FACULTY: ENVIRONMENTAL ENGINEERING
MAIN FIELD OF STUDY: ENVIRONMENTAL QUALITY MANAGEMENT
FORM OF STUDIES: FULL-TIME STUDIES

Table of contents

PROGRAM OF STUDIES

FACULTY:	**ENVIRONMENTAL ENGINEERING**
MAIN FIELD OF STUDY:	**ENVIRONMENTAL QUALITY MANAGEMENT**
DISCIPLINES:	**environmental engineering, mining and energetics**
EDUCATION LEVEL:	**second-level studies**
FORMA STUDIÓW:	**full-time studies**
PROFILE:	**general academic**
LANGUAGE OF STUDY:	**English**
IN EFFECTS SINCE ACADEMIC YEAR:	**2022/2023**

Content:

ASSUMED LEARNING OUTCOMES

FACULTY: **ENVIRONMENTAL ENGINEERING**

MAIN FIELD OF STUDY: **ENVIRONMENTAL QUALITY MANAGEMENT**

EDUCATION LEVEL: **second-level studies**

PROFILE: **general academic**

Location of the main field of study:

Branch of science: **technical and engineering sciences**

Disciplines: **environmental engineering, mining and energetics**

Explanation of the markings:

P7U – universal first degree characteristics corresponding to education at the second-level studies - 7 PRK level
P7S – second degree characteristics corresponding to education at the second-level studies - 7 PRK level PRK
W – category „knowledge”
U – category „skills”
K – category „social competences”

K(faculty symbol)_W1, K(faculty symbol)_W2, K(faculty symbol)_W3, …- main-field-of study learning outcomes related to the category "knowledge"
K(faculty symbol)_U1, K(faculty symbol)_U2, K faculty symbol)_U3, …- main-field-of study learning outcomes related to the category "skills"
K(faculty symbol)_K1, K(faculty symbol)_K2, K(faculty symbol)_K3, …- main-field-of study learning outcomes related to the category "social competences"
….._inż – learning outcomes related to the engineer competences

Main field of study learning outcomes	Description of learning outcomes for the main-field-of study: **ENVIRONMENTAL QUALITY MANAGEMENT** *After the graduation graduate:*	Reference to PRK characteristics Universal first degree characteristics (U)	Second degree characteristics typical for qualifications obtained in higher education (S) Characteristics for qualifications on 7 level of PRK	Characteristics for qualifications on 7 level of PRK, enabling acquiring engineering competences
KNOWLEDGE (W)				
K2EQM_W01	*possesses expanded and broadened knowledge on a certain fields of mathematics, physics and chemistry including, i.a. statistics, technical physics, environmental chemistry essential for the description and analysis of measurement data*	P7U_W	P7S_WG	
K2EQM_W02	*possesses detailed knowledge on the construction law, technologies and organisation of works and spacial management*	P7U_W	P7S_WK	
K2EQM_W03	*knows and understands the social, economic and legal conditions of engineering activity and resulting responsibility. Is able to predict and consider the consequences of this activity to the environment, community and economy. Knows and understand the company aims in various organisational and legal forms. Recognizes the variety of functioning problems, also in the context of company surrounding*	P7U_W	P7S_WK	P7S_WK_inż
K2EQM_W04	*possesses the knowledge on the necessity to manage intellectual property resources*	P7U_W	P7S_WK	P7S_WK_inż
K2EQM_W05	*possesses basic knowledge on management, including quality management and running a business*	P7U_W	P7S_WK	P7S_WK_inż
K2EQM_W06	*possesses basic knowledge on the efficacy and methods of research as well as on assessing the reliability, safety and risk factors in the systems operation processes in environmental engineering*	P7U_W	P7S_WG	P7S_WG_inż
K2EQM_W07	*possesses expanded knowledge on key issues and ways of obtaining energy from alternative sources; is aware of the development trends concerning alternative energy sources, possesses basic knowledge on the lifecycle of devices and facilities connected with alternative energy sources*	P7U_W	P7S_WG	P7S_WG_inż
K2EQM_W08	*possesses knowledge on the development trends and latest achievements in technologies and organisation of installation and construction works*	P7U_W	P7S_WK	P7S_WK_inż
K2EQM_W09	*possesses systematic, supported by theory knowledge on assessing the quality of*	P7U_W	P7S_WG	P7S_WG_inż

	natural waters as well as on advanced, modern, high performance technologies of water and sewage treatment			
K2EQM_W10	*possesses expanded and broadened knowledge on mineral and organic resources, their processing and use, considering the by-produced waste*	P7U_W	P7S_WG	P7S_WG_inż
K2EQM_W11	*possesses systematic, supported by theory knowledge on the advanced, modern technologies of waste management*	P7U_W	P7S_WG	P7S_WG_inż
K2EQM_W12	*possesses detailed, supported by theory knowledge on hazards, especially of microbiological origin, and characteristics of anthropogenic pollution*	P7U_W	P7S_WG	
K2EQM_W13	*possesses systematic, supported by theory, detailed knowledge on the advanced, modern technologies of gas treatment*	P7U_W	P7S_WG	P7S_WG_inż
K2EQM_W14	*possesses supported by theory knowledge connected with selected issues on water supply and sewage systems*	P7U_W	P7S_WG	P7S_WG_inż
SKILLS (U)				
K2EQM_U01	*is able to describe collected statistic data, apply the methods of statistical inference in a reference to processes and phenomena in the field of environmental engineering*	P7U_U	P7S_UW	P7S_UW_inż
K2EQM_U02	*is able to use information and communication techniques, proper for developing control algorithms and programmable controllers (PLC) applied in environmental engineering field; uses analysis and simulation methods to solve a task; is able to rate the usefulness and the possibility to apply a device or a computer system in order to control the above processes*	P7U_U	P7S_UW	P7S_UW_inż
K2EQM_U03	*knows how to prepare a bill of quantities and investment cost estimate*	P7U_U	P7S_UW	P7S_UW_inż
K2EQM_U04	*understands foreign language texts concerning their field of studies e.g. business and technical document; is able to obtain necessary, foreign language information from different sources; possesses proper linguistic means to communicate effectively in professional environment*	P7U_U	P7S_UW P7S_UK P7S_UO	P7S_UW_inż
K2EQM_U05	*quite well comprehends the content and meaning of oral or written statement (in foreign language) concerning every day and professional life issues; is able to write a short text on familiar topic, including non-literary text; is able to participate in conversations which concern familiar topics and, to a limited extent, state opinions about their work and studies, with the use of socio cultural knowledge*	P7U_U	P7S_UW P7S_UK	
K2EQM_U06	*is able to obtain information from literature, data bases and other sources, on resources and waste management; is able to compile obtained information, interpret and critically evaluate is, draw conclusions, formulate and support opinions*	P7U_U	P7S_UW	P7S_UW_inż
K2EQM_U07	*with the use of standardised methods of analysis, is able to plan and conduct experiments, simple research activities on water and sewage treatment, as well as on waste management, with the consideration of biological aspects; is able to interpret*	P7U_U	P7S_UW	P7S_UW_inż

	the results and draw conclusions			
K2EQM_U08	*is able to apply information and communication techniques, essential to prepare compilations and projects*	P7U_U	P7S_UW	P7S_UW_inż
K2EQM_U09	*knows how to perform mass balances of processes and devices used for gas treatment, with the use of proper methods, techniques and instruments*	P7U_U	P7S_UW	P7S_UW_inż
K2EQM_U10	*knows how to plan and conduct simple computer simulations on water supply and sewage systems, interpret the results and draw conclusions*	P7U_U	P7S_UW	P7S_UW_inż
K2EQM_U11	*is able to present and comment on the results of their master's thesis, reason about the ways of achieving the given results; is able to indicate alternative solutions to the issue analysed*	P7U_U	P7S_UW P7S_UK P7S_UO	
K2EQM_U12	*is able to compose a master's thesis in the field of environmental engineering: is able to obtain information from native and foreign literature, data bases and other sources, compile, interpret and evaluate it, is able to use analytical, simulative and experimental methods to formulate and solve the problems, is capable of interdisciplinary compilation of knowledge, of adopting systematic approach considering also non- technological aspects, is able to assess the usefulness and possibilities of adopting modern technological achievements (techniques and technologies) in the presented discipline, is able to suggest procedures to upgrade/improve existing technological solutions, is able to interpret results of research, draw conclusions and formulate recommendations, is able to compose a master's thesis in accordance to the proper formal register*	P7U_U	P7S_UW P7S_UU	P7S_UW_inż
SOCIAL COMPETENCES (K)				
K2EQM_K01	*is ready to act and think in a creative and enterprising way, is able to set priorities in order to complete a given task*	P7U_K	P7S_KK	
K2EQM_K02	*is aware of the social effects of engineering activities on the environment and the liability for the decisions made*	P7U_K	P7S_KR	
K2EQM_K03	*understands the necessity of a lifetime learning process. Is able to perform critical analysis of own knowledge and receiving content*	P7U_K	P7S_KO	
K2EQM_K04	*by participation in a group motion activity is ready to cooperate with a team under specific regulations and fair play rules; is aware of civilization hazards and prevents these threats by initiating the actions in favour of public interest*	P7U_K	P7S_KO PS7_KR	

DESCRIPTION OF THE PROGRAM OF STUDIES

Main field of study: **ENVIRONMENTAL QUALITY MANAGEMENT**	Profile: **GENERAL ACADEMIC**
Education level: **SECOND LEVEL STUDIES (MASTER'S DEGREE)**	Form of studies: **FULL-TIME STUDIES**

1 General description

1.1. Number of semesters	*1.2. Total number of ECTS points necessary to complete studies at a given level*
3	90
1.3. Total numer of hours	*1.4. Prerequisites (particularly for second-level studies)*
1080	Diploma of the 1st level studies (minimum 7 semesters and 210 ECTS points) in: Environmental Engineering, Environmental Protection, Technologies for Environmental Protection or related. Each application is assessed individually on its merits. If in doubt, please contact the Admission Officer. English: TOEFL iBT minimum 87 points or IELTS – minimum 6.5 points.
1.5. Upon completion of studies graduate obtains	*1.6. Graduate profile, employability:*
Master Engineer	The EQM graduates ought to acquire deepen knowledge in mathematics and natural sciences, as well as in technical and engineering sciences. They ought to get specialist knowledge in environmental engineering. They ought to be prepared for solving problems in sustainable development and technology, involving indoor and outdoor environment. They should be able to play the role of the leader of the team and to organize and run research projects and scientific debates. The graduates should be able to deal with administrative and simple legal problems of companies. They ought to acquire the experience necessary for professional career at research units, industry and at universities or colleges. Job prospects: the graduate of EQM is able to design, maintain and operate the systems of air, water, wastewater treatment as well as waste management. He may work in a private sector, industry and governmental administration. The profile of the graduate is suitable for work at universities or in research and

	development institutions. The EQM graduate is aware of the necessity of lifelong learning process and development of professional skills. He is well prepared for a doctoral school.
1.7. Possibility of continuing studies	*1.8. Indicate connection with University's mission and its development strategy*
Eligibility to apply for admission to a doctoral school, non-degree postgraduate programmes	The mission of our University and our Faculty is to shape the creative and critical personalities of students and define the directions of development in science and technology. The education offered at our institution is strongly linked with scientific research and the needs of economy and is consistent with standards of the European Higher Education Area. The offered obligatory and optional courses are in accordance with the Polish Qualifications Framework. The assumed learning effects involves recommendations of industry specialists, professional associations and international standards. In the course of educational process, besides the traditional knowledge transfer, self-directed learning practices are implemented. The degrees awarded by Wrocław University of Science and Technology and Faculty of Environmental Engineering are a symbol of high quality of education, confirmed by the Polish Accreditation Commission.

2 Detailed description

2.1 Total number of learning outcomes in the program of study:

W (knowledge) =	14
U (skills) =	12
K (competences) =	4
W + U + K =	30

2.2 For the main field of study assigned to more than one discipline - the number of learning outcomes assigned to the discipline:

D1 (major):	30	This number must be greater than half the number of learning outcomes
D2:	-	
D3:	-	
D4:	-	

2.3 For the field of study assigned to more than one discipline - percentage share of the number of ECTS points for each discipline:

D1 (major):	100	% of ECTS points
D2:	-	% of ECTS points
D3:	-	% of ECTS points
D4:	-	% of ECTS points

2.4 a) For the general academic profile field of study – the number of ECTS points assigned to the classes related to the University's academic activity in the discipline or disciplines to which the faculty is assigned

ECTS (DN):	57	(must be greater than 50% of the total number of ECTS points from 1.2)

b) For the practical profile field of study - the number of ECTS points assigned to the classes shaping practical skills

ECTS (P):	n/d	(must be greater than 50% of the total number of ECTS points from 1.2)

2.5 Concise analysis of compliance of the assumed learning outcomes with the needs of the labour market

The needs of the labour market in matters of environmental engineering haven been described in the present Description of the Program of Studies (in 1.6 Graduate profile, employability). The graduate of the Environmental Quality Management field of study has a considerable knowledge on environmental engineering and environmental protection. He is prepared for solving problems on sustainable development and renewable energy resources, planning, exploitation and conducting research projects in the following areas: processes, technologies and systems of water and wastewater treatment, as well as air protection and waste management; monitoring and evaluation environmental contamination. He is also prepared to use software in modelling and designing of sanitary infrastructure. The graduate of the Environmental Quality Management field of study (EQM), due to acquired knowledge and practical skills, meets the present needs of national and international labour market, especially as an employee highly-educated in problems of sustainable development.

2.6 The total number of ECTS points that a student must obtain in classes requiring direct participation of academic teachers or other persons conducting classes and students (the sum of ECTS points for courses / groups of courses marked with the BU 1a code) 46.7 ECTS

ECTS (BU):	49.8	(enter the sum of ECTS credits for the courses / groups of courses coded BU[1], while for the full-time studies this number must be higher than 50% of the total number of ECTS credits from point 1.2)

2.7 Total number of ECTS points, which student has to obtain from basic sciences classes

Number of ECTS points for obligatory subjects	8
Number of ECTS points for optional subjects	0
Total number of ECTS points	8

2.8 Total number of ECTS points, which student has to obtain from practical classes, including laboratory classes (enter total number of ECTS points for courses/group of courses denoted with code P)

Number of ECTS points for obligatory subjects	16
Number of ECTS points for optional subjects	26
Total number of ECTS points	42

2.9 Minimum number of ECTS points, which student has to obtain doing education blocks offered as part of university-wide classes or other main field of study (enter number of ECTS points for courses/groups of courses denoted with code O)

ECTS (O):	18	(enter number of ECTS points for courses/groups of courses denoted with code O)

2.10 Total number of ECTS points, which student may obtain doing optional blocks:

ECTS:	28	(min. 30% of total number of ECTS points)

3 Description of the process leading to learning outcomes acquisition:

The duration of the full-time study period, second level (seven level of PRK) in Environmental Quality Management field of study (EQM) is 3 semesters. The required number of ECTS credits to achieve a full qualification is 90. The classes organized directly at the University (ZZU) cover 1080 h. The programme of studies involves: general education and university-wide courses, as well as basic sciences, field-of-studies, and specialization courses. The optional courses are also offered to students. The cursers are delivered as lectures, exercises, laboratories, projects, and seminaries. The verification of student practical achievements (the practical assumed learning effects) is made by short tests, colloquies, projects, reports, communications, oral presentations, and discussions. The student engagement and the ability to cooperate in a student group is also evaluated. The verification of theoretical knowledge is made through colloquies, and written or oral exams. In order to receive the Master's degree, the graduate is required to write a Master's thesis and pass the diploma exam. The diploma exam can be taken by student after completing the programme of studies and involves verification of learning effects referring to the following courses: Water treatment technology, Wastewater treatment technology, Water supply systems, Sewage systems, Waste management, Sanitary biology, Environmental health hazards, Air pollutants and their sources.

