

Course title: Water technology Technologia wody		
Programme: Environmental engineering		Code: 5.6.10
Type of course: Elective	Course level: First cycle degree (undergraduate)	Semester: V
Form of classes: Lecture, Laboratory	Number of hours per week/meeting: 2L, 2 Lab	Credit points: 7 ECTS
Education profile: General academic		Course language: English

GUIDE TO THE SUBJECT

I. COURSE CHART

COURSE OBJECTIVES

- C.1.** To acquaint the students with basic knowledge in water treatment processes
- C.2.** To develop the ability to execute and assess laboratory work required for water quality analysis as well as to calculate technological parameters of water treatment processes
- C.3.** To develop the ability to apply the knowledge in water treatment for selecting the best treatment strategies based on influent characteristics and effluent quality requirements

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The students are expected to have background knowledge in chemistry, biology and unit processes in environmental engineering from previous semesters.
2. In particular they are expected to have basic competences in engineering calculations.

LEARNING OUTCOMES

- EK 1 - has a knowledge in water treatment methods
- EK 2 - is able to calculate technological parameters of water treatment processes and recognize appropriate ranges for the parameters as well as is able to provide technological research on water treatment
- EK 3 - is able to select the technology of water treatment taking into consideration physicochemical characteristics of the influent as well as effluent quality requirements

COURSE CONTENT

Form of classes - lectures	Course hours
Water contaminants. Water intakes. Law requirements for drinking water and water for industry.	4
Treatment of water at the source. Technological schemes of surface and underground water treatment.	2

Preliminary treatment of water. Sedimentation and flotation. Mathematical model of sedimentation. Sedimentation tanks. Technological research of	3
Coagulation and flocculation. Colloid systems. Coagulants and flocculants. Mechanism of coagulation process. Technological research of coagulation process (jar test). Factors affecting coagulation process. Technologies of	3
Filtration. Processes which take place during filtration. Filtration materials. Kinds of filters. Removal of pollutants with slow and fast filters.	2
Adsorption. Adsorption as unit process. Sorbents used in water treatment. Technological schemes of activated carbon use.	2
Iron and manganese control. Methods used for Fe and Mn removal. Parameters	3
Advanced oxidation processes. Use of AOP methods in water treatment.	2
Disinfection. Law requirements for water safety. Methods of disinfection. Physical and chemical methods of disinfection (effectiveness, advantages and disadvantages of methods). Toxic by-products of disinfection.	3
Ion exchange. Treatment of water for industry. Used ion exchangers. Technological schemes used for water softening and demineralization. Softening by precipitation	2
Membrane processes.	2
Analysis of selected water treatment plants technologies and effectiveness.	2
Form of classes - laboratory	
Water and wastewater laboratory safety training	1
Analysis of physicochemical properties of water	1
Sedimentation	4
Coagulation	4
Adsorption	4
Iron control	4
Ion exchange	4
Water softening and demineralization	4
Disinfection	4

COURSE STUDY METHODS

1. Lecture with multimedia presentation
2. Instructional materials
3. Laboratory – laboratory models of water treatment installations

METHODS OF ASSESSMENT (F - formative; S - summative)

F1. – regular tests (during each laboratory)
F2. – preparation of laboratory work reports
S1. – summary tests

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in class activities.....	30 L, 30 Lab → 60 h
Consultations.....30 h
Preparation for laboratories30 h
Preparation for summary test.....30 h

Writing of laboratory reports.....25 h
Total	Σ 175 h
Total ECTS	7 ECTS

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Pizzi N.: Water Treatment, principles and Practices of Water Supply Operations, AWWA, Denver 2010
Hendrics D.: Water Treatment Unit processes. Physical and Chemical, CRC Press, Boca Raton 2006

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

1. Dr hab. Inż. Ewa Wiśniowska, prof. PCz., ewisniowska@is.pcz.czest.pl

NAME OF LECTURER (s) (NAME, SURNAME, E-MAIL ADDRESS)

1. Dr hab. Inż. Ewa Wiśniowska, prof. PCz., ewisniowska@is.pcz.czest.pl 2. Dr inż. Elżbieta Sperczyńska, sperczynska@is.pcz.czest.pl 3. Dr Beata Karwowska, bkarwowska@is.pcz.pl
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Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assesment
EK 1	K_W40	C.1	L1 – L30	1, 2	S1.
EK 2	K_W40, K_U41	C.2	Lab1 – Lab30	3	F1., F2.
EK 3	K_U41	C.3	L1 – L30, Lab1 – Lab30	1, 3	F1., F2., S1.

II. OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: www.is.pcz.pl
2. The information about the consultation hours is provided to students on the first class meeting and posted online at the website of Department of Chemistry, Water and Wastewater Technology.

3. The information on course completion and grade is provided to students on the first class meeting.