COURSE DESCRIPTION CARD - SYLLABUS

Course name
Water and Wastewater Chemistry [N2IŚrod1-ZwWOWiG>CHW]

Course

Field of study
Environmental Engineering

Year/Semester
1/1

Area of study (specialization)
Water Supply, Water and Soil Protection

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
18

Laboratory classes
10

Other (e.g. online)
0

Tutorials
18

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

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Prerequisites

1. Knowledge: 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. Skills: 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. Social competencies: Awareness of the need for the continuous updating and supplementing knowledge and skills

Course objective

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

Course-related learning outcomes

Knowledge:
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.
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.
3. A student knows short and long term processes occuring in the aquatic environment, he/she has knowledge of the biogeochemical cycles in aquatic environments.
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.
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.

Skills:
1. . A student can obtain information about the degree water of contamination and wastewater load, from literature, databases and other carefully selected sources.
2. A student can make mathematical calculations under the laws of chemistry and physics for the test water or sewage.
3. . A student is able to apply the norms and standards for assessing the quality of water and wastewater in practice.

Social competences:
1. A student understands the need for teamwork in solving theoretical and practical problems.
2. A student sees the need for systematic deepening and broadening his/her competence.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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

Programme content

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.

Teaching methods

Learning methods: information lecture, lecture with multimedia presentation, problem lecture; tutorials:accounting exercises; laboratory:laboratory experience

Bibliography

Basic:
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

Additional:
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. Taraźniejszość i przyszłość produktów leczniczych w społeczeństwie i środowisku Przemysł chemiczny 92/5 2013

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	46	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	79	3,00