4 List of education blocks:

4.1 List of obligatory blocks

4.1.1 List of general education blocks

4.1.1.1 Liberal-managerial subjects block *min. 5 ECTS points*

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scient. act.[5]	practical [6]	type [7]
1	n/d	Ethics of new and emerging technologies	1					K2EQM_W03, K2EQM_W04, K2EQM_K02	15	60	2		0.8	T/Z	Z	O			KO
2	n/d	Strategic management	2					K2EQM_W03, K2EQM_W05	30	90	3		1.3	T/Z	Z	O			KO
		Total	3	0	0	0	0		45	150	5	0	2.1						

Altogether for general education blocks:

Łączna liczba godzin					Łączna liczba godzin ZZU	Łączna liczba godzin CNPS	Łączna liczba punktów ECTS	Łączna liczba punktów ECTS zajęć DN[5]	Liczba punktów ECTS zajęć BU[1]
Le	Cl	La	Pr	Se	h	h	Points	Points	Points
3	0	0	0	0	45	150	5	0	2.1

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

4.1.2 List of basic sciences blocks

4.1.2.1 *Mathematics block* *min. 3 ECTS points*

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scient .act.[5]	practical[6]	type[7]
1	n/d	Engineering applications of mathematical statistics	1					K2EQM_W01	15	60	2		0.8	T/Z	Z	0			PD
2	n/d	Engineering applications of mathematical statistics		1				K2EQM_U01, K2EQM_K01	15	30	1		0.8	T/Z	Z	0		P	PD
		Total	1	1	0	0	0		30	90	3	0	1.6						

4.1.2.2 *Chemistry block* *min. 5 ECTS point*

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical[6]	type[7]
1	n/d	Environmental chemistry	2					K2EQM_W01, K2EQM_W09, K2EQM_K02	30	90	3		1.3	T/Z	Z	0			PD
2	n/d	Environmental chemistry			1			K2EQM_U07, K2EQM_U09	15	60	2		0.8	T	Z	0		P	PD
		Total	2	0	1	0	0		45	150	5	0	2.1						

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

Altogether for basic sciences blocks:

Total number of hours					Total number of ZZU hours	Total numer of CNPS hours	Total number ECTS points	Number of ECTS points for DN[5] classes	Number of ECTS points for BU[1] classes
Le	Cl	La	Pr	Se	h	h	Points	Points	Points
3	1	1	0	0	75	240	8	0	3.7

4.1.3 List of main-field-of-study blocks

4.1.3.1 Obligatory main-field-of-study blocks ***min. 49 ECTS point***

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Automation in environmental engineering			1			K2EQM_U02	15	60	2		0.8	T	Z			P	K
2	n/d	Water quality management	2					K2EQM_W09	30	90	3	3	1.3	T/Z	E		DN		K
3	n/d	Raw materials management	1					K2EQM_W10, K2EQM_W12, K2EQM_K02	15	30	1	1	0.8	T/Z	Z		DN		K
4	n/d	Raw materials management					1	K2EQM_U06, K2EQM_K02, K2EQM_K03	15	30	1	1	0.8	T/Z	Z		DN	P	K
5	n/d	Water treatment technology	2					K2EQM_W09	30	60	2	2	1.3	T/Z	E		DN		K
6	n/d	Water treatment technology			1			K2EQM_U07, K2EQM_K01	15	30	1	1	0.8	T	Z		DN	P	K
7	n/d	Sanitary biology	1					K2EQM_W12, K2EQM_K02	15	30	1	1	0.8	T/Z	E		DN		K
8	n/d	Sanitary biology			1			K2EQM_U07, K2EQM_K02	15	30	1	1	0.8	T	Z		DN	P	K
9	n/d	AutoCad			1			K2EQM_U08, K2EQM_K03	15	30	1		0.8	T	Z			P	K

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

10	n/d	Water supply systems	1					K2EQM_W14, K2EQM_K02	15	30	1	1	0.8	T/Z	Z		DN		K
11	n/d	Water supply systems				1		K2EQM_U02, K2EQM_U05, K2EQM_U10, K2EQM_K02, K2EQM_K04	15	30	1	1	1	T	Z		DN	P	K
12	n/d	Environmental management	2					K2EQM_W03, K2EQM_K02	30	90	3		1.3	T/Z	Z				K
13	n/d	Spatial planning	1					K2EQM_W02, K2EQM_K01, K2EQM_K02	15	60	2		0.8	T/Z	Z	O			KO
14	n/d	Reliability of engineering systems	1					K2EQM_W06	15	60	2	2	0.8	T/Z	Z		DN		K
15	n/d	Biodegradable materials	2					K2EQM_W10, K2EQM_K03	30	60	2	2	1.3	T/Z	Z		DN		K
16	n/d	Wastewater treatment technology	2					K2EQM_W09	30	60	2	2	1.3	T/Z	Z		DN		K
17	n/d	Wastewater treatment technology			1			K2EQM_U07, K2EQM_K01	15	30	1	1	0.8	T	Z		DN	P	K
18	n/d	Solid waste management	2					K2EQM_W11	30	60	2	2	1.3	T/Z	E		DN		K
19	n/d	Solid waste management			1			K2EQM_U07, K2EQM_U09, K2EQM_K02	15	30	1	1	0.8	T	Z		DN	P	K
20	n/d	Waste gases purification	2					K2EQM_W13	30	60	2	2	1.3	T/Z	E		DN		K
21	n/d	Waste gases purification		1				K2EQM_U09, K2EQM_K01	15	30	1	1	0.8	T/Z	Z		DN	P	K
22	n/d	Environmental toxicology	1					K2EQM_W12, K2EQM_K02	15	30	1	1	0.8	T/Z	Z		DN		K
23	n/d	Environmental toxicology			1			K2EQM_U07, K2EQM_K02	15	30	1	1	0.8	T	Z		DN	P	K
24	n/d	Environmental health hazards	2					K2EQM_W12	30	60	2	2	1.3	T/Z	Z		DN		K
25	n/d	Sewage systems	1					K2EQM_W14, K2EQM_K02	15	60	2	2	0.8	T/Z	Z		DN		K
26	n/d	Sewage systems				1		K2EQM_U02, K2EQM_U05, K2EQM_U08,	15	30	1	1	1	T	Z		DN	P	K

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

								K2EQM_U10, K2EQM_K02, K2EQM_K04										
27	n/d	Membrane separation processes in environmental protection	1					K2EQM_W09	15	60	2	2	0.8	T/Z	Z		DN		K
28	n/d	Membrane separation processes in environmental protection			1			K2EQM_U07, K2EQM_K01	15	30	1	1	0.8	T	Z		DN	P	K
29	n/d	Organization of construction works	1					K2EQM_W08, K2EQM_W09	15	60	2		0.8	T/Z	Z				K
30	n/d	Buildings regulations	2					K2EQM_W02	30	60	2		1.3	T/Z	Z				K
31	n/d	Renewable energy systems	1					K2EQM_W07	15	60	2	2	0.8	T/Z	Z		DN		K
		Total	28	1	8	2	1		600	1470	49	37	29.7						

Altogether (for main-field-of-study blocks):

Total number of hours					Total number of ZZU hours	Total numer of CNPS hours	Total number ECTS points	Number of ECTS points for DN[5] classes	Number of ECTS points for BU[1] classes
Le	Cl	La	Pr	Se	h	h	Points	Points	Points
28	1	8	2	1	600	1470	49	37	29.7

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

4.2 List of optional blocks

4.2.1 List of general education blocks

4.2.1.1 *Foreign languages block* *min. 3 ECTS points*

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Foreign language I		1				K2EQM_U05	15	30	1		0.8	T/Z	Z	O		P	KO
2	n/d	Foreign language II		3				K2EQM_U04	45	60	2		1.8	T/Z	Z	O		P	KO
		Total	0	4	0	0	0		60	90	3	0	2.6						

Altogether for general education blocks:

Total number of hours					Total number of ZZU hours	Total numer of CNPS hours	Total number ECTS points	Number of ECTS points for DN[5] classes	Number of ECTS points for BU[1] classes
Le	Cl	La	Pr	Se	h	h	Points	Points	Points
0	4	0	0	0	60	90	3	0	2.6

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

4.2.2 List of main-field-of-study blocks

4.2.2.1 Optional courses block 1 *min. 1 pkt. ECTS (choice of 1 courses)*

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Biomonitoring	1					-	15	30	1		0.8	T/Z	Z				K
2	n/d	Methods and techniques of air pollutants measurement	1					-	15	30	1		0.8	T/Z	Z				K
		Total	1	0	0	0	0		15	30	1	0	0.8						

4.2.2.2 Optional courses block 2 *min. 2 pkt. ECTS (choice of 1 courses)*

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Air pollutants and their sources	1					-	15	30	1		0.8	T/Z	Z				K
2	n/d	Air pollutants and their sources			1			-	15	30	1		0.8	T	Z			P	K
3	n/d	Modeling of water and sewage treatment processes	1					-	15	30	1		0.8	T/Z	Z				K
4	n/d	Modeling of water and sewage treatment processes			1			-	15	30	1		0.8	T	Z			P	K
		Total	1	0	1	0	0		30	60	2	0	1.6						

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

Altogether for main-field of study blocks:

Łączna liczba godzin					Total number of ZZU hours	Total numer of CNPS hours	Total number ECTS points	Number of ECTS points for DN[5] classes	Number of ECTS points for BU[1] classes
Le	Cl	La	Pr	Se	h	h	Points	Points	Points
2	0	1	0	0	45	90	3	0	2.4

4.2.2.3 Diploma project (master thesis) block ***min. 22 ECTS points***

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Diploma seminar					2	K2EQM_U06, K2EQM_U11	30	60	2		1.3	T/Z	Z		0	P	K
2	n/d	Diploma project (master thesis)				15		K2EQM_U06, K2EQM_U12	225	600	20	20	8	T	Z		DN	P	K
		Total	0	0	0	15	2		255	660	22	20	9.3						

Altogether for Diploma project (master thesis) block blocks:

Łączna liczba godzin					Total number of ZZU hours	Total numer of CNPS hours	Total number ECTS points	Number of ECTS points for DN[5] classes	Number of ECTS points for BU[1] classes
Le	Cl	La	Pr	Se	h	h	Points	Points	Points
0	0	0	15	2	255	660	22	20	9.3

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

4.3 Practises block

Not applicable

4.4 ,,Diploma dissertation" block

Type of diploma dissertation	Master Thesis
Number of diploma dissertation semesters:	1
Number of ECTS points:	20
Code:	N/D
Character of diploma dissertation:	Master Thesis (literature survey and/or project and/or computer program and/or assessment-diagnosis) Master thesis should include computational, investigational or experimental solution of the posted scientific or technical problem using the knowledge acquired during the second degree studies. The thesis should include: 1) definition of thesis problem, 2) an extension of the problem, 3) method of particular solutions, 4) the use of appropriate analytical tools, 5) formulation of research proposals on the basis of analysis, 6) deposition of the research problem in broadly citing literature review.
Number of ECTS BU[1]	8
Number of ECTS DN[5]	20

5 Ways of verifying assumed learning outcomes

Type of classes:	Ways of verifying assumed learning outcomes:
lecture	exam, test
class	test, colloquium, participation in the discussion of problems, activity
laboratory	test, entrance test, lab report
project	project defence
seminar	participation in discussion, presentation of the topic, the essay
training	practice report
diploma dissertation	thesis preparation

6 Range of diploma examination

Questions related to water and wastewater treatment.

Questions related to water supply and sewage systems.

Questions related to solid waste management.

Questions related to sanitary biology and environmental health hazards.

Questions related to air pollutants and their sources.

Requirements concerning deadlines for crediting courses/groups of courses for all courses in particular blocks.

Each course should be credited in a semester in which it is offered.

7 Plan of studies (attachment no. 3)

Approved by faculty student government legislative body:

Date

name and surname, signature of student representative

Date

Dean’s signature

PLAN OF STUDIES

FACULTY:	**ENVIRONMENTAL ENGINEERING**
MAIN FIELD OF STUDY:	**ENVIRONMENTAL QUALITY MANAGEMENT**
EDUCATION LEVEL:	**second-level studies**
FORM OF STUDIES:	**full-time studies**
PROFILE:	**general academic**
LANGUAGE OF STUDY:	**English**
IN EFFECTS SINCE ACADEMIC YEAR:	**2022/2023**

1 Set of obligatory and optional courses and groups of courses in semestral arrangement

Semester 1

Obligatory courses/groups of courses ***number of ECTS 28 points***

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses cl cl	Way[3] of crediting lab lab	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Ethics of new and emerging technologies	1					K2EQM_W03, K2EQM_W04, K2EQM_K02	15	60	2		0.8	T/Z	Z	O	0		KO
2	n/d	Strategic management	2					K2EQM_W03, K2EQM_W05	30	90	3		1.3	T/Z	Z	O	0		KO
3	n/d	Engineering applications of mathematical statistics	1					K2EQM_W01	15	60	2		0.8	T/Z	Z	0	0		PD
4	n/d	Engineering applications of mathematical statistics		1				K2EQM_U01, K2EQM_K01	15	30	1		0.8	T/Z	Z	0	0	P	PD
5	n/d	Environmental chemistry	2					K2EQM_W01, K2EQM_W09, K2EQM_K02	30	90	3		1.3	T/Z	Z	0	0		PD
6	n/d	Environmental chemistry			1			K2EQM_U07, K2EQM_U09	15	60	2		0.8	T	Z	0	0	P	PD
7	n/d	Automation in environmental engineering			1			K2EQM_U02	15	60	2		0.8	T	Z		0	P	K
8	n/d	Water quality management	2					K2EQM_W09	30	90	3	3	1.3	T/Z	E		DN		K
9	n/d	Raw materials management	1					K2EQM_W10, K2EQM_W12, K2EQM_K02	15	30	1	1	0.8	T/Z	Z		DN		K
10	n/d	Raw materials management					1	K2EQM_U06, K2EQM_K02, K2EQM_K03	15	30	1	1	0.8	T/Z	Z		DN	P	K
11	n/d	Water treatment technology	2					K2EQM_W09	30	60	2	2	1.3	T/Z	E		DN		K

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

12	n/d	Water treatment technology			1			K2EQM_U07, K2EQM_K01	15	30	1	1	0.8	T	Z		DN	P	K
13	n/d	Sanitary biology	1					K2EQM_W12, K2EQM_K02	15	30	1	1	0.8	T/Z	E		DN		K
14	n/d	Sanitary biology			1			K2EQM_U07, K2EQM_K02	15	30	1	1	0.8	T	Z		DN	P	K
15	n/d	AutoCad			1			K2EQM_U08, K2EQM_K03	15	30	1		0.8	T	Z		0	P	K
16	n/d	Water supply systems	1					K2EQM_W14, K2EQM_K02	15	30	1	1	0.8	T/Z	Z		DN		K
17	n/d	Water supply systems				1		K2EQM_U02, K2EQM_U05, K2EQM_U10, K2EQM_K02, K2EQM_K04	15	30	1	1	1	T	Z		DN	P	K
		Total	13	1	5	1	1		315	840	28	12	15.8						

Optional courses/group of courses (foreign language) ***number of ECTS points 1***

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses cl cl	Way[3] of crediting lab lab	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Foreign language I		1				K2EQM_U05	15	30	1		0.8	T/Z	Z	O	0	P	KO
		Total	0	1	0	0	0		15	30	1	0	0.8						

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

Optional courses (block 1 - *choice of 1 courses)* ***number of ECTS points 1***

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Biomonitoring	1					-	15	30	1		0.8	T/Z	Z		0		K
2	n/d	Methods and techniques of air pollutants measurement	1					-	15	30	1		0.8	T/Z	Z		0		K
		Total	1	0	0	0	0		15	30	1	0	0.8						

Altogether in semester:

Łączna liczba godzin					Total number of ZZU hours	Total numer of CNPS hours	Total number ECTS points	Number of ECTS points for DN[5] classes	Number of ECTS points for BU[1] classes
Le	Cl	La	Pr	Se	Points	h	Points	Points	Points
14	2	5	1	1	345	900	30	12	17.4

Semester 2

Obligatory courses/groups of courses ***number of ECTS 28 points***

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Environmental management	2					K2EQM_W03, K2EQM_K02	30	90	3		1.3	T/Z	Z		0		K
2	n/d	Spatial planning	1					K2EQM_W02, K2EQM_K01, K2EQM_K02	15	60	2		0.8	T/Z	Z	O	0		KO
3	n/d	Reliability of engineering systems	1					K2EQM_W06	15	60	2	2	0.8	T/Z	Z		DN		K
4	n/d	Biodegradable materials	2					K2EQM_W10, K2EQM_K03	30	60	2	2	1.3	T/Z	Z		DN		K

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

5	n/d	Wastewater treatment technology	2					K2EQM_W09	30	60	2	2	1.3	T/Z	Z		DN		K
6	n/d	Wastewater treatment technology			1			K2EQM_U07, K2EQM_K01	15	30	1	1	0.8	T	Z		DN	P	K
7	n/d	Solid waste management	2					K2EQM_W11	30	60	2	2	1.3	T/Z	E		DN		K
8	n/d	Solid waste management			1			K2EQM_U07, K2EQM_U09, K2EQM_K02	15	30	1	1	0.8	T	Z		DN	P	K
9	n/d	Waste gases purification	2					K2EQM_W13	30	60	2	2	1.3	T/Z	E		DN		K
10	n/d	Waste gases purification		1				K2EQM_U09, K2EQM_K01	15	30	1	1	0.8	T/Z	Z		DN	P	K
11	n/d	Environmental toxicology	1					K2EQM_W12, K2EQM_K02	15	30	1	1	0.8	T/Z	Z		DN		K
12	n/d	Environmental toxicology			1			K2EQM_U07, K2EQM_K02	15	30	1	1	0.8	T	Z		DN	P	K
13	n/d	Environmental health hazards	2					K2EQM_W12	30	60	2	2	1.3	T/Z	Z		DN		K
14	n/d	Sewage systems	1					K2EQM_W14, K2EQM_K02	15	60	2	2	0.8	T/Z	Z		DN		K
15	n/d	Sewage systems				1		K2EQM_U02, K2EQM_U05, K2EQM_U08, K2EQM_U10, K2EQM_K02, K2EQM_K04	15	30	1	1	1	T	Z		DN	P	K
16	n/d	Membrane separation processes in environmental protection	1					K2EQM_W09	15	60	2	2	0.8	T/Z	Z		DN		K
17	n/d	Membrane separation processes in environmental protection			1			K2EQM_U07, K2EQM_K01	15	30	1	1	0.8	T	Z		DN	P	K
		Total	17	1	4	1	0		345	840	28	23	16.8						

