledge and skills
<b>Assumptions and objectives of the course:</b> -passing thorough knowledge of the chemistry of water and wastewater, chemical and physical processes occurring in aquatic environment, the basis of technical and legal framework for the prevention, formation and reduction of water pollution		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b> 1. . A student has knowledge about water as a basic component of the environment. He knows the natural distribution of inland waters. He/She knows the effect of water constituents on the biochemical processes of the environment - [[K2_W01K2_W03, K2_W05]] 2. A student has knowledge of the technical methods of pollution prevention and reduction of pollution of both water and wastewater. He/She knows the sources and types of pollution of natural waters and the impact of water pollution on aquatic life - [[K2_W03, K2_W07]] 3. A student knows short and long term processes occurring in the aquatic environment, he/she has knowledge of the biogeochemical cycles in aquatic environments - [[K2_W03, K2_W05,]] 4. A student has knowledge of the wastewater and sewage sludge as pollutants. He/She knows the specific organic and mineral substances present in wastewater and their impact on the environment and their effects on living organisms - [[K2_W03, K2_W07, K2_W04]] 5. A student knows how to implement water protection and wastewater treatment policy. He/She knows the legal basis for the protection of the environment and environmental services organization - [[K2_W02, K2_W03, K2_W05, K2_W08]]		
<b>Skills:</b>		

1. . A student can obtain information about the degree water of contamination and wastewater load, from literature, databases and other carefully selected sources - [[K2\_U01]]
2. A student can make mathematical calculations under the laws of chemistry and physics for the test water or sewage - [[K2\_U01, K2\_U04,]]
3. . A student is able to apply the norms and standards for assessing the quality of water and wastewater in practice - [[K2\_U01, K2\_U05 K2\_U08, K2\_U09,]]

**Social competencies:**

1. A student understands the need for teamwork in solving theoretical and practical problems. - [[K2\_K03, K2\_K04]]
2. A student is aware of the need to verify the legal aspects related to the protection of water and wastewater treatment - [[K2\_K05]]
3. A student sees the need for systematic deepening and broadening his/her competence - [[K2\_K01]]

**Assessment methods of study outcomes**

-Lecture

- A written test after the lectures hale finished, the test will last for 90 minutes; (W01, W03, W05, W07)
- Individual discussion possible after the results of a written test.

Tutorials

- 2 mini-written tests during the semester;
- 1 written assignment test (finall),the test will last for 90 minutes, (W01, W03, U01)
- Assessment the accuracy of independently solved tasks (U01, U03, K01)
- Continuous assessment for each classes (rewarded activity)

Laboratory

- each laboratory practice will be preceded by an entrace exam that will check students? readiness to complete an experiment, the test will last for 90 minutes (U01, U08)
- written assignment test (final),
- the development and defense of individual or team written reports on each exercise (U01, U04, U09, W07, W05)

Scale of written evaluations:

- 50% - 60% sufficient
- 61% - 70% positive plus
- 71% - 80% good
- 81 - 90% good plus
- 91 - 100% very good

**Course description**

- The role of water in the formation of the Earth's climate. Terrestrial water cycle. Water resources in Poland.
  - Construction of a water molecule, dipole moment, hydrogen bonding. Physical states of water, the structure of liquid water, steam and ice. Phase diagram of water, the phenomena associated with phase transitions.
  - Physico-chemical analysis of natural ingredients and impurities comprising water and sewage.
  - The physical properties of water: dielectric constant, specific heat, thermal conductivity, surface tension, conductivity, absorption of light radiation, the solubility of gases and liquids. The density of water and related phenomena. The chemical properties of water: dissociation, the ion product, reaction, the isotope.
  - Water enrichment with minerals: chemical composition and structure of minerals, the physical and chemical soil weathering processes.
  - The role of ion exchange in shaping the composition of natural waters. Aquatic dispersions.
  - Evolution of the composition of water from precipitation to groundwater.
  - Classification of natural waters by the ionic composition and degree of mineralization. Carbon dioxide. Carbonate-calcium balance. Basic indicators of the ionic composition of the water
  - Eutrophication of waters. Nitrogenous compounds as indicators of water pollution. Heavy metals in water and their toxic effects in the water. Natural organic compounds in water.
  - Water pollution by urban and industrial wastewater. Contamination of oil and its derivatives. Contamination of synthetic organic compounds: phenols, surfactants, pesticides, polycyclic aromatic hydrocarbons.
  - By-products of water disinfection. Radioactive pollution. Estimating health risks. Standards of water quality and water treatment.
- Learning methods: information lecture, lecture with multimedia presentation, problem lecture; tutorials:accounting exercises; laboratory:laboratory experience

<b>Basic bibliography:</b>		
1. Dojlido J.R.: Chemia wód powierzchniowych, Wydawnictwo Ekonomia i Środowisko, Białystok, (1995).		
2. Hermanowicz W. i inni, Fizyko-chemiczne badanie wody i ścieków, Arkady, Warszawa, (1998)		
3. Hermanowicz W., Dojlido J., Dożańska W., Koziorowski B., Zerbe J., Fizyko-chemiczne badanie wody i ścieków, Arkady, Warszawa, (1999)		
4. Gomółka E., Szaynok A., Chemia wody i powietrza, Wrocław 1997		
<b>Additional bibliography:</b>		
1. Anielak A.M., Chemiczne i fizykochemiczne oczyszczanie ścieków, PWN, Warszawa, 2002		
2. Atkins P.W., Chemia fizyczna, Wyd. Naukowe PWN, Warszawa 2001		
3. Wyrwas B., Kruszelnicka I., Ginter- Kramarczyk D., Wpływ wybranych anionowych i niejonowych ZPC na pracę osadu czynnego, Przemysł chemiczny 90/4 2011		
4. Ginter - Kramarczyk i in. Tarażniejszość i przyszłość produktów leczniczych w społeczeństwie i środowisku Przemysł chemiczny 92/5 2013		
<b>Result of average student's workload</b>		
<b>Activity</b>	<b>Time (working hours)</b>	
1. Participation in lectures	30	
2. Participation in auditorium exercises	30	
3. Laboratory classes	15	
4. Participation in consultations relating to the implementation of the tutorials	2	
5. Preparing to the final exam of tutorials	20	
6. Preparation for the exam and the presence in the exam	20	
7. Preparing for laboratory exercises and the final exams	15	
<b>Student's workload</b>		
<b>Source of workload</b>	<b>hours</b>	<b>ECTS</b>
Total workload	125	5
Contact hours	77	3
Practical activities	45	2