STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Sewage Treatment		**1010702311010710060**

Field of study	Profile of study (general academic, practical)	Year /Semester
Environmental Protection Technologies	**(brak)**	**1 / 1**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**full-time**

No. of hours				No. of credits
Lecture: **1**	Classes: **1**	Laboratory: **2**	Project/seminars: **-**	**4**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
(brak)	**(brak)**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**4 100%**
Technical sciences	**4 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of chemistry, physics and mathematics from the elevated degree studies in the fields: chemical technology, environmental technology, chemical and process engineering or other related fields. Knows the basic methods, techniques, tools and materials used in solving simple engineering tasks. He knows the rules for the protection of the environment associated with chemical production. Has knowledge of raw materials, products and processes used in the chemical industry also has basic information on the design, construction chemical energy.
2	**Skills**	Can work individually and in teams, able to plan and carry out experiments, interpreted the results and draw conclusions
3	**Social competencies**	Understand the need for continuous training and are aware of their responsibility for collaborative tasks related to teamwork

Assumptions and objectives of the course:

Gaining knowledge of the treatment of industrial wastewater with particular reference to toxic substances. Getting familiar with the technology used to liquidation or disposal of pollutants contained in the wastewater. Knowledge of methods of waste disposal and emissions produced during wastewater treatment processes. Skills of the laboratory experiments of wastewater treatment technologies.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Knows the basic rules of procedure in the neutralization of the impact of pollutants on the environment. - [K_W07]
2. Knows the basic rules of waste disposal and recycling of industrial waste - [K_W08]
3. Has detailed knowledge of technological solutions for environmental protection - [K_W13]

Skills:

1. Able to critically evaluate and verify the experimental results - [K_U08]
2. Can point out different methods of industrial waste utilization - [K_U11]
3. Uses the basic laws for the protection of the environment - [K_U16]
4. Has the skills to indicate the direction for the neutralization and disposal of atypical industrial waste - [K_U17]

Social competencies:

1. Is aware of the limitations of science and technology related to environmental protection. - [K_K02]
2. Is aware of emergence of moral and ethics problems in the context of professional activity - [K_K04]

Assessment methods of study outcomes

Evaluation of written answers in the subjects related to the theme of the laboratory.

Assessment of oral response and activity in the course of classes.

Design of the instalation of waste neutralization for a given process.

A written final exam.

Course description

1. Indicators of water pollutions, the legal standards relating to water and wastewater.
2. Technologies of neutralization of waste water containing heavy metals
3. Coagulation and flocculation processes used for the purification of waste water.
4. Adsorption and its application in wastewater treatment technologies.
5. Application of ion exchange processes.
6. The oxidation methods in wastewater treatment, neutralization of cyanides connected with the recovery of selected metals.
7. Neutralization and recovery of chromium from chromium waste.
8. Flocculation and its application to wastewater treatment.
9. Management of waste produced in the process of neutralization.
10. Galvanization and neutralization technologies (periodic, continuous, Lancy).
11. The calculations relevant for the chosen methods of waste water neutralization in metal finishing plant(consumption of reagents, processes, the proposed method of neutralization, amount of generated wastes)
12. Design calculations of ion exchangers.
13. Design principles of neutralization station for selected processes.
14. Laboratories: students carry out wastewater treatment with ammonium ions and some heavy metals (combined with the analysis of emissions that occur during the processes and the possibilities of recovery, neutralization of wastewater containing toxic materials, aplication of electrochemical methods.

Basic bibliography:

1. B.Bartkiewicz, Oczyszczanie ścieków przemysłowych, Wyd. Naukowe PWN, Warszawa 2010.
2. T.Stefanowicz, Gospodarka wodno-ściekowa i odpadowa w przemyśle elektrochemicznym, Wyd. Politechniki Poznańskiej, Poznań, 2001.
3. J.Łomotowski, A. Szpindor, Nowoczesne systemy oczyszczania ścieków, Arkady, Warszawa 2002.
4. A.M. Anielak, Chemiczne i fizykochemiczne oczyszczanie ścieków, Wyd. Naukowe PWN, Warszawa 2000

Additional bibliography:

1. L.K Wang, N.K. Shammas, Y.-T. Hung (eds) Advances in Hazardous Industrial Waste Treatment CRC Press, Taylor and Francis Group, Boca Raton Fl. USA 2009.
2. J. Coca-Prados, G. Gutiérrez-Cervelló (eds), Water Purification and Management, Springer, 2011.
3. S.A.K.Palmer, M.A.Breton, T.J.Nunno, D.M.Sullivan, N.F.Surprenant, Metal/Cyanide Containing Wastes Treatment Technologies, Pollution Technology Review No 158, Noyes Data Co, Park Ridge, New Jersey, 1988.
4. N.P.Cheremisinoff, Handbook of Water and Wastewater Treatment Technologies, Butterworth-Heinemann, U.S.A. 2002.

Result of average student's workload

Activity	Time (working hours)
1. Preparation for exam and exam	25
2. Preparation for classes and laboratories	20
3. Consultation	5
4. Lecture	15
5. Laboratory classes	30
6. Classes	15

Student's workload

Source of workload	hours	ECTS
Total workload	110	4
Contact hours	75	2
Practical activities	50	3