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

Optional courses/group of courses (foreign language) ***number of ECTS 2 points***

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Foreign language II		3				K2EQM_U04	45	60	2		1.8	T/Z	Z	O	0	P	KO
		Total	0	3	0	0	0		45	60	2	0	1.8						

Altogether in semester:

Łączna liczba godzin					Total number of ZZU hours	Total numer of CNPS hours	Total number ECTS points	Number of ECTS points for DN[5] classes	Number of ECTS points for BU[1] classes
Le	Cl	La	Pr	Se	h	h	Points	Points	Points
17	4	4	1	0	390	900	30	23	18.6

Semester 3

Obligatory courses ***number of ECTS points 6***

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Organization of construction works	1					K2EQM_W08, K2EQM_W09	15	60	2		0.8	T/Z	Z		0		K
2	n/d	Buildings regulations	2					K2EQM_W02	30	60	2		1.3	T/Z	Z		0		K
3	n/d	Renewable energy systems	1					K2EQM_W07	15	60	2	2	0.8	T/Z	Z		DN		K
		Total	4	0	0	0	0		60	180	6	2	2.9						

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

Optional courses (block 2 - *choice of 1 courses)* ***number of ECTS points 2***

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Air pollutants and their sources	1					-	15	30	1		0.8	T/Z	Z				K
2	n/d	Air pollutants and their sources			1			-	15	30	1		0.8	T	Z			P	K
3	n/d	Modeling of water and sewage treatment processes	1					-	15	30	1		0.8	T/Z	Z				K
4	n/d	Modeling of water and sewage treatment processes			1			-	15	30	1		0.8	T	Z			P	K
		Total	1	0	1	0	0		30	60	2	0	1.6						

Diploma project (master thesis) block ***number of ECTS points 22***

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course / group of courses	Way[3] of crediting	Course/group of courses			
			Le	Cl	La	Pr	Se		ZZU	CNPS	total	DN classes[5]	BU classes[1]			University-wide[4]	rel. to scien. act.[5]	practical.[6]	type[7]
1	n/d	Diploma seminar					2	K2EQM_U06, K2EQM_U11	30	60	2		1.3	T/Z	Z		0	P	K
2	n/d	Diploma project (master thesis)				15		K2EQM_U06, K2EQM_U12	225	600	20	20	8	T	Z		DN	P	K
		Total	0	0	0	15	2		255	660	22	20	9.3						

Altogether in semester:

Łączna liczba godzin					Total number of ZZU hours	Total numer of CNPS hours	Total number ECTS points	Number of ECTS points for DN[5] classes	Number of ECTS points for BU[1] classes
Le	Cl	La	Pr	Se	h	h	Points	Points	Points
5	0	1	15	2	345	900	30	22	13.8

[1]BU – number of ECTS points assigned to hours of classes requiring direct contact (attendance) of teachers with students
[2]Traditional – T, remote – Z
[3]Exam – E, crediting – Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]Course/ group of courses related to scientific activity – DN
[6]Practical course / group of courses– P. P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]Optional – enter W, obligatory – enter Ob

2 Set of examinations in semestral arrangement

Course code	Names of courses ending with examination	Semester
n/d	Water quality management	1
n/d	Water treatment technology	1
n/d	Sanitary biology	1
n/d	Solid waste management	2
n/d	Waste gases purification	2

3 Numbers of allowable deficit of ECTS points after particular semesters

Semester	Allowable deficit of ECTS points after semester
1	6
2	6
3	0

Opinion of student government legislative body

…… ……

Date Name and surname, signature of student representative

…… ……

Date Dean’s signature

Subject cards

FACULTY: **ENVIRONMENTAL ENGINEERING**

MAIN FIELD OF STUDY: **ENVIRONMENTAL QUALITY MANAGEMENT**

LEVEL OF STUDY: **second-level studies**

FORM OF STUDY: **full-time studies**

IN EFFECTS SINCE ACADEMIC YEAR: **2022/2023**

LIST OF CARDS:

Ethics of new and emerging technologies (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Etyka nowych technologii**
Name in English	**Ethics of new and emerging technologies**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**University-wide**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	2				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Basic knowledge from the field of humanities and social sciences

SUBJECT OBJECTIVES

C1	Obtaining knowledge on ethical and societal implications of new and emerging technologies
C2	Learning how to use ethical argumentation and justify ethical opinions
C3	Introducing students to norms and standards of professional ethics
C4	Expounding non-technical aspects of engineering activity and elucidating the problem of social responsibility of science and technology

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	The student obtains knowledge on ethical aspects of development and employment of new technologies in society.
PEU_W02	The student obtains knowledge essential to understanding and interpreting social and philosophical aspects of engineering activity
Relating to social competences:	
PEU_K01	The student is aware of the importance of non-technical aspects of engineering of a chosen specialty and understands the consequences of engineering activity in terms of its environmental and social impact as well as their responsibility for making decisions

PROGRAMME CONTENT

Form of classes lecture		Number of hours
Le1	Introduction: morality, ethics, law	2
Le2	The structure of a moral dilemma; main ethical theories	2
Le3	Engineering ethics; models of technology assessment	2
Le4	Ethics of information technologies. Case studies	2
Le5	Neuroethics: brain-machine interaction technologies. Case studies	2
Le6	Autonomous robots (roboethics); nanoethics. Case studies	2
Le7	Selected codes of engineering ethics. Case studies analyses	2
Le8	Responsibility for future generations	1
Total hours		15

TEACHING TOOLS USED	
N1	Multimedial presentation
N2	Informative lecture
N3	Interactive lecture

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_K01	Written essay prepared on the basis of the lecture and selected literature or a test written in class

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Arystoteles, Etyka nikomachejska, przeł. D. Gromska, PWN, Warszawa 1956.
2	Bińczyk E., Technonauka w społeczeństwie ryzyka, Wyd. Naukowe UMK, Toruń 2012.
3	Chyrowicz B., O sytuacjach bez wyjścia w etyce, Wyd. Znak, Kraków 2008.
4	Kant I., Uzasadnienie metafizyki moralności, przeł. M. Wartenberg, Kęty 2009
5	Małek M., Mazurek E., Serafin K. (red.), Etyka i technika. Wrocław 2014.
6	Mill J.S., O wolności, tłum. A.Kurlandzka, Warszawa 2005.
7	Mill J.S., Utylitaryzm, tłum. M.Ossowska, Warszawa 2005.
8	Woleński J., Hartman J., Wiedza o etyce, Warszawa 2008
Secondary literature	
1	Bińczyk E., Stępień T., Modeling Technoscience and Nanotechnology Assessment, Peter Lang Edition, Frankfurt-Wien 2014.
2	Breazeal, C., Scassellati, B., Robot in Society: Friend or Appliance, Proc. Agents (1999): 18-26.
3	Budinger T., Budinger M., Ethics of Emerging Technologies, Hoboken NJ 2006.
4	Dautenhahn K., et al., What is a Robot Companion: Friend, Assistant or Butler, IROS (2005)
5	Jaśtal J. (red.) Etyka i charakter, Kraków 2004
6	Ossowska M., Socjologia moralności. Zarys zagadnień, PWN, Warszawa 2005.
7	Schermer M., The Mind and the Machine. On the Conceptual and Moral Implications of Brain-Machine Interaction, Nanoethics (2009) 3: 217-230
8	Singer P. (red.) Przewodnik po etyce, Warszawa 2000.
9	Swierstra T., Rip A., Nano-Ethics as NEST-ethics: Patterns of Moral Argumentation About New and Emerging Science and Technologies, Nanoethics (2007) 1: 3-20.
10	Takayama, L. et al., Beyond Dirty, Dangerous and Dull: What Everyday People Think Robots Should Do, HRI-08 (2008).
11	Thrun S., Toward a Framework of Human-Robot Interaction, HCI-19 (2004): 9-24.
12	Witt K. (i in.), Deep Brain Stimulation and the Search for Identity, Neuroethics (2011)

SUBJECT SUPERVISOR

Name and surname:	Monika Małek-Orłowska
E-mail:	monika.malek@pwr.edu.pl

Strategic management (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Zarządzanie strategiczne**
Name in English	**Strategic management**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**University-wide**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
Number of hours of total student workload (CNPS)	90				
Form of crediting	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	3				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1,3				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	No prerequisites

SUBJECT OBJECTIVES

C1	Obtaining knowledge about strategic management
C2	Introduce instruments (strategies, models and methods), that support strategic management
C3	Acquire by students skills for practice strategic management tools

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Students know the idea of strategic management
PEU_W02	Knowledge about variety of strategies
PEU_W03	Familiarity with instruments (concepts, methods, models) of estimation a strategy

PROGRAMME CONTENT

Form of classes lecture		Number of hours
Le1	Enterprise and its market function	2
Le2	Role of strategy at management of an enterprise	2
Le3	Selected concepts of strategic management	2
Le4	Vision, mission statement and enterprise strategic aims	2
Le5	Strategic analyses of macro environment	2

Le6	Methods of predict the macro environment trends	2
Le7	Strategic analyses of sector environment	2
Le8	Analyses of organizational resources	2
Le9	Core competences strategy	2
Le10	Estimation an enterprise strategic position	2
Le11	Formulating a strategy and strategic choice	2
Le12	Models of strategic choice	2
Le13	Implementation a strategy	2
Le14	Modern management concepts and strategic management	2
Le15	General remarks and summary	2
Total hours		30

TEACHING TOOLS USED	
N1	Multimedia performance
N2	Reports
N3	Selected statistical data

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
1	F1	PEU_W01, PEU_W02, PEU_W03
2	F2	PEU_W01, PEU_W02, PEU_W03
3	F3	PEU_W01, PEU_W02, PEU_W03
	P = 0.25F1 + 0.5F2 + 0.25F3	

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Gierszewska G., Olszewska B., Skonieczny J., Zarządzanie strategiczne dla inżynierów, PWE Warszawa 2013
2	Zarządzanie strategiczne. Systemowa koncepcja biznesu, pod red. M. Moszkowicza, PWE Warszawa 2005
Secondary literature	
1	Obłój K., Pasja i dyscyplina strategii, Wydawnictwo Poltex 2010
2	Krawiec F., Zarządzanie strategią firmy, Difin,
3	Świda A., Strategic Management, Wroclaw University of Technology, Wrocław 2011
4	O strategii, Harvard Business Reviev Polska 2012
5	Gierszewska G., Romanowska M.,Analiza strategiczna?, PWE Warszawa 2009

SUBJECT SUPERVISOR

Name and surname:	Adam Świda
E-mail:	adam.swida@pwr.edu.pl

Engineering applications of mathematical statistics (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Inżynierskie zastosowania matematyki statystycznej**
Name in English	**Engineering applications of mathematical statistics**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15	15			
Number of hours of total student workload (CNPS)	60	30			
Form of crediting	Crediting with grade	Crediting with grade			
For group of courses mark (X) final course					
Number of ECTS points	2	1			
including number of ECTS points for practical(P) classes		1			
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8	0.8			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Basic knowledge in algebra and mathematical analysis, including: vectors, matrices, solving linear systems, functions (linear, polynomial, power, exponential, logarithmic), differentiation and integration of univariate functions, which is necessary for understanding mathematical aspects of technical and engineering problems.

SUBJECT OBJECTIVES

C1	Learning the methods and tools of statistical data description
C2	Becoming familiar with theoretical probability distribution functions
C3	Gaining knowledge on methods of statistical inference and their application to solving engineering problems
C4	Learning the application of methods and tools to perform statistical description of the data, in particular in the environmental context.
C5	Learning the use of methods and tools to perform statistical inference in order to analyze the phenomena and processes which occur in the environment.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	To have the knowledge on the methods and tools of descriptive statistics and the way of applying them to analyze the data in the domain of environmental engineering.
PEU_W02	To know theoretical probability distributions of discrete and continuous variables
PEU_W03	To have the knowledge on the methods and tools of inferential statistics and the way of applying them to analyze the phenomena and processes which occur in the environment
Relating to skills:	
PEU_U01	To be able to perform the statistical description of the data e.g. measurement data

PEU_U02	To be able to select and apply the methods and tools of statistical inference for analyzing the phenomena and processes which take place in the environment
Relating to social competences:	
PEU_K01	Capability for creative performance

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Variables, data, methods and tools of descriptive statistics, types of varia-bles, population, sample, measures of center, measures of spread, histo-gram, box plot	2
Le2	Discrete variables and their distributions: binomial, Poisson, negative bi-nomial, multinomial; examples of their use for analyzing environmental problems	2
Le3	Continuous variables and their distributions: normal, t-Student, F Snedecore, Chi-square	2
Le4	Confidence interval and level, tolerance interval and level; examples of their engineering applications	2
Le5	Statistical inference with statistical tests: for one and two means, for one and two variances, normality tests; examples of their applications to envi-ronmental problems	2
Le6	Statistical inference with statistical tests: for one and two means, for one and two variances, normality tests; examples of their applications to envi-ronmental problems	2
Le7	Regression analysis and its engineering applications: linear and nonlinear regression, univariate and multivariate regression, model validation, pre-diction with the regression model	2
Le8	Final test	1
Total hours		15

Form of classes -classes		Number of hours
Cl1	Statistical description of the data on the selected parameter of the environment	2
Cl2	Application of discrete variables distributions to solving engineering prob-lems	2
Cl3	Confidence interval and tolerance interval applied to analyzing engi-neering problems	2
Cl4	Statistical tests as the tools of solving problems in environmental engineering	2
Cl5	Normality tests	2
Cl6	Analysis of variance applied to studying the change of the state of environment	2
Cl7	Defining, parameterization and validation of the regression model of the relationship between environmental parameters	2
Cl8	Final test	1
Total hours		15

TEACHING TOOLS USED	
N1	Multimedia performance
N2	Reports
N3	Selected statistical data

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_W03	Final test
P2	PEU_U01, PEU_U02, PEU_K01, PEU_K02	Final test

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	M. Maciejewska, Engineering Applications of Mathematical Statistics, PRINTPAP, 2011
2	P. M. Berthouex, L. C. Brown, Statistics for Environmental Engineers, CRC Press, 2002
3	B.F.J. Manly, Statistics for Environmental Science and Management, CRC Press, 2008
4	V. Barnett, Environmental Statistics: Methods and Applications , John Wiley & Sons, 2006.

