

Course title: <b>Waste products in water and sewage treatment Produkty odpadowe w oczyszczaniu wody i ścieków</b>		
Programme: <b>Environmental Engineering</b>		Code: <b>5.6.10</b>
Type of course: <b>Elective, module 5.6.</b>	Course level: <b>II-nd cycle degree</b>	Semester: <b>III</b>
Form of classes: <b>Lecture, laboratory</b>	Number of hours per week/meeting: <b>1L<sup>E</sup>, 2 Lab</b>	Credit points: <b>4 ECTS</b>
Education profile: <b>academic</b>		Course language: <b>English</b>

## **GUIDE TO THE SUBJECT**

### **I. COURSE CHART**

#### **COURSE OBJECTIVES**

- C.1. To relay to students knowledge on utilization technologies of waste products generated during water and wastewater treatment as well as on assessment methods of technological processes.
- C.2. To learn practical skills on sewage sludge properties which are necessary for designing technology of sludge treatment.
- C.3. To acquire a skill of technological and economical assessment of sewage sludge treatment processes.

#### **PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. The students are expected to have background knowledge in water and wastewater technology at level of I-st degree cycle.
2. In particular they are expected to have basic competences in engineering calculations and in laboratory work.
3. They are also expected to have ability to work in a team and knowledge about health and safety regulations.

#### **LEARNING OUTCOMES**

- EK 1 - has a knowledge in treatment methods of water treatment waste products, can critically evaluate technological processes
- EK 2 - has a knowledge in treatment methods of wastewater treatment waste products, can critically evaluate technological processes
- EK 3 - is able to evaluate and explain aerobic/ chemical stabilization effect on parameters of sewage sludge
- EK 4 - is able to compare and evaluate dynamics of changes in physical and chemical properties during stabilization of sewage sludge

EK 5 - is able to evaluate and compare the effectiveness of stabilization processes

### COURSE CONTENT

Form of classes - lectures	Hours
Characteristics of leachates, reject water and condensates generated during water treatment. Characteristics of sludge from water treatment	2
Treatment technologies of waste products from water treatment	4
Characteristics of sewage sludges generated during wastewater treatment	2
Processes used for treatment of sewage sludge: gravity thickening, flotation, preliminary conditioning, biochemical stabilization. Final utilization of sewage sludge. Treatment with other waste products. Innovative methods of sludge treatment.	5
Characteristic and treatment of reject water.	2
Form of classes - laboratory	Hours
Water and wastewater laboratory safety training	2
Preparation of sewage sludge for stabilization. Characteristics of raw sewage sludge (selected physicochemical properties of sewage sludge)	6
Aerobic/ chemical stabilization of sewage sludge (optional), control of stabilization process.	12
Analysis of sewage sludge after aerobic/ chemical process.	6
Preparation of laboratory work report.	3
Colloquium	1

### COURSE STUDY METHODS

1. multimedia presentation
2. classical board
3. laboratory models of sludge treatment installations

### METHODS OF ASSESMENT ( F - formative; S - summative)

F1 – performance during the laboratory
F2 – evaluation of laboratory work and preparation of laboratory report
P1 – exam
P2 – colloquium

### STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures .....	15 h
Participation in laboratories .....	30 h
Exam .....	2 h
<b>FACE-TO-FACE CONTACT WITH THE LECTURER, Hours/ECTS</b>	<b>47 h / 1,9 ECTS</b>
Preparation for laboratories .....	17 h
Preparation for colloquium.....	15 h
Preparation for exam .....	21 h

<b>STUDENT'S OWN WORK, hours/ECTS</b>	<b>53 h/ 2,1 ECTS</b>
<b>TOTAL HOURS IN SEMESTER</b>	<b>Σ 100 h</b>
<b>TOTAL NUMBER OF ECTS POINTS FOR THE COURSE</b>	<b>.4 ECTS</b>

#### **PRIMARY AND SUPPLEMENTARY TEXTBOOKS**

Janosz-Rajczyk M. (red.): Badania wybranych procesów oczyszczania ścieków, Wydawnictwo Politechniki Częstochowskiej, Częstochowa 2008
Gajowska L., Guberski S., Gutowski W., Mamak Z., Szperliński Z.: Laboratoryjne badania
Bień J., Wystalska K.: Osady ściekowe. Teoria i praktyka, Wydawnictwo Politechniki Częstochowskiej, Częstochowa 2011
Łomotowski J., Szpindor A.: Nowoczesne systemy oczyszczania ścieków, Arkady Warszawa 1999
Borkowski S.: Tlenowa stabilizacja termofilowa osadów ściekowych, Ochrona Środowiska, 2000, 4, 21-25
Hermanowicz W., Dojlido J., Kozirowski B., Zerbe J.: Fizyczno-chemiczne badanie wody i ścieków, Arkady, Warszawa 1999
Barbusiński K.: Intensyfikacja procesu oczyszczania ścieków i stabilizacji osadów nadmiernych z wykorzystaniem odczynnika Fentona, Zeszyty naukowe Politechniki Śląskiej, Zeszyt 5, Gliwice 2004.

#### **SUBJECT COORDINATOR (NAME, SURNAME, E-MAIL ADDRESS)**

1. dr inż. Ewa Wiśniowska, ewisniowska@is.pcz.czest.pl
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#### **NAME OF LECTURER (s) (NAME, SURNAME, E-MAIL ADDRESS)**

1. Dr inż. Beata Bień, bmat@is.pcz.czest.pl
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<b>Learning outcome</b>	<b>In relation to the learning outcomes specified for the field of study</b>	<b>Course objectives</b>	<b>Course content</b>	<b>Course study methods</b>	<b>Methods of assesment</b>
<b>EK 1</b>	K_W22	C.1	L1 – L6	1	P1.
<b>EK 2</b>	K_W22	C.1	L7 – L15	1	P1.
<b>EK 3</b>	K_U24, K_K09	C.2	Lab1 – Lab30	2	F1., F2., P2.
<b>EK4</b>	K_U23, K_U24, K_K09	C.2, C.3	Lab1 – lab30	2	F1., F2., P2.
<b>EK5</b>	K_U23, K_K09	C.3	Lab1 – lab30	2	F1., F2., P2.

## **II. OTHER USEFUL INFORMATION**

1. All information on the class schedules will be posted on the information section board and on the website [www.is.pcz.czest.pl](http://www.is.pcz.czest.pl)
2. The information on office course will be provided by the lecturer during the first meeting with the students as well as will be posted on the Institute of Environmental Engineering website
3. The information on the grade requirements will be provided to the students during the first meeting