Secondary literature	
1	NIST/SEMATECH e-Handbook of Statistical Methods, http://www.itl.nist.gov/div898/handbook/, 7/18/2006

SUBJECT SUPERVISOR

Name and surname:	Monika Maciejewska
E-mail:	monika.maciejewska@pwr.edu.pl

Environmental chemistry (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Chemia środowiska**
Name in English	**Environmental chemistry**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
Number of hours of total student workload (CNPS)	90		60		
Form of crediting	Crediting with grade		Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	3		2		
including number of ECTS points for practical(P) classes			2		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.3		0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Knowledge in the field of inorganic and organic chemistry

SUBJECT OBJECTIVES

C1	Becoming familiar with the physical and chemical properties of water; chemical composition of natural waters and their contamination; water classification and water quality standards
C2	Becoming familiar with the physical and chemical processes which influence the content of the trace compounds in the air. Learning methods of mathematical description of the temporal and special variability of substances concentration in the air
C3	Gaining knowledge in the types of waste, the methods for determination of physico-chemical properties of the waste and the theoretical ways for their treatment

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Student has the knowledge in the field of the physical and chemical analysis required in assessment of drinking water quality
PEU_W02	Student understands the usefulness of physicochemical analysis in assessment of water quality
PEU_W03	Student is familiar with basic notions: atmosphere, troposphere, trace compound, air contaminant, mass balance of the substance in the air
PEU_W04	Student is able to describe and explain the processes which take place in the troposphere in gaseous phase
PEU_W05	Student is able to describe and explain the processes which take place in the troposphere in liquid phase
PEU_W06	Student knows the methods of determining sieve, morphological and chemical composition of waste
PEU_W07	Student is able to specify the parameters that determine the calorific and fertilizing properties of waste

PEU_W08	Student knows the theoretical basis of waste treatment, can compare individual technologies
Relating to skills:	
PEU_U01	Student has the ability to analyse physical and chemical properties of water samples
PEU_U02	Student has the ability of water quality assessment and its suitability for consumption
PEU_U03	Student has the ability to plan the experiment, its implementation and the correct interpretation of the results
PEU_U04	Student is able to apply the mathematical description of the mass-balance of species in the troposphere
PEU_U05	Student is able to analyse quantitatively selected processes taking place in gas phase and liquid phase in the troposphere.
PEU_U06	Student is able to predict and utilise the footprint of point emission source
Relating to social competences:	
PEU_K01	Student is aware of the effects of pollution of natural waters
PEU_K02	Student understands the role of trace compounds in the troposphere
PEU_K03	Student is aware of risks to the environment arising from incorrect waste management

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Physical and chemical properties of water. Minerals and natural organic compounds in water	3
Le2	Classification and water quality standards	2
Le3	Physical and chemical parameters of water analysis	2
Le4	Tests for determination of organic compounds in water	2
Le5	Crediting (part I)	1
Le6	Atmosphere, air and trace compounds. Mass balance of species in air and its mathematical description	3
Le7	Chemistry of gas phase in the troposphere.	2
Le8	Chemistry of liquid phase in the troposphere.	2
Le9	Species removal from the troposphere: wet and dry deposition.	2
Le10	Crediting (part II)	1
Le11	Quantitative characteristics of waste. General chemistry: differences between chemical compounds and mixtures, methods of separating components from mixtures as a basis for sieve and morphological analyses	3
Le12	Determination and evaluation of fertilizing and calorific properties of waste	2
Le13	Organic chemistry: elements, general properties, characteristics of common compounds pointing out the connection with waste (e.g. chlorinated hydrocarbons as solvents, alkenes as raw materials for the production of polyolefins)	2
Le14	Organic chemistry: carbohydrates, fats, proteins. Decomposition under aerobic and anaerobic conditions (chemical reactions, biocatalysis, quality of end-products)	2
Le15	Crediting (part III)	1
Total hours		30

Form of classes - laboratory		Number of hours
La1	Introduction; overview of the scope of the course. Analyses: alkalinity, hardness, calcium and magnesium	2
La2	Analyses: chlorides, ammonium nitrogen, nitrite nitrogen and nitrate nitrogen, sulphates and total dissolved solids	2
La3	Analyses: ferric, chemical oxygen demand (COD-Mn), manganese. Electrolyte balance. Assessment of water quality	3
La4	Temporal variability of species concentration in air as a function of the delivery and removal processes	2
La5	Quantitative analysis of photochemical cycle NO2, NO, O3	2
La6	Modelling of gas phase -liquid phase equilibrium for SO2 in the tropo-sphere	2
La7	Emission sources identification using a receptor model	2
Total hours		15

TEACHING TOOLS USED	
N1	Informative lecture
N2	Problematic lecture
N3	Calculation of the measurement results
N4	Preparing a research report
N5	Computer lab

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
F1	PEU_W01 , PEU_W02, PEU_K01	test
F2	PEU_W03 , PEU_W04, PEU_W05, PEU_K02	test
F3	PEU_W06 , PEU_W07, PEU_W08, PEU_K03	test
F4	PEU_U04 , PEU_U05, PEU_U06	computational exercises
F5, F6	PEU_U01 , PEU_U02, PEU_U03	test
F7	PEU_U01 , PEU_U02, PEU_U03	report
F1	PEU_W01 , PEU_W02, PEU_K01	test
	P1 = 1/3F1 + 1/3F2 +1/3F3 P6 = 0.5(0.4F5+0.4F6+0.2F7) + 0.5P4	

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	E. Gomółka, A. Szaynok, Chemia wody i powietrza, Oficyna Wydawnicza Politechniki Wrocławskiej, 1997.
2	J. Dojlido, Chemia wód powierzchniowych, Wydawnictwo Ekonomia i Środowisko, 1995.
3	B. i E. Gomółkowie, Ćwiczenia laboratoryjne z chemii wody, Oficyna Wydawnicza Politechniki Wrocławskiej, 1998
4	J.H. Seinfeld, S.N. Pandis: Atmospheric chemistry and Physics: Prom Air Pollution to Climate Change, 2nd edition, John Wiley & Sons, USA 2006.
5	D.J. Jacob, Introduction to Atmospheric Chemistry, Princeton University Press, USA 1999.
6	K. Schmidt-Szałowski i inni, Podstawy technologii chemicznej, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2004.
7	Bilitewski B., Hardtle G., Marek K., Podręcznik gospodarki odpadami. Wyd. Seidel-Przywecki Sp. z o.o., Warszawa, 2006.
Secondary literature	
1	A. Śliwa, Obliczenia chemiczne - zbiór zadań z chemii ogólnej i analitycznej, PWN, 1973
2	G.W. Vanloon, S.J. Duffy, Chemia środowiska, PWN, 2008
3	Wandrasz J., Wandrasz A., Paliwa formowane. Wyd. Seidel-Przywecki Sp. z o.o., Warszawa, 2006
4	Materiały Konferencyjne, Paliwa z odpadów, 2001-2011
5	R.M. Harrison: Principles of Environmental Chemistry. Royal Society of Chemistry, UK 2007

SUBJECT SUPERVISOR

Name and surname:	Izabela Kowalska (water chemistry), Monika Maciejewska (air chemistry), Emilia DenBoer (waste chemistry)
E-mail:	izabela.kowalska@pwr.edu.pl, monika.maciejewska@pwr.edu.pl, emilia.denboer@pwr.edu.pl

Environmental management (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Zarządzanie środowiskiem**
Name in English	**Environmental managment**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
Number of hours of total student workload (CNPS)	90				
Form of crediting	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	3				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.3				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	No prerequisites

SUBJECT OBJECTIVES

C1	Familiarizing students with basics of environmental management

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Gaining knowledge on the basics of environmental management
Relating to social competences:	
PEU_K01	Becoming aware of the mechanisms of environmental management

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Introduction to environmental management	2
Le2	Goals, concepts and principles of environmental management	2
Le3	Environmental management approaches	2
Le4	Environmental management mechanisms	2

Le5	Environmental management: system and process	2
Le6	Environmental management and science	2
Le7	Environmentalism, social science, economics and environmental manage-ment	2
Le8	Business, law and environmental management	2
Le9	Participants of environmental management	2
Le10	Environmental management versus real- world	2
Le11	Benefits and costs	2
Le12	Environmental management practice (Standards, Environmental Management System for SMEs)	2
Le13	Environmental management practice (Standards, Environmental Management System for SMEs)	2
Le14	Environmental management practice (Standards, Environmental Management System for SMEs)	2
Le15	Assignment	2
Total hours		30

TEACHING TOOLS USED	
N1	Lecture supported with the power point presentation

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_K01	test

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	C.J. Barrow, Environmental Management for Sustainable Development, Second Edition, Routledge Taylor & Francis Group, London, 2006
2	Chełmicki W., Woda-zasoby, degradacja, ochrona, PWN, Warszawa 2001

SUBJECT SUPERVISOR

Name and surname:	Łukasz Szałata
E-mail:	lukasz.szalata@pwr.edu.pl

Spatial planning (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Planowanie przestrzenne**
Name in English	**Spatial planning**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**University-wide**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	2				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	No prerequisites

SUBJECT OBJECTIVES

C1	to acquaint students with the foundations of spatial development and the complexity of spatial planning
C2	to present the principles of developing and implementing spatial policy at the national, regional and urban level
C3	to present different planning systems across Europe
C4	to make students aware of the territorial aspects of the EU and national policies

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Demonstrate knowledge of determinants of spatial policy at the national, regional level and in other structural units.
PEU_W02	Identify systemic problems of spatial development.
PEU_W03	Demonstrate knowledge of contemporary trends in sustainable spatial development
Relating to social competences:	
PEU_K01	Critically analyze available information.
PEU_K02	Communicate with the professionals working in the built environment

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Introduction to spatial planning ? territorial aspects of human activities	1
Le2	Development of human settlements.	2
Le3	From a city to functional urban area.	2
Le4	Models in planning.	2
Le5	Planning systems in Europe 1: Poland, France, Germany.	2
Le6	Planning systems in Europe 2: Netherlands, Spain, UK.	2
Le7	Territorial agenda of the EU. Urban agenda of the EU.	2
Le8	Environmental aspects in planning.	2
Total hours		15

TEACHING TOOLS USED	
N1	Multimedia presentation
N2	Written essay prepared on the given topic

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_W03, PEU_K01, PEU_K02	Lecture attendance. Essay on the selected spatial planning topic

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	European Commission (2011) Cities of tomorrow - Challenges, visions, ways forward.
2	European Commission (2011) Territorial Agenda of the EU. Towards an Inclusive, Smart and Sustainable Europe of Diverse Regions. http://ec.europa.eu/regional_policy/sources/policy/what/territorial-cohesion/territorial_agenda_2020.pdf
3	European Commission (2016) Urban Agenda for the EU. Pact of Amsterdam. http://urbanagendaforthe.eu/wp-content/uploads/2016/05/Pact-of-Amsterdam_v7_WEB.pdf
4	European Commission (2014) The urban dimension of EU policies - key features of an EU urban agenda. Communication to the Council, EP, CoR, EESC. http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1429515590530&uri=CELEX:52014DC0490
5	European Council of Spatial Planners (ECTP-CEU), (2003) The European Council of Town Planners
6	European Council of Spatial Planners (ECTP-CEU), (2013) The Charter of European Planning. http://www.ectp-ceu.eu/images/stories/PDF-docs/The%20Charter%20of%20European%20Planning-LowResV2.pdf
7	European Council of Spatial Planners (ECTP-CEU) European Charter on Participatory Demo-cracy in Spatial Planning Processes. http://www.ectp-ceu.eu/images/stories/PDF-docs/V10%20final%20LEBF%20on%20ECTP%20Charter%20part%20Democ%20sans%20mod.pdf
8	ESPON (2010) FOCI - Future Orientation for Cities. Final Report - Scientific Report.
9	ESPON (2014) TOWN: Small and Medium-Sized Towns. Final Report - Scientific Report.
10	Leipzig Charter (2007) http://ec.europa.eu/regional_policy/archive/themes/urban/leipzig_charter.pdf
11	Ward, S.V. (1992) Planning the Twentieth-Century City, John Wiley & Sons.
Secondary literature	
1	Batty, M. (2007) Cities and Complexity. Understanding Cities with Celular Automata, Agen-Based Model and Fractals. The MIT Press, Cambridge, Massachusetts-London
2	Batty, M. (2013) The New Science of Cities. Press, Cambridge, Massachusetts-London.
3	Burdett, R., Sudjic, D., (ed.) (2007) The Endless City. Phaidon.
4	Hall, P., Pain, K., (2006) The Polycentric Metropolis. Learning from Mega-City Regions in Europe. Earthscan.
5	Sievert, T., (2003) Cities Without Cities: An Interpretation of the Zwischenstadt. Taylor & Francis.

SUBJECT SUPERVISOR

Name and surname:	Izabela Mironowicz
E-mail:	izabela.mironowicz@pwr.edu.pl

Reliability of engineering systems (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Niezawodność systemów inżynierskich**
Name in English	**Reliability of engineering systems**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	2				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Has a fundamental knowledge of the design, construction and operation of systems in environ-mental engineering.

SUBJECT OBJECTIVES

C1	Gaining basic knowledge of purpose and research methods for assessment of reliability of sys-tems in environmental engineering.
C2	Gaining basic knowledge of purpose and research methods for risk assessment and operation safety of the systems in environmental engineering.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Has a knowledge about functioning of the engineering systems (water supply, wastewater disposal, heating, air conditioning, etc.) and requirements for the users and the environment.
PEU_W02	Has a knowledge about the advisability of testing the reliability, safety and risk of engineering systems and the basic indicators used in this research.
PEU_W03	Knows the basic methods of analysis and evaluation of the reliability and safety opera-tion of engineering systems based on data obtained from their operation and maintenance.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Introduction to the course. Reliability of systems in environmental engineering. Terminology.	2
Le2	Purpose, scope and methods of testing the reliability of engineering structures. Indicators of reliability.	2
Le3	Reliability of structures. Reliability analysis of selected objects and systems engineering.	2
Le4	The required level of reliability. Safety and risk in environmental engineering. Terminology.	2
Le5	Methods of safety analysis and risk assessment.	2
Le6	The risk analysis and safety of selected objects and engineering systems.	2
Le7	Risk and safety management.	2
Le8	Final test.	1
Total hours		15

TEACHING TOOLS USED	
N1	Informative lecture, multimedia presentation.
N2	Problem solving lecture.
N3	Self study; Individual studies and preparation for final test.
N4	Consultation and self study.
N1	Informative lecture, multimedia presentation.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_W03	final test

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Smith D.: Reliability, Maintainability and Risk - Practical Methods for Engineers (8th ed.), Elsevier 2011
2	Tung Y., Yen B., Melching - Hydrosystems Engineering Reliability Assessment and Risk Analysis, McGraw-Hill, 2006
Secondary literature	
1	Hester R.E., Harrison R.M.: Risk assessment and Risk Management, Royal Society of Chemistry, 1998.

SUBJECT SUPERVISOR

Name and surname:	Aleksandra Sambor
E-mail:	aleksandra.sambor@pwr.edu.pl

Organization of construction works (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Organizacja robót budowlanych**
Name in English	**Organization of construction works**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	2				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Has a fundamental knowledge of technology and organization of construction works.

SUBJECT OBJECTIVES

C1	Gaining knowledge about the technology and organization of installation works.
C2	Knowledge of modern technologies and organization of installation works.
C3	Acquisition of knowledge about proper use of technology works in the design and execution of installation works.
C4	Acquisition of installation work organization skills used in on-site construction.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Has a knowledge of modern technology and organization of installation works.
PEU_W02	Knows how to apply modern technology of work organization.
PEU_W03	Able to select the correct parameters for the different technologies work.
PEU_W01	Has a knowledge of modern technology and organization of installation works.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Stages and phases of the investment process. The rights and obligations of the participants of the investment process. The components of the construction project. Project documentation as a basis for the organization of installation works.	2
Le2	Technology of internal and external installation works. Elements of the construction site management. The conditions of storage of basic building materials.	2
Le3	The organization of internal and external installation works.	2
Le4	Take-off (simplified and detailed method). Types of estimates and costing methods.	2
Le5	Estimate of investor (simplified and detailed method). Computer-aided cost estimating, Review of software used for cost estimation.	2
Le6	Computer-aided project management.	2
Le7	Earthworks (categories of land, preparatory works, execution of the works).	2
Le8	Test	1
Total hours		15

TEACHING TOOLS USED	
N1	Informative lecture.
N2	Problem solving lecture.
N3	Multimedia presentation.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_W03, PEU_W04	Final test.

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Hendrickson C. Project Management for Construction. Department of Civil and Environmental Engineering, 2008, Carnegie Mellon University (electronic version available at: http://pmbook.ce.cmu.edu/)
2	A Guide to the Project Management Body of Knowledge (PMBOK Guide) - 5th ed., Project Management Institute, Inc.
3	Woodward J.F.: Construction project management: Getting it right first time. Thomas Telford, 1997.
4	Peurifoy R.L, Oberlender G.D.: Estimating Construction Costs. McGraw-Hill, 2001
5	Jonathan F. Hutchings, Project Scheduling Handbook (Civil and Environmental Engineering). Marcel Dekker, 2003.
Secondary literature	
1	Fewings P., Construction project management :An integrated approach. Taylor & Francis, 2005.
2	Neale R. H., Neale D. E. Construction planning. Engineering management. Amer Society of Civil Engineers, 1990.
3	Gahlot P.S., Dhir B.M.: Construction Planning And Management, New Age Publishers, 1990.

SUBJECT SUPERVISOR

Name and surname:	Aleksandra Sambor
E-mail:	aleksandra.sambor@pwr.edu.pl

Building regulations (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Prawo budowlane**
Name in English	**Building regulations**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	1				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.3				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	No requirements.

SUBJECT OBJECTIVES

C1	Gaining knowledge about the building regulations in Poland, EU and international standards.
C2	Acquisition of knowledge about engineering design, execution and construction according to current regulations and standards.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Has a knowledge of law and regulations related to investment process.
Relating to social competences:	
PEU_K01	Is aware of responsibilities and consequences for decisions.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Stages and phases of the investment process. The rights and obligations of the participants of the investment process. The components of the construction project. Project documentation as a basis for the organization of installation works.	6
Le2	European Union legislation. EC Directives related to investment process. Building policy and legislation.	2
Le3	Building process regulations.	4
Le4	Building code - Poland, EU and selected international examples.	4
Le5	Building code - professional responsibilities and penalties.	4
Le6	Technical conditions and requirements for buildings and their location. Building permit.	4
Le7	Safety and health protection at construction works. Professional engineer certification in Poland and EU.	4
Le8	Final test.	2
Total hours		30

TEACHING TOOLS USED	
N1	Informative lecture.
N2	Problem solving lecture.
N3	Multimedia presentation.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_K01	Final test

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	EC Directive internet portal.
2	Polish legislation internet portal.
3	The Construction Law - Prawo budowlane. Tłumaczenie: Dorota Bielecka, Maciej Bielecki. Wydawnictwo C.H. Beck.
Secondary literature	
1	M. J. Billington, Keith Bright, J. R. Waters (2007) The Building Regulations: Explained and Illustrated 13th Edition, Wiley-Blackwell

SUBJECT SUPERVISOR

Name and surname:	Aleksandra Sambor
E-mail:	aleksandra.sambor@pwr.edu.pl

Renewable energy systems (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Odnawialne źródła energii**
Name in English	**Renewable energy systems**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	2				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Basic knowledge in the field of physics, energy performance and environmental engineering

SUBJECT OBJECTIVES

C1	To acquaint students with the alternative energy sources, the use and simple operation of energy systems, components
C2	To familiarize with examples of technical installation, operation of renewable energy systems

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	One has knowledge related to renewable energy sources and technical solution of installation
PEU_W02	One knows the range of applicability and design criteria
Relating to social competences:	
PEU_K01	Critically analyze available information.
PEU_K02	Communicate with the professionals working in the built environment

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Introduction to climate change, energy challenges, energy and environ-ment, forms of energy, laws of energy conservation, importance of using renewable energy sources for sustainable development	2
Le2	Classification , characteristic and comparison of energy sources, energy efficiency, demand side management, principles of energy systems	2
Le3	Solar thermal, electrical systems, applications	2
Le4	Renewable hybrid systems, applications	2
Le5	Wind energy systems, hydro-energy systems	2
Le6	Energy from waste and biomass.	2
Le7	Software RETscreen application for renewable energy systems designing	2
Le8	Diagnostic test	1
Total hours		15

TEACHING TOOLS USED	
N1	Informative lecture, preparing report
N2	Subject lecture

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02	Test

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Boyle G. , Renewable Energy; Power for a Sustainable Future, Oxford University Press (2004)
2	Twidell J., Weir, Renewable Energy Resources, Taylor & Francis (2005)
3	Martin Kaltschmitt, Wolfgang Streicher, Andreas Wiese: Renewable Energy: Technology, Economics and Environments, Springer 2007
Secondary literature	
1	Leon Freris, David Infield: Renewable Energy in Power Systems, Wiley 2008
2	IEA, World Energy Outlook 2014. Paris: OECD/IEA
3	Current literature
4	internet

SUBJECT SUPERVISOR

Name and surname:	Marderos Ara Sayegh
E-mail:	ara.sayegh@pwr.edu.pl

Water quality management (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Zarządzanie jakością wód**
Name in English	**Water quality management**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
Number of hours of total student workload (CNPS)	90				
Form of crediting	Examination with grade				
For group of courses mark (X) final course					
Number of ECTS points	3				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.3				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Knowledge in general chemistry, physics, chemistry and microbiology of water as well as hydrology

SUBJECT OBJECTIVES

C1	Delivering knowledge related to the course of natural processes in hydrosphere and factors creating water quality
C2	Familiarizing students with assessment of aquatic environment reaction to the changes in water systems

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Students know quality of hydrosphere and factors that it create. Students know mechanisms of migration and transformation of pollutants in hydrosphere
PEU_W02	Students are able to determine stoichiometry and kinetics of reactions of pollutants transformation in hydrosphere and are able to predict water quality in emer-gency state of contamination
PEU_W03	Students know how to create the plan of water quality protection

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Systems of water quality management in EU and Poland arrangement	2
Le2	Stoichiometry and kinetics of reactions in aquatic environment	2
Le3	Rules of constant rate and order of reaction determination	2
Le4	Mathematical models of physical processes in hydrosphere (models of natural system hydraulics,	2

	models of disturbed flow, systems with heterogeneous reactions)	
Le5	Mathematical models of physical processes in hydrosphere (models of natural system hydraulics)	2
Le6	Mathematical models of physical processes in hydrosphere (models of disturbed flow)	2
Le7	Forecasting of water quality changes in environment - introduction	2
Le8	Analysis of pollutant transport within phases and through interphase boundary	2
Le9	Principles of mathematical models of water quality changes construc-tion	2
Le10	Models of water quality resulting from natural hydrogeological con-ditions	2
Le11	Quality models of water contaminated by anthropogenic sources	2
Le12	Analysis of model solutions for different operational states	2
Le13	Models of lake water quality changes (models of lake water circula-tion, ecological models, limnological models)	2
Le14	Quality models of groundwater contaminated by anthropogenic sources involving geological layer properties	2
Le15	Examples of aquatic environment assessment impact	2
Total hours		30

TEACHING TOOLS USED	
N1	Inquire lecture
N2	Problem lecture

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_W03	Examination

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Adamski W., Parks E., Water Quality Management, Wydawnictwa Politechniki Wrocławskiej, Wrocław 2011
2	Chełmicki W., Woda-zasoby, degradacja, ochrona, PWN, Warszawa 2001
3	Roberts A.E., Water Quality Control Handbook, McGraw-Hill 2006
4	Krenkel P., Water Quality Management, Academic Press 2012
5	Kiley G., Environmental Engineering, McGraw-Hill (1997)
Secondary literature	
1	Litynski T., Jurkowska H., Żyzność gleby i odżywianie się roślin, PWN, Warszawa, 1982
2	Allan J.D., Ekologia wód płynących, PWN, Warszawa, 1998
3	Rup K., Procesy przenoszenia zanieczyszczeń w środowisku naturalnym, Wydawnictwo Naukowe PWN, Warszawa 2019
4	Bajkiewicz-Grabowska E., Magnuszewski A., Mikulski Z., Przewodnik do ćwiczeń z hydrologii ogólnej, PWN, Warszawa 1993
5	Licznar P., Modelowanie erozji wodnej gleby, Wyd. Akademii Rolniczej we Wrocławiu, Wrocław, 2001
6	Atlas Hydrologiczny Polski, IMiGW, Wyd. Geol. Warszawa, 1996

SUBJECT SUPERVISOR

Name and surname:	Wojciech Adamski
E-mail:	wojciech.adamski@pwr.edu.pl

Raw materials management (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Gospodarka surowcami**
Name in English	**Raw materials management**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		30		
Form of crediting	Crediting with grade		Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	1		1		
including number of ECTS points for practical(P) classes			1		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8		0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	The basic knowledge in the field of inorganic and organic chemistry

SUBJECT OBJECTIVES

C1	Gaining knowledge in the quality and quantity of domestic natural resources (fossil fuels, chemical and plant raw materials, metals, rocks) in Poland, other EU countries and in the world
C2	Understanding the pathways from raw material to waste (LCA) for key industries

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Student has knowledge of quality and quantity of domestic mineral resources, plant raw materials and fossil fuels in selected EU countries, methods of their processing and the kinds of generated waste
PEU_W02	Student is able to define the various stages of the life cycle of products and processes (from raw materials, through products to waste)
Relating to skills:	
PEU_U01	Student is able to gather, compile and present information about the market of raw materials in selected country and knows how to use them.
PEU_U02	Student is able to compare data from different countries , answer questions from the group, participate in discussions on other topics
Relating to social competences:	
PEU_K01	Student is aware of the dangers to the environment arising from the processing of raw materials
PEU_K02	Student can cooperate with a group and perform various roles including the role of a presenter, discussion member, an opponent

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	From Raw Materials to Waste: Life Cycle Assessment (LCA)	2
Le2	Classification of minerals and ways to protect the deposits, the amount of reserves and annual production of raw materials in Poland compared to the EU and the world, trends of changes	2
Le3	Metallic raw materials: exploration and processing of copper, the types of waste. KGHM international	2
Le4	Chemical raw materials: extraction and processing of rock salt, properties and uses of chlorine & soda ash	2
Le5	Energy resources: mining and processing of hard coal , types of waste	2
Le6	Mineral resources: gypsum, anhydrite (properties, applications, gypsum waste)	2
Le7	Plant raw materials: forest production: characteristics and use of wood, waste management	2
Le8	Test	1
Total hours		15

Form of classes - laboratory		Number of hours
Se1	Introduction; an overview of the scope of the seminar, presentation the latest laws and regulations relating to the seminar, choice of presentation topics	2
Se2	Presentation by the students native land in terms of geography, climate, raw materials and industry. Group discussions. Depending on the group size and native lands of the students, additional presentations on the characteristics, extraction and processing of: iron, aluminum, zinc and lead, sulfur (native and waste), lignite, natural gas, oil and bituminous shale, raw materials for lime and cement industries	12
Se3	Overdue presentations, seminar summary	1
Total hours		15

TEACHING TOOLS USED	
N1	Informative lecture
N2	Consultations
N3	Presentation
N4	Discussion
N5	Exam

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_K01	Test
F1	PEU_U01	Consultations
F2	PEU_U01, PEU_U02, PEU_K02	Presentation
F3	PEU_U02, PEU_K02	Discussion
	P2 = (F1+F2 + F3)/3	

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	J.R.Craig, D.J. Vaughan, B.J. Skinner, Zasoby Ziemi, PWN, Warszawa 2003
2	Information from the website of the Polish Geological Institute, www.pgi.gov.pl (English version available)
3	Foreign articles within the framework of the course
Secondary literature	
1	Newspaper "Rzeczpospolita", Appendix Economy
2	News from the website of the Polish Ministry of Economy (www.mg.gov.pl/newsletter) and from other countries (native country of student)

SUBJECT SUPERVISOR

Name and surname:	Emilia den Boer
E-mail:	Emilia.denboer@pwr.edu.pl

Water Treatment Technology (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Oczyszczanie wody**
Name in English	**Water Treatment Technology**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Examination with grade		Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	2		1		
including number of ECTS points for practical(P) classes			1		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.3		0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Basic knowledge on the engineering level within the range of water chemistry and water treatment

SUBJECT OBJECTIVES

C1	Learning of mechanisms, course and efficiency of nonconventional water treatment pro-cesses, also for chosen industrial purposes, as well as problems related to water secondary pollution
C2	Gaining skills for impact assessment of quality of treated water, technological parameters of unit treatment processes on removal efficiency of different fraction of pollution

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Student has knowledge related to course and efficiency of nonconventional water treatment processes Student is able to determine water treatment technology dependent on water composition and quality required, involving rules of circular economy
PEU_W02	Student has knowledge related to the operation principles of devices used for nonconventional and advanced systems of water treatment
Relating to skills:	
PEU_U01	Based on raw water analysis student is able to propose technological version of wa-ter treatment, among other desalination, softening and demineralization Student is able to carry out laboratory scale experiments and based on the result assess usability of methods proposed
Relating to social competences:	
PEU_K01	Capability for creative performance
PEU_K02	Capability of way of proceedings determination for specified objective achievement

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Factors influencing course and efficiency of basics surface water treatment processes	2
Le2	Factors influencing course and efficiency of basics ground water treatment processes	2
Le3	Nonconventional processes of water treatment - infiltration (mechanisms, course, efficiency, devices applied)	2
Le4	Nonconventional processes of water treatment – chemical oxidation (mechanisms, course, efficiency, devices applied)	2
Le5	Nonconventional processes of water treatment – filtration through biologically active bed (mechanisms, course, efficiency, devices applied)	2
Le6	Nonconventional processes of water treatment – softening (mechanisms, course, efficiency, devices applied)	2
Le7	Nonconventional processes of water treatment - precipitation (mechanisms, course, efficiency, devices applied)	2
Le8	Nonconventional processes of water treatment – ion-exchange (mechanisms, course, efficiency, devices applied)	2
Le9	Membrane processes in water renovation and resources recovery	2
Le10	Nonconventional processes application for drinking water treatment	2
Le11	Nonconventional processes application for industrial wastewater treatment	2
Le12	Chemical and biological stability of water	2
Le13	Nonorganic and organic water treatment by-products	2
Le14	Water quality changes in water distribution system	2
Le15	Secondary pollution protection	2
Total hours		30

Form of classes - laboratory		Number of hours
La1	Introduction, talk over the range of experiments and health and safety regulation in chemical laboratory. Analytical methods	2
La2	Comparison of coagulation and enhanced coagulation efficiency in surface water treatment	4
La3	Removal of iron and manganese compounds	4
La4	NOM removal from water by adsorption and ion-exchange process	4
La5	Crediting	1
Total hours		15

TEACHING TOOLS USED	
N1	Informative lecture
N2	Problem lecture
N3	Results of measurement calculation
N4	Report working out

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

	Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
1	P1	PEU_W01, PEU_W02	Examination
2	F1-F3	PEU_U01, PEU_K01, PEU_K02	Test
3	F4	PEU_U01, PEU_K01, PEU_K02	Report
	P2 = 0.25F1 + 0.25F2 + 0.25F3 + 0.25F4		

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Kowal A.L., Świderska-Bróż M., Oczyszczanie wody Podstawy teoretyczne i technologiczne, procesy i urząd□dzenia, PWN, Warszawa 2009.
2	Adamski W. Szlachta M., Water treatment technology : principles and modeling, Wrocław University of Technology, 2011
3	Uzdatnianie wody. Procesy fizyczne, chemiczne i biologiczne, praca zbiorowa pod redakcją J. Nawrockiego, PWN, Warszawa 2010.
4	Crittenden J., MWH's water treatment : principles and design, John Wiley & Sons, Third Edition, 2012
5	Edzwald J.K, Water quality & treatment : a handbook on drinking water, McGraw-Hill, 2011
6	Instruction for laboratory exercises
7	B. E. Gomółkowie, Ćwiczenia laboratoryjne z chemii wody, Wyd. PWr, Wrocław 1996.
8	Bodzek M., Konieczny K., Wykorzystanie procesów membranowych w uzdatnianiu wody, Projprzem-EKO, Bydgoszcz 2005
9	Journals related to water treatment technology
Secondary literature	
1	M. Bodzek, K. Konieczny, Usuwanie zanieczyszczeń nieorganicznych ze środowiska wodnego metodami membranowymi, Wyd. Seidel-Przywecki, Warszawa 2011
2	S. l D. Faust, O. M. Aly, Chemistry of Water Treatment. Lewis Publisher, Second Edition, 1998.
3	G. Budd, B. Long, J. Edwards, P. Singer, M. Meisch, Evaluation of MIEX Process Impacts on Different Source Waters. AwwaRF Report 91067F, 2006.

SUBJECT SUPERVISOR

Name and surname:	Wojciech Adamski
E-mail:	Wojciech.adamski@pwr.edu.pl

Sanitary biology (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Biologia sanitarna**
Name in English	**Sanitary biology**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		30		
Form of crediting	Examination with grade		Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	1		1		
including number of ECTS points for practical(P) classes			1		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8		0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Has a basic knowledge about biology, microbiology and biochemistry

SUBJECT OBJECTIVES

C1	To gain the basic knowledge of structure, functioning and systematics of major groups of microorganisms
C2	To gain the knowledge of basic methods of microbial culturing and environment quality assessment
C3	To gain the basic knowledge of application of microorganisms in environmental pollutants clean-up
C4	To gain skills in carrying out the microbiological assessment of environmental samples

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Has basic knowledge of sanitary biology, including requirements for water, soil, air and wastes; knows microbiological processes, which play the basic role in biological methods of environmental clean-up
Relating to skills:	
PEU_U01	Is capable to perform sanitary analysis of water, air and soil and to assess the quality of analyzed sample
Relating to social competences:	
PEU_K01	Is conscious about dangers resulted from emission of microbiological pollutants

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Nutrition, growth and reproduction across microorganisms. Culturing methods. Characteristics of selected groups of microorganisms	2
Le2	Microbiology of water and effluents	2
Le3	Microbiology of soil and waste	2
Le4	Microbiology of air	2
Le5	Application of microorganisms in environment protection	2
Le6	Biodeterioration of natural and synthetic materials	2
Le7	Advanced techniques of microbiology	2
Le8	The basics of microbial genetics	1
Total hours		15

Form of classes - laboratory		Number of hours
La1	Introduction, safety guidelines in microbiological laboratory. Morphology of bacterial cell, basic staining. Morphology of bacterial cell. Two dyes staining.	3
La2	Sterilization and disinfection. Inoculation and culturing methods.	3
La3	Microbiological analysis of water.	3
La4	Microbiological analysis of soil	3
La5	Microbiological analysis of air. Credit.	3
La2	Sterilization and disinfection. Inoculation and culturing methods.	3
Total hours		15

TEACHING TOOLS USED	
N1	Informative lecture
N2	Problematic lecture
N3	Calculation of the measurement results
N4	Preparing a research report
N5	Computer lab

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_K01	Examination
F1	PEU_U01	Practical skills
F2	PEU_U01, PEU_K01	Presentation/report
	P2=0.5F1+0.5F2	

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Willey J.M., Sherwood L.M., Woolverton C.J., Prescott?s Microbiology.
2	Kołwzan B., Adamiak W., Rybak J., Sanitary biology, Łodź: PRINTPAP, 2011
3	Schlegel H.G., General Microbiology. Cambridge University Press, 1993

SUBJECT SUPERVISOR

Name and surname:	Mirela Wolf Baca
E-mail:	Mirela.wolf-baca@pwr.edu.pl

AutoCAD (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**AutoCAD**
Name in English	**AutoCAD**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)			15		
Number of hours of total student workload (CNPS)			30		
Form of crediting			Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points			1		
including number of ECTS points for practical(P) classes			1		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)			0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Has a fundamental knowledge and skills in technical drawing, descriptive geometry and computer science.

SUBJECT OBJECTIVES

C1	Familiarize with the basics of CAD software using Autodesk AutoCAD.
C2	The acquisition of skills for operation of 2D CAD drafting software using Autodesk AutoCAD
C3	The acquisition of skills for preparation of technical documentation using Autodesk AutoCAD

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Student has the knowledge in the field of the physical and chemical analysis required in assessment of drinking water quality
PEU_W02	Student understands the usefulness of physicochemical analysis in assessment of water quality
PEU_W03	Student is familiar with basic notions: atmosphere, troposphere, trace compound, air contaminant, mass balance of the substance in the air
PEU_W04	Student is able to describe and explain the processes which take place in the troposphere in gaseous phase
PEU_W05	Student is able to describe and explain the processes which take place in the troposphere in liquid phase
PEU_W06	Student knows the methods of determining sieve, morphological and chemical composition of waste
PEU_W07	Student is able to specify the parameters that determine the calorific and fertilizing properties of waste
PEU_W08	Student knows the theoretical basis of waste treatment, can compare individual technologies
Relating to skills:	
PEU_U01	Able to work with 2D CAD drafting program Autodesk AutoCAD.

PEU_U02	Able to enter geometric data using various functions of the software.
PEU_U03	Able to properly choose the procedures and instructions in the preparation of digital documentation.
PEU_U04	Able to prepare the final engineering drawing for printing and digital publishing.
Relating to social competences:	
PEU_K01	Has the ability to obtain information from various sources.

PROGRAMME CONTENT

Form of classes – laboratory		Number of hours
La1	Discussion of the principles and safety in the computer laboratory. Intro-duction, history of computer aided design. Introduction to CAD/CAM software (Open-source and commercial)	2
La2	Methods for location of points on the drawing area, types of coordinates and units, drawing boundaries. Layers, meaning, how to create and change their parameters. Creating a template	2
La3	Basic commands for creating, deleting simple geometric elements. Practi-cal exercises. Presentation of the commands associated with the modifica-tion and transformation of objects. Hatch sections: methods and hatches, parameters and settings. Practical exercises	2
La4	Text in AutoCAD: formatting styles, methods for creating text objects, edit text, change. Printing drawings, printing device configuration, parameter setting print edition. Practical exercises	2
La5	Sizing objects. Creating a linear dimension. Sizing radial and reference.Formatting dimension styles. Design of a complete 2D drawing (basic difficulty level). Practical exercises	2
La6	Create own library of blocks, save to disk, share and publish in internet (cloud services, shared environment), insert into drawing, splitting into separate components. Using blocks from external sources (internet)	2
La7	Preparation of intermediate 2D drawings. Preparation of advanced 2D drawings. Advanced drafting options	2
La8	Introduction to 3D modelling. Advanced practical exercises	1
Total hours		15

TEACHING TOOLS USED	
N1	CAD software Autodesk AutoCAD.
N2	Sample drawings (at different difficulty level).
N3	Digital libraries of engineering elements.
N4	Consultation.
N5	Discussion of techniques used.
N6	Individual studies and self study.
N7	Individual work: preparation for classes.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
F1-F5	PEU_U01, PEU_U02, PEU_U03, PEK_U04, PEK_K01	Discussion. Preparation of drawing
	P = 0.2F1 + 0.2F2 + 0.2F3 +0.2F4 + 0.2F5	

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	B. Fane (2015), AutoCAD 2014 For Dummies, John Wiley & Sons
2	E. Finkelstein (2015), AutoCAD 2015 Bible, Wiley Publishing Inc.

SUBJECT SUPERVISOR

Name and surname:	Michał Oktawiec
E-mail:	michal.oktawiec@pwr.edu.pl

Water supply systems (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Zaopatrzenie w wodę**
Name in English	**Water supply systems**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		30		
Form of crediting	Crediting with grade		Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	1		1		
including number of ECTS points for practical(P) classes			1		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8		0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Has a basic knowledge of hydraulics.

SUBJECT OBJECTIVES

C1	Gaining knowledge in water supply systems design and modeling.
C2	Gaining knowledge concerning current materials and sanitary fittings used for water distribution systems construction.
C3	Acquiring skills of water supply systems computer models construction and practical application.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Has knowledge of water distribution systems design and modeling.
PEU_W02	Has knowledge of materials and sanitary fittings used for water distribution systems construction.
PEU_W03	Knows the basic methods, techniques, and tools used to build and calibrate models of water distribution systems
Relating to skills:	
PEU_U01	Is able to design water distribution system.
PEU_U02	Is able to develop a computer model of water distribution system.
PEU_U03	Is able to simulate water flows for various water use scenarios.
Relating to social competences:	
PEU_K01	Is aware of the dangers to the society resulting from water supply system malfunction.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Introduction to water supply systems lectures. Anatomy of contemporary water supply systems.	2
Le2	Guidelines concerning materials and sanitary fittings used for water distribution systems construction.	2
Le3	Estimation of current and future water demands. Peaking factors and time-varying demands.	2
Le4	Water distribution networks hydraulics.	2
Le5	Assembling a model of water supply system, description of typical model components.	2
Le6	Integrating GIS and hydraulic modeling. Using SCADA data for hydraulic modeling.	2
Le7	Identification and solving common water distribution system problems.	2
Le8	Pass writing.	1
Total hours		30

Form of classes - project		Number of hours
Pr1	Design project release and discussion.	2
Pr2	Water distribution system layout planning.	2
Pr3	Daily water demands, peaking factors and time-varying demands identification.	2
Pr4	Hydraulic calculations and system sizing.	2
Pr5	Building computer model of water distribution system. Defining basic elements and network topology.	2
Pr6	Steady-state and extended-period simulations of water flows for different scenarios.	2
Pr7	Simulation results overview.	2
Total hours		15

TEACHING TOOLS USED	
N1	Informational lecture.
N2	Computer laboratory.
N3	Consultations.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

	Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
1	P1	PEU_W01, PEU_W02, PEU_W03, PEU_K01	Pass writing.
2	F1	PEU_U01, PEU_U02, PEU_U03, PEU_K01	Evaluation of computational and graphical part of design project
3	F2	PEU_U01, PEU_U02, PEU_K01	Critical discussion of design
	P2 = 0.8F1 + 0.2F2		

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Haestad Methods, T.M. Walski, D.V. Chase, D.A. Savic, W. Grayman, S. Beckwith, E. Koelle, Advanced Water Distribution Modeling and Managment, Haestad Press, 2004
2	P. Lonsdale, D. Obradovic, Public Water Supply: Models, Data and Operational Management, CRC Press, 1998
3	L. Mays, Water Distribution System Handbook, McGraw-Hill Professional, 1999
Secondary literature	
1	EN 805, Water supply. Requirements for systems and components outside buildings
2	Siwoń Z., Łomotowski J., Cieżak W., Licznar P., Cieżak J., Analizy i prognozowanie rozbiorów wody w systemach wodociągowych, PAN, Komitet Inżynierii Lądowej i Wodnej, Instytut Podstawowych Problemów Techniki, Warszawa, 2008

SUBJECT SUPERVISOR

Name and surname:	Paweł Licznar
E-mail:	Pawel.licznar@pwr.edu.pl

Biodegradable materials(n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Materiały biodegradowalne**
Name in English	**Biodegradable materials**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	2				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.3				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	No prerequisites

SUBJECT OBJECTIVES

C1	Has a basic knowledge in the field of organic chemistry

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Has knowledge of biodegradable materials applications on a global scale. Can assess their pros and cons, in the field of application and environmental impact.
PEU_W02	Knows raw materials for biodegradable materials production, regarding to world region. Knows biodegradable materials used in construction, medicine, automotive and construction industry
Relating to social competences:	
PEU_K01	Understands the need for continuous expand of their knowledge

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Introduction	3
Le2	Life Cycle Assesment of biodegradable materials	2
Le3	Composting, methods, standards, monitoring	2

Le4	Composting, methods, standards, monitoring	2
Le5	PLA, production, processing, applications	3
Le6	PHB, production, processing, applications	3
Le7	Starch, production, processing, applications	3
Le8	Lignin and cellulose materials	3
Le9	Visit at the laboratory, presentation of raw materials, processing equipment, typical end products	2
Le10	Biodegradable materials in medicine	3
Le11	Biodegradable materials in automotive industry	2
Le12	Test	2
Total hours		30

TEACHING TOOLS USED	
N1	Lecture
N2	Issues of concern

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_U01	Test

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Handbook of Biopolymers and Biodegradable Plastics - Properties, Processing and Applications, ed. Ebnesajjad, Sina, Elsevier/William Andrew, 2013.
Secondary literature	
1	Biodegradable polymer blends and composites from renewable resources, ed. by Long Yu, Wiley and sons 2009

SUBJECT SUPERVISOR

Name and surname:	Stanisław Frąckowiak
E-mail:	stanislaw.frackowiak@pwr.edu.pl

Wastewater Treatment Technology (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Technologia oczyszczania ścieków**
Name in English	**Wastewater Treatment Technology**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Crediting with grade		Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	2		1		
including number of ECTS points for practical(P) classes			1		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.3		0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Knowledge on engineering level in the range of technological processes of sewage treatment and sludge processing
2	Knowledge within the range of general chemistry - stoichiometry and kinetics of transfor-mations

SUBJECT OBJECTIVES

C1	Learning of scientific basis of engineering of biological processes for sewage treatment and sludge processing
C2	Understanding of importance of sewage contamination fractionation in context of mechanisms and efficiency of their removal
C3	Understanding of relation between biological treatment of sewage efficiency and process parameters and their connection with sludge stabilization
C4	Understanding of mechanisms of organic pollutants, nitrogen and phosphorous removal from waste water, and sludge processing
C5	Getting acquainted with chosen laboratory methods of sewage treatment processes and sludge processing investigation

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Knowledge of scientific fundamentals of engineering of biological treatment processes for sewage treatment
PEU_W02	Capability of selection of technological system for municipal sewage treatment for proper efficiency of organic compounds, nitrogen and phosphorous removal, as well as recovery of nutrients
PEU_W03	Capability of observed removal efficiency of organic compounds, nitrogen and phosphorous, connection with parameters of biological treatment

Relating to skills:	
PEU_U01	Capability of laboratory tests of chosen processes of sewage treatment and sludge processing conducting and obtained results interpretation
PEU_U02	Capability of conclusions from laboratory tests for technological process assessment
Relating to social competences:	
PEU_K01	Capability of creative activity
PEU_K02	Capability of proper way of proceedings for proper goal achievement determination

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Sewage characteristic in context of its biological treatment	2
Le2	Mechanisms of organic compounds removal by biological treatment methods	2
Le3	Mechanisms of organic compounds removal by integrated treatment methods	2
Le4	The basic stoichiometry of pollution transformation during biological treatment	2
Le5	The kinetic characteristic of pollution transformation during biological treatment	2
Le6	Reactors and process parameters of activated sludge	2
Le7	Oxygen demand - system of aeration	2
Le8	Systems of aerobic sewage treatment by activated sludge	2
Le9	Mechanisms of biological removal of nitrogen	2
Le10	Mechanisms of biological removal of phosphorous	2
Le11	Systems for nitrogen removal by nitrification	2
Le12	Systems for nitrogen removal by nitrification and denitrification	2
Le13	Mechanisms of biological removal of nitrogen and phosphorous from sewage	2
Le14	Systems for anaerobic-anoxic treatment by activated sludge	2
Le15	Systems for anaerobic-anoxic and aerobic treatment by activated sludge	2
Total hours		30

Form of classes - laboratory		Number of hours
La1	Introduction, range of laboratory tests, health and safety regulation in chemical laboratory. Description of analytical methods	2
La2	Chemical removal of phosphorous from sewage	4
La3	Removal of biogens in activated sludge reactor	4
La4	Sludge thickening	4
La5	Crediting	1
Total hours		15

TEACHING TOOLS USED	
N1	Informative lecture
N2	Problem lecture
N3	Results of measurement calculation
N4	Report elaboration
N1	Informative lecture

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_W03	test
F1-F3	PEU_U01, PEU_U02, PEU_K01, PEU_K02	test
F4	PEU_U01, PEU_U02, PEU_K01, PEU_K02	Report
	P2 = 0.25F1 + 0.25F2 + 0.25F3 + 0.25F4	

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Lecture Notes
2	Metcalf and Eddy Inc., Wastewater Engineering. Treatment and Reuse Environmental Science for Environmental Management, McGraw Hill (2003).
3	M. Henze, P. Herremoes, J. la Cour Jansen, E. Arvin, Wastewater Treatment. Biological and Chemical Processes, Springer (2002).
4	M. Henze, M. Żygadło, Oczyszczanie ścieków : procesy biologiczne i chemiczne, Wydawnictwo Politechniki Świętokrzyskiej, Kielce, 2002
5	G.Tchobanoglous, Wastewater engineering : treatment and reuse, Boston. McGraw-Hill, 2004
6	C.Leslie, Biological wastewater treatment, CRC Press/Taylor&Francis, London, 2011
7	Laboratory instruction
Secondary literature	
1	Metcalf & Eddy, Inc. (1991), Wastewater Engineering: Treatment, Disposal and Reuse, McGraw Hill, Inc.
3	L. Hartman, Biologiczne oczyszczanie ścieków, Instalator Polski, Warszawa 1996.
4	J. Łomotowski, A. Szpindor, Nowoczesne systemy oczyszczania ścieków, Arkady 1999.
5	Praca zbiorowa, Poradnik eksploatatora oczyszczalni ścieków, PZiTS Poznań, 1997
6	J. Bever, A. Stein, H. Teichman, Zaawansowane metody oczyszczania ścieków, Projprzem-EKO, Bydgoszcz 1997

SUBJECT SUPERVISOR

Name and surname:	Wojciech Adamski
E-mail:	wojciech.adamski@pwr.edu.pl

Solid waste management (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Gospodarka odpadami**
Name in English	**Solid waste management**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Examination with grade		Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	2		1		
including number of ECTS points for practical(P) classes			1		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.3		0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Has basic knowledge on waste management
2	Has basic knowledge of physics and chemistry needed to understand the phenomena of environmental engineering
3	Has basic knowledge and understanding of the processes of biological and physico - chemical processes in the environment and assessing environmental hazards

SUBJECT OBJECTIVES

C1	Acquiring knowledge about the current environmental policy of the European Union in the field of waste management , currently produced quantities and composition of the waste
C2	Acquisition of knowledge in the field of modern waste management technology
C3	Acquiring the ability to carry out basic indications and techniques for the analysis of waste

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Has basic knowledge of legislation on waste management of the EU and Poland
PEU_W02	Has in-depth knowledge on the best available technology, waste treatment , conditions of processes , basic parameters and the final products
PEU_W03	Is able to list the key issues related to waste management technologies , discuss their impact on the environment and the possibility of its limitations
Relating to skills:	
PEU_U01	Is able to plan and carry out basic experiments
PEU_U02	Can interpret the results of chemical analyzes and develop them in the form of a report

PEU_U03	Can choose the optimal waste management technologies based on the obtained results
PEU_U04	Can make a report in writing and orally present research results
Relating to social competences:	
PEU_K01	Has the ability to work in a group and has the ability to present their work to the forum
PEU_K02	Is aware of risks to the environment arising the consumption of goods and manufacturing

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Challenges of Modern Waste Management	2
Le2	Selected aspects of European Waste Policy	2
Le3	Integrated waste management, LCA and Industrial Symbiosis	2
Le4	Comparison of various separate waste collection systems	2
Le5	Sorting and dismantling	2
Le6	Best available technologies for biological waste treatment	2
Le7	Best available technologies for biological waste treatment	2
Le8	Emissions from biological waste treatment installations and abatment technologies; quality of products	2
Le9	Selected technologies of mechanical-biological treatment	2
Le10	Fuel properties of waste and waste derived fuels	2
Le11	Selected technologies for thermal treatment of waste	2
Le12	Landfilling of waste	2
Le13	Limiting emisions from waste landfills	2
Le14	Closure, recultivation and revitalisation of waste landfills	2
Le15	Economic aspects of waste management	2
Total hours		30

Form of classes - laboratory		Number of hours
La1	Introduction, presentation of the scope of work, safety instructions	3
La2	Material composition analyses of waste/composts/stabilates, vegetation tests, acidity, water content	3
La3	Standard analyses: loss of ignition, digestion of the samples	3
La4	Datermining total Nitrogen and total Phosphorus content, fertilising value	3
La5	Determination of the heat of combustion - fuel properties; Calculation of results, comparison of results	3
Total hours		15

TEACHING TOOLS USED	
N1	Informative lecture
N2	Problem-oriented lecture
N3	Carrying out tests on waste and chemical determinations
N4	Discussion and interpretation of results
N5	Elaboration of lab report

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_W03	Examination
F1	PEU_U01, PEU_U02, PEU_U03	Preparation to classes
F2	PEU_U04, PEU_K01, PEU_K02	Report
	P2 = F1*0.3 + F2*0.7	

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	den Boer, E., den Boer, J. Szpadt, R. Solid waste management - podręcznik dla kierunku Environmental Quality Management, Environmental Engineering, Politechnika Wrocławska, Wrocław, 2011
2	Waste Management / Bernd Bilitewski, Klaus Marek, Georg Härdtle ISBN: 9783540592105 - Verlag: Springer Berlin
3	den Boer, E., den Boer, J. Jager, J. Waste Management planing and optimisation. Handbook for Municipal Waste Prognosis and Sustainability Assessment, Ibidem Verlag, Stuttgart 2005 http://www.iwar.bauing.tu-darmstadt.de/abft/Lcaiwm/Main.htm
Secondary literature	
1	McDougall, White, P., Franke, M. i Hindle P. Integrated Solid Waste Management a Life Cycle Inventory, Blackwell Science, 2001

SUBJECT SUPERVISOR

Name and surname:	Emilia den Boer
E-mail:	emilia.denboer@pwr.edu.pl

Environmental chemistry (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Oczyszczanie gazów**
Name in English	**Waste gases purification**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	15			
Number of hours of total student workload (CNPS)	60	30			
Form of crediting	Examination with grade	Crediting with grade			
For group of courses mark (X) final course					
Number of ECTS points	2	1			
including number of ECTS points for practical(P) classes		1			
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.3	0.8			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Basic knowledge in chemistry and mathematics

SUBJECT OBJECTIVES

C1	Understanding the theoretical and application fundamentals of technologies for cleaning the most important industrial waste gases
C2	Learning basics of calculation methodology for inorganic waste gases purification by means of absorption
C3	Learning basics of calculation methodology for organic waste gases purification by means of adsorption

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Ability to indicate the type of pollutants emitted into the atmosphere from industrial sources
PEU_W02	Ability to pre-selection of technologies for protection of the atmospheric air
Relating to skills:	
PEU_U01	The ability to perform calculation for the process of waste gases purification by means of absorption and to determine the geometry of the absorber.
PEU_U02	The ability to perform calculation for the process of waste gases purification by means of periodic adsorption and to determine the geometry of the adsorber
Relating to social competences:	
PEU_K01	Ability to select and assess way of action to achieve required goals

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Introduction - air quality as a global and/or local problems	2
Le2	Air pollutants formation during combustion processes	2
Le3	Air protection indicators	2
Le4	Theoretical fundamentals of industrial dust collection	2
Le5	Industrial dust collectors	2
Le6	Fly ash - formation, properties, utilization	2
Le7	Theory of gas pollutants removal from industrial flue gases	2
Le8	Sulfur dioxide control technologies	2
Le9	Wet lime/limestone technology for sulfur dioxide removal	2
Le10	Nitrogen oxides control technologies	2
Le11	Selective catalytic removal (SCR) technology for nitrogen oxides removal	2
Le12	Chelate technology for nitrogen oxides removal	2
Le13	Anthropogenic carbon dioxide emission and control problems	2
Le14	Odors problems	2
Le15	Summary and future trends	2
Total hours		30

Form of classes - classes		Number of hours
Cl1	Gas absorption in liquids; Equilibrium line and operation line; Mass balance	2
Cl2	Calculation of liquid demand for the co-current and counter-current absorption system; system with recirculation	2
Cl3	Determination of the active height for waste gases purification in scrubbers; geometry of the absorber	3
Cl4	Gas adsorption on the solid sorbent; Adsorption isotherm; Isotherm conversion between different operating conditions	3
Cl5	Methods to calculate: time of periodic adsorption; geometry of the adsorber; thermal effect of the process	3
Cl6	Final test	2
Total hours		15

TEACHING TOOLS USED	
N1	Problem lecture
N2	Tutorial

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02	Examination
P2	PEU_U01, PEU_U02, PEU_K01	Final test

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	J. Kuropka, Oczyszczanie gazów odlotowych z zanieczyszczeń gazowych, Obliczenia, tabele, materiały pomocnicze, OWPWr, Wrocław, 1996
2	T. Hobler, Dyfuzyjny ruch masy i absorbery, WNT, Warszawa, 1962
3	A.L. Kohl, R.B. Nielsen, Gas Purification, Elsevier, 1997

SUBJECT SUPERVISOR

Name and surname:	Andrzej Szczurek
E-mail:	andrzej.szczurek@pwr.edu.pl

Environmental toxicology (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Toksykologia środowiskowa**
Name in English	**Environmental toxicology**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		30		
Form of crediting	Crediting with grade		Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	1		1		
including number of ECTS points for practical(P) classes			1		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8		0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	To have a basic knowledge in biology, microbiology, biochemistry

SUBJECT OBJECTIVES

C1	Knowledge of the basic principles and application of environmental toxicology
C2	Ability of performing toxicological analysis of environmental samples

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Has a basic knowledge about environmental toxicology
Relating to skills:	
PEU_U01	Is able to perform ecotoxicological examinations of water, soil, air and waste
Relating to social competences:	
PEU_K01	Is conscious of threats to people and natural environment of chemical pollutions associated with emission.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Introduction and history of environmental toxicology.	2
Le2	Toxicity testing. Sources and types of toxins. Definition of toxins. Dose- response. Biological and physicochemical factors determining the toxicity.	2

Le3	Methods of soil and waste toxicity assessment.	2
Le4	Methods of air toxicity assessment.	2
Le5	Methods of water and sediments toxicity assessment.	2
Le6	Metals and their impact on the environment.	2
Le7	Ecotoxicology of selected compounds: polychlorinated organic compounds (polychlorinated biphenyls, dioxins, PAHs).	2
Le8	Final test	1
Total hours		30

Form of classes - laboratory		Number of hours
La1	The introduction, the scope of exercises and principles of BHP in the toxicological laboratory. Preparing the biological material for toxicity screening. Assessment of the impact of biological, physicochemical factors to the toxicity of xenobiotics. The use of indicator organisms for examination of water and quality (invertebrates).	3
La2	The use of indicator organisms for examination of water quality (plants).	3
La3	The use of indicator organisms for examination of soil and waste quality.	3
La4	The use of indicator organisms for examination of soil and waste quality.	3
La5	Presentation of the results including the report from laboratories	3
Total hours		15

TEACHING TOOLS USED	
N1	Informative lecture
N2	Presentation of conducting toxicological tests
N3	Preparation of report containing the summary of all examinations.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01	Final test
F1	PEU_U01, PEU_K01	Credit
F2	PEU_U01, PEU_K01	Report
	P2=0.5F1+0.5F2	

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Botana Luis M. Environmental toxicology. De Gruyter 2018
2	Rybak J., Kołwzan B., Ecotoxicology : course in English : theory and laboratory practice. Łódź : PRINTPAP, 2011
3	Ming Ho You Environmental Toxicology: Biological and Health Effects of Pollutants, Second Edition CRC Press; 2nd edition 2007
Secondary literature	
1	Wright DA, Welbourn P, Environmental Toxicology. Cambridge Environmental Chemistry, Cambridge University Press, 2002.
2	D'Mello Felix JP. A Handbook of Environmental Toxicology: Human Disorders and Ecotoxicology, Cabi 2019.

SUBJECT SUPERVISOR

Name and surname:	Justyna Rybak
E-mail:	justyna.rybak@pwr.edu.pl

Environmental health hazards (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Środowiskowe zagrożenia zdrowia**
Name in English	**Environmental health hazards**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	2				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.3				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Basic knowledge in general chemistry
2	Understanding of biology and physiology of human body

SUBJECT OBJECTIVES

C1	Understanding of influence of chemical, physical and biological environmental factors on human body.
C2	Extended knowledge of changes on cellular level and basic physiological functions of the human body caused by environmental factors.
C3	Forecast of results and understanding the limited exposure of human body to hazardous environmental factors.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Be knowledgeable about the sources of environmental contaminants and their impact to the human body
PEU_W02	Be able to know and understand the changes in the human body caused by environmental factors, both natural and anthropogenic
PEU_W03	Be aware to health hazards and the need to reduce risk exposure to environmental factors

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Human health- priority against the risk of environmental hazards. Introduction.	2
Le2	Water quality and its impact on human health. Modern approaches.	2
Le3	Pharmaceuticals in the Environment: Overview of sources, concerns, and solutions.	2
Le4	Impacts of indoor air pollution on human health.	2
Le5	Additives and contaminants of food.	2
Le6	Endocrine disruptors and theirs influence on reproduction	2
Le7	Climate change: distributive impacts.	2
Le8	Environmental determination of cancer	2
Le9	Minerals in environment and health.	2
Le10	Impacts of solid waste on human health	2
Le11	Ionizing and electromagnetic radiation health effects	2
Le12	Impacts of sunscreens on the environment.	2
Le13	Importance of children's health protection.	2
Le14	Reducing risk - environmental engineering perspective	2
Le15	Credits	2
Total hours		30

TEACHING TOOLS USED	
N1	Lecture
N2	Multimedial presentation

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_W03	Written test

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Herman Koren Michael S. Bisesi Handbook of environmental health CRC Press 2018
2	Morton Lippmann (Ed.), Environmental toxicants: Human exposures and their health effects, John Wiley & Sons, New Jersey 2009
3	Robert H. Friis, Essentials of Environmental Health, Jones & Bartlett Publishers 2012
4	Luise Theodore & R. Ryan Dupont Environmental Health and Hazard Risk Assessment: Principles and Calculations CRC Press 2012
Secondary literature	
1	Additional reading (scientific papers) recommended by lecturer

SUBJECT SUPERVISOR

Name and surname:	Justyna Rybak
E-mail:	justyna.rybak@pwr.edu.pl

Sewage systems (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Sewage systems**
Name in English	**Systemy kanalizacyjne**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**obligatory**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	60			30	
Form of crediting	Crediting with grade			Crediting with grade	
For group of courses mark (X) final course					
Number of ECTS points	2			1	
including number of ECTS points for practical(P) classes				1	
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8			0.8	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Has a basic knowledge of hydraulics and hydrology.

SUBJECT OBJECTIVES

C1	Gaining knowledge in sewage systems design and modeling.
C2	Gaining knowledge concerning materials and techniques used for sewage systems construction.
C3	Acquiring skills of sewage systems computer models construction and practical application.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Has knowledge of sewage systems design and modeling.
PEU_W02	Has knowledge of materials and techniques used for sewage systems construction.
Relating to skills:	
PEU_U01	Is able to design a gravity wastewater collection system.
PEU_U02	Is able to develop a hydrodynamic model of wastewater collection system.
PEU_U03	Is able to simulate wastewater flows.
Relating to social competences:	
PEU_K01	Is aware of the dangers to the environment resulting from improper sewage system de-sign and functioning.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Introduction to sewage systems lectures. Historical perspective of contemporary sewage systems.	1
Le2	Guidelines concerning materials and techniques used for sewage systems construction.	1
Le3	Wastewater collection systems hydrology. Dry and wet wastewater flows.	1
Le4	Surface runoff modelling in urban conditions.	2
Le5	Design methods of new gravity wastewater collection systems.	1
Le6	Steady gravity flows hydraulics.	1
Le7	Unsteady gravity flows hydraulics.	1
Le8	Hydrodynamic equations use for unsteady gravity flows modelling.	2
Le9	Constructing the sewage systems computer models.	1
Le10	Application of hydrodynamic sewage system model for probabilistic assessment of sewage system functioning.	1
Le11	Wastewater detention facilities and their design.	1
Le12	Stormwater detention tanks design based on hydrodynamic simulations.	1
Le13	Pass writing.	1
Total hours		30

Form of classes - project		Number of hours
Pr1	Design project release and discussion.	2
Pr2	New gravity wastewater collection system layout planning.	2
Pr3	Design storm identification, surface runoff calculations and sanitary flows estimation.	2
Pr4	Hydraulic calculations and system sizing.	2
Pr5	Developing of computer model for designed wastewater collection system.	2
Pr6	Hydraulic simulations of wastewater flows.	2
Pr7	Simulation results overview.	2
Total hours		15

TEACHING TOOLS USED	
N1	Informational lecture.
N2	Computer laboratory.
N3	Consultations.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_K01	Pass writing.
P2	PEU_U01, PEU_U02, PEU_U03, PEU_K01	Consultations and verification of project correctness.

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Haestad Methods, T.M. Walski, T.E. Barnard, E. Harold, L.B. Merritt, N. Walker, B.E. Whitman Wastewater Collection System Modeling and Design, Haestad Press, 2007
2	Haestad Methods, S.R. Durrans, Stormwater Conveyance Modeling and Design, Haestad Press, 2003
3	P. Lonsdale, D. Obradovic, Public Water Supply: Models, Data and Operational Management, CRC Press, 1998
4	P. Bizier, Gravity Sanitary Sewer Design and Construction (ASCE Manuals and Reports on En-gineering Practice No. 60), 2007
Secondary literature	
1	Kotowski A., Podstawy bezpiecznego wymiarowania odwodnień terenów. Sieci kanalizacyjne (Tom I). Obiekty specjalne

	(Tom II). Wydawnictwo Seidel-Przywecki, Warszawa 2015.
2	EN 752, Drain and sewer systems outside buildings, 1997
3	T.G. Schmitt, ATV-DVWK Kommentar, ATV-A 118 Hydraulische Berechnung von Entwässe-rungssystemen, DWA, Hennef, 2000
4	Nowakowska M., Kotowski A.: Metodyka i zasady modelowania odwodnień terenów zurbanizowanych. Oficyna Wyd. Politechniki Wrocławskiej, Wrocław 2017.

SUBJECT SUPERVISOR

Name and surname:	Paweł Licznar
E-mail:	pawel.licznar@pwr.edu.pl

Diploma seminar (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Seminarium dyplomowej**
Name in English	**Diploma seminar**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**optional**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)					30
Number of hours of total student workload (CNPS)					60
Form of crediting					Crediting with grade
For group of courses mark (X) final course					
Number of ECTS points					2
including number of ECTS points for practical(P) classes					2
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)					1,3

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	ECTS deficit not greater than it is due to the resolution of the Faculty Council

SUBJECT OBJECTIVES

C1	To posses the knowledge of presentation of personal qualifications in the scope of knowledge, skills and social competences in the field of technical sciences and in the range proper for the field of study Environmental Quality Management
C2	To strengthen the ability of individual and group work

SUBJECT EDUCATIONAL EFFECTS

Relating to skills:	
PEU_U01	Is able to present personal qualifications in the scope of knowledge, skills and so-cial competences in the range proper for the field of study Environmental Quality Management
Relating to social competences:	
PEU_K01	Is able to think and act creatively and enterprisingly; is able to work individually and in the group

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Se1	Introduction	2
Se2	Presentation no1 - presentation of the subject, the scope of work, and used literature	2
Se3	Presentation no1 - presentation of the subject, the scope of work, and used literature	2
Se4	Presentation no1 - presentation of the subject, the scope of work, and used literature	2
Se5	Presentation no1 - presentation of the subject, the scope of work, and used literature	2
Se6	Presentation no2 -presentation of achievements to date	2
Se7	Presentation no2 - presentation of achievements to date	2
Se8	Presentation no2 - presentation of achievements to date	2
Se9	Presentation no2 - presentation of achievements to date	2
Se10	Presentation no3 - presentation of all effect of work done at course Diploma project	2
Se11	Presentation no3 - presentation of all effect of work done at course Diploma project	2
Se12	Presentation no3 - presentation of all effect of work done at course Diploma project	2
Se13	Presentation no3 - presentation of all effect of work done at course Diploma project	2
Se14	Presentation no3 - presentation of all effect of work done at course Diploma project	2
Se15	Crediting	2
Total hours		30

TEACHING TOOLS USED	
N1	Presentation of selected issues of diploma project
N2	Multimedia presentation
N3	Consultations

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_U01, PEU_K01	ability to discuss selected issues; participation in the discussio

PRIMARY AND SECONDARY LITERATURE

Primary literature
-
Secondary literaturę
-

SUBJECT SUPERVISOR

Name and surname:	Wojciech Adamski
E-mail:	wojciech.adamski@pwr.edu.pl

Diploma project (Master thesis) (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Praca dyplomowa magisterska**
Name in English	**Diploma project (Master thesis)**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**optional**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				225	
Number of hours of total student workload (CNPS)				600	
Form of crediting				Crediting with grade	
For group of courses mark (X) final course					
Number of ECTS points				20	
including number of ECTS points for practical(P) classes				20	
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)				8	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	ECTS deficit not greater than it is due to the resolution of the Faculty Council

SUBJECT OBJECTIVES

C1	Completion by a student a master diploma project on the basis of the general and detailed knowledge acquired during study, which is structured and underpinned by the theory within a range of science and technical areas relevant to main field of study Environmental Quality Management
C2	Writing by a student thesis (as work) on the basis of information literature, design work or research results
C3	Strengthening ability to work independently and in a team

SUBJECT EDUCATIONAL EFFECTS

Relating to skills:	
PEU_U01	Is able to write and elaborate a technical text from the studied field of study Environmental Engineering and specialization Environmental Quality Management
Relating to social competences:	
PEU_K01	Is able to work independently or in a group, taking different roles

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Pr1	Collection of the literature of the subject and becoming acquainted with the collected data	-
Pr2	Own work - analysis of the literature, performation of experiments	-
Pr3	Writing a thesis as works	-
Pr1	Collection of the literature of the subject and becoming acquainted with the collected data	-
Total hours		-

TEACHING TOOLS USED	
N1	Own work - literature studies
N2	Own work - performation of experiments
N3	Writing technical text controlled by the promoter
N4	Consultations

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_U01, PEU_K01	Work in a semester, delivery of thesis as works

PRIMARY AND SECONDARY LITERATURE

Primary literature
Literature discussed with supervisor
Secondary literature
-

SUBJECT SUPERVISOR

Name and surname:	Wojciech Adamski
E-mail:	wojciech.adamski@pwr.edu.pl

Membrane separation processes in environmental protection środowiska (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Membranowe procesy separacji w ochronie środowiska**
Name in English	**Membrane separation processes in environmental protection**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**optional**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Crediting with grade		Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	2		1		
including number of ECTS points for practical(P) classes			1		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8		0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Knowledge in the scope of water chemistry as well as water and wastewater treatment

SUBJECT OBJECTIVES

C1	To acquaint students with mechanisms of membrane transport
C2	To familiarize with examples of membrane hybrid and integrated systems in water and wastewater treatment
C3	To pass ability to asses separation and transport phenomena and properties of membranes

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	The role of membrane in interphase membrane transport
PEU_W02	Usefulness of hybrid and integrated membrane systems to treat water and wastewater
PEU_W03	Selection of methods to improve separation and transport features of membranes
Relating to skills:	
PEU_U01	Assess membrane separation and transport properties
PEU_U02	Make use of research results to elaborate technologies of polluted streams cleaning or fractioning processes
Relating to social competences:	
PEU_K01	Ability to select and assess way of action to achieve required goals

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Classification of membrane processes. The role of membrane in interphase membrane transport	2
Le2	Membrane processes with the use of specific membranes	2
Le3	Removal of organic pollutants from aqueous solutions	2
Le4	Integrated and hybrid membrane systems in water treatment. Desalination installations with zero liquid discharge	2
Le5	Aerobic and anaerobic membrane bioreactors in wastewater treatment	2
Le6	Exploitation of membrane installations. Prevention methods of flux decline. Membrane cleaning techniques	2
Le7	Nutrients recovery from wastewater by membrane processes	2
Le8	Test	1
Total hours		15

Form of classes - laboratory		Number of hours
La1	Introduction, presentation of experiments and principles dealing with chemical laboratory safety rules	2
La2	Determination of separation and transport features of ultrafiltration membranes	3
La3	Concentration of solutions and mixture components using pressure-driven membrane processes	3
La4	Water softening with the use of Donnan dialysis	3
La5	Desalination of water solutions by electrodialysis	3
La6	Completion	1
Total hours		15

TEACHING TOOLS USED	
N1	Information lecture
N2	Subject lecture

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_W03	test
F1, F2	PEU_U01, PEU_U02, PEU_K01	test
F3, F4	PEU_U01, PEU_U02, PEU_K01	test
F5	PEU_U01, PEU_U02, PEU_K01	report
	P2 = 0.2F1+0.2F2+0.2F3+0.2F4+0.2F5	

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Kabsch-Korbutowicz M., Majewska-Nowak K., Membrane separation processes in environmental protection, Wrocław University of Technology (2011)
2	Drioli E., Encyclopdia of membranes, Springer (2016)
3	Baker R.W., Membrane technology and applications, Chichester, John Wiley & Sons (2004)
4	Stephenson T., Membrane bioreactors for wastewater treatment, London, IWA Publishing (2001)
5	Kołtuniewicz A., Membranes in clean technologies : theory and practice, Weinheim, Wiley-VCH (2008)
6	Bodzek M., Konieczny K., Wykorzystanie procesów membranowych w uzdatnianiu wody, Projprzem-EKO, Bydgoszcz (2005)
7	Bodzek M., Konieczny K., Usuwanie zanieczyszczeń nieorganicznych ze środowiska wodnego metodami membranowymi, Wyd. Seidel-Przywecki (2011)

8	Scott K., Handbook of industrial membranes, Elsevier, Oxford (1995)
9	Sata I., Ion Exchange Membranes: Preparation, Characterization, Modification and Application, Royal Society of Chemistry, London (2004)
Secondary literature	
1	Rautenbach R., Procesy membranowe, Wydawnictwo Naukowo -Techniczne, Warszawa (1996)
2	Judd S., Jefferson B., Membranes for Industrial Wastewater Recovery and Re-use, Elsevier, Oxford (2003)
3	Current literature, internet

SUBJECT SUPERVISOR

Name and surname:	Katarzyna Majewska-Nowak
E-mail:	katarzyna.majewska-nowak@pwr.edu.pl

Methods and techniques of air pollutants measurement (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Metody i techniki pomiaru zanieczyszczeń powietrza**
Name in English	**Methods and techniques of air pollutants measurement**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**optional**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	30				
Form of crediting	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	1				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Basic knowledge in chemistry and physics

SUBJECT OBJECTIVES

C1	To present a selection of best methods and techniques of air sampling
C2	To present a selection of best, latest methods and techniques of air pollutants analysis

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Student has knowledge on a selection of best methods and techniques of air sampling
PEU_W02	Student has knowledge on a selection of best, latest methods and techniques of air pollutants analysis

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Introduction	1
Le2	Principles of sampling procedures	2
Le3	Methods and instruments of particulate matter sampling	1
Le4	Methods and instruments of gaseous pollutants sampling	1
Le5	Analysis of particulate matter	2
Le6	Air pollutants analysis - optical methods	2
Le7	Air pollutants analysis - electrochemical methods	2

Le8	Air pollutants analysis - other analytical methods	1
Le9	Calibration methods	2
Le10	Assignment	1
Total hours		15

TEACHING TOOLS USED	
N1	Lecture
N2	Problem solving exercises.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02	Written assignment.

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Andrzej Szczurek (2011) Methods and measuring techniques of air pollutants. WUT
2	Paul M. Berthouex, Linfield C. Brown (2002) Statistics for Environmental Engineers, Lewis Publishers
Secondary literature	
1	James P. Lodge, ed. (1988) Methods of Air Sampling and Analysis. Intersociety Committee
2	Heikki Torvela (1994) Measurement of Atmospheric Emission, 1 edition. Springer.

SUBJECT SUPERVISOR

Name and surname:	Andrzej Szczurek
E-mail:	andrzej.szczurek@pwr.edu.pl

Modeling of water and sewage treatment processes (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Modelowanie procesów oczyszczania wód i ścieków**
Name in English	**Modeling of water and sewage treatment processes**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**optional**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		30		
Form of crediting	Crediting with grade		Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	1		1		
including number of ECTS points for practical(P) classes			1		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8		0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Basic knowledge in mathematics and chemistry of water
2	Basic knowledge in physical and chemical methods of water treatment
3	Basic knowledge in processes of sewage treatment

SUBJECT OBJECTIVES

C1	Acquainting with mechanics and rules of construction of mathematical models of unit pro-cesses for surface water, groundwater and sewage treatment
C2	Gaining skills for models application for water treatment systems designing and prediction of treatment efficiency
C3	Gaining skills for computer simulation of sewage biological treatment

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Knowledge in the field of physical, chemical phenomena proceeding during water treatment
PEU_W02	Knowledge in the field of mathematical modeling of unit processes for sewage treatment
PEU_W03	Knowledge in the field of rules of mathematical models construction, and under-standing of theory of reactors
Relating to skills:	
PEU_U01	Ability of mathematical models of water treatment unit processes application for designing and efficiency of treatment prediction
PEU_U02	Ability of computer simulator for analysis of activated sludge treatment process
Relating to social competences:	

PEU_K01	Ability for creative operation
PEU_K02	Awareness of the importance of decisions making and their environmental impact

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	The role of mathematical models and computer simulation in engi-neering practice. Stoichiometry and process kinetics. Ideal reactor models	2
Le2	Modeling of some physical unit processes for water treatment (flocculation, sedimentation - static, kinetics and dynamic models)	2
Le3	Modeling of some physical unit processes for water treatment (filtration, adsorption - static, kinetics and dynamic models)	2
Le4	Modeling of some chemical processes for water treatment (oxidation, chemical disinfection)	2
Le5	Hydraulic retention time, sludge age	2
Le6	Substitute model of mixture of organic compounds COD division into fraction. Model of hydrolysis of slowly decomposed organic compounds	2
Le7	Model of aerobic decomposition of organic contamination Model of activated sludge	2
Le8	Test	1
Total hours		15

Form of classes - laboratory		Number of hours
La1	Sequence of unit processes of water treatment. Determination of sedimentation velocity for grain particles. Determination of real operation time for filter bed	3
La2	Adsorption in flow system - determination of GAC bed run time and adsorption capacity	3
La3	Computer programme application for membrane installation designing - simulation of various desalination systems with the use of reverse osmosis	3
La4	Familiarize with computer programme SymOS. Influence of sludge age on efficiency of sewage treatment by activated sludge	3
La5	Dynamics of oxygen demand in sewage treatment by activated sludge. Influence of process parameters on efficiency of treatment in MLE system	3
Total hours		15

TEACHING TOOLS USED	
N1	Inquire lecture
N2	Problem lecture
N3	Computer simulation
N4	Problem classes
N5	Report working out

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02, PEU_W03, PEU_K02	Test
F1, F2	PEU_U01, PEU_U02, PEU_K01	Report
F3, F4	PEU_U01, PEU_U02, PEU_K01	Report
F5, F6	PEU_U01, PEU_U02, PEU_K01	Report
	P2 = 0.1F1 + 0.2F2 + 0.1F3 + 0.2F4 + 0.2F5 + 0.2F6	

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	W. Adamski, Modelowanie systemów oczyszczania wód, PWN (2002)
2	Wastewater Treatment Process Modeling, Second Edition, Water Environment Federation, McGraw Hill Professional

	(2014)
3	E. Worch, Adsorption Technology in Water Treatment: Fundamentals, Processes, and Modelling, Walter de Gruyter (2012)
4	Mohammed Abdalla Hussein, Wael Mahmoud Kamel, Yaser Hagag Mohamed, Modern Techniques in Water Research and Technology: Design an Innovative Model for Water Treatment, LAP LAMBERT Academic Publishing (November 12, 2012)
5	W.J. Masschelein, Unit Processes in Drinking Water Treatment, Marcel Dekker Inc. (1992)
6	S. Judd, B. Jefferson, Membranes for industrial wastewater recovery and re-use, Elsevier, Oxford (2003)
7	A.L. Kowal, M. Świderska-Bróż, Oczyszczanie wody, PWN, Warszawa 2009.
8	M. Bodzek, K.Konieczny, Wykorzystanie procesów membranowych w uzdatnianiu wody, Projprzem-EKO, Bydgoszcz 2005
Secondary literature	
1	E. Brauns, Calculation of cross-flow reverse osmosis at your desk, Desalination and Water Reuse 10(4), pp. 18-25 (2001)
2	E. Brauns, W. Doyen, C. Dotremont, E. Van Hoof, I. Genne, A pragmatic cost calculation and design software tool for pressure driven membrane filtration systems, Desalination and Water Reuse 12(1), pp. 40-44 (2002)
3	M. Cheryan, Ultrafiltration and Microfiltration Handbook, Technomic Publishing Company Inc. Basel 1998
4	Hydranautics RO System Design, Hydranautics, www.hydranautics.com

SUBJECT SUPERVISOR

Name and surname:	Wojciech Adamski
E-mail:	wojciech.adamski@pwr.edu.pl

Biomonitoring (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Monitoring biologiczny**
Name in English	**Biomonitoring**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**optional**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	30				
Form of crediting	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	1				
including number of ECTS points for practical(P) classes					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	To have a basic knowledge in biology

SUBJECT OBJECTIVES

C1	Knowledge of factors which determinate the presence of aquatic and terrestrial organisms
C2	Acquisition of knowledge about biological processes and threats appearing in the natural environment
C3	Knowledge of biological techniques of monitoring the environment

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Has a knowledge about conditions influencing the presence of aquatic and terrestrial organisms, diversity of the flora and fauna and techniques universally used in the environmental monitoring
Relating to social competences:	
PEU_K01	Possess skills to work in the group and to play different roles (leader, contractor, commentator) and understands main threats for ecosystems and knows how to prevent them

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Significance of biological monitoring for environmental protection. Features of taxonomic categories perForming functions for bioindication. Aquatic environment. Rivers as the place of life. Assemblages of organisms of flowing waters. Lakes and ponds as the place of life. Assemblages of organisms in	2

	lakes. The use of invertebrates for water environmental monitoring. Review of monitoring methods with the use of invertebrates.	
Le2	Applying algae and plants (macrophytes) in the monitoring of the aquatic environment. Review of monitoring methods with the use of these taxa Applying vertebrates (fish) in the monitoring of the aquatic environment. Review of monitoring methods with the use of these taxa.	2
Le3	Amphibians - organisms living on the border of two environments - as bioindicators. The application of amphibians in the biomonitoring	2
Le4	Air. Species of plants and animals used in the monitoring of air.	2
Le5	Land environment: explaining the term: biodiversity and its meaning in the biomonitoring. Methods of measurement of biodiversity (biodiversity indicators species, substitute diversity estimation, method of many taxa). Common and rare species. Estimation and the categorization of species. The genetic diversity versus the diversity of biocenosis.	2
Le6	Organisms used in biodiversity evaluation and the land environmental monitoring. Selected birds and mammals. Monitoring of ecosystems: forests, agroceonoses and cities.	2
Le7	Application of biomonitoring in the reintroduction of species and the restitution of endangered sites. Monitoring of protected and valuable areas. Endangered ecosystems in the world and in Poland and methods of monitoring them. Systems of monitoring in the world and in Poland.	2
Le8	Final test	1
Total hours		15

TEACHING TOOLS USED	
N1	Informative lecture
N2	Problem lecture

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_K01	Final test

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Zimny H.: 2006 Ekologiczna ocena stanu środowiska: bioindykacja i biomonitoring
2	Market B.A, Breure A.M., Zechmeister H. G: 2004 Bioindicators and Biomonitors, Volume 6 Oxford University Press
3	Allan J.D.: 1998 Ekologia wód płynących, PWN.
4	Kudelska D., Soszka H.: 1996 Przegląd stosowanych w różnych krajach sposobów oceny i klasyfikacji wód powierzchniowych, Biblioteka Monitoringu Środowiska PIOŚ.
5	Mason C.F.,: 1987 Biology of freshwater pollution, Longman.
6	Andrzejewski R., Weigle A. (red) 2003: Różnorodność biologiczna Polski. Warszawa. Narodowa Fundacja Ochrony Środowiska.
7	Bis B., Mikulec A.: Typy biocenotyczne rzek Polski: wyznaczenie granic klas za pomocą Polskiego Wielometrycznego Wskaźnika Stanu Ekologicznego Rzek MMI_PL, na podstawie makrobezkręgowców bentosowych (moduł oceny: RIVECO macro). W: Przewodnik do oceny stanu ekologicznego rzek na podstawie makrobezkręgowców bentosowych. Barbara Bis (red.). Warszawa: Narodowa Fundacja Ochrony Środowiska, Główny Inspektorat Ochrony Środowiska, 2012, s. 82-93.
Secondary literature	
1	Chandler J.R.: 1970 A biological approach to water quality management, Water Pollution Control, 69, 415-421
2	EPA, 1998, Rapid Bioassessment Protocols for Use in Streams and Wadable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition, EPA Raports, 7-1, 7-20.

SUBJECT SUPERVISOR

Name and surname:	Justyna Rybak
E-mail:	justyna.rybak@pwr.edu.pl

Air pollutants and their sources (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Zanieczyszczenia powietrza i ich źródła**
Name in English	**Air pollutants and their sources**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**optional**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		30		
Form of crediting	Crediting with grade		Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	1		1		
including number of ECTS points for practical(P) classes			1		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.8		0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Basic knowledge in chemistry and physics
2	Computer skills (e.g. MS Excel)

SUBJECT OBJECTIVES

C1	To transmit the knowledge on air pollutants and their sources
C2	To bequeath the knowledge concerning air pollution impact on environment and human health
C3	To present methods of air pollution sources impact analysis for outdoor air
C4	To present methods of air pollution sources impact analysis for indoor air

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
PEU_W01	Student has knowledge on air pollutants and their sources
PEU_W02	Student has knowledge on air pollution impact on environment and human health
Relating to skills:	
PEU_U01	Student is familiar with methods of air pollution sources impact analysis for outdoor air
PEU_U02	Student is familiar with methods of air pollution sources impact analysis for indoor air

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Le1	Atmosphere, its chemical and physical properties; structure; composition of unpolluted atmosphere	2
Le2	Sulphur oxides - properties, sources, environmental effects and abatement techniques	2
Le3	Nitrogen oxides - properties, sources, environmental effects and abatement techniques	2
Le4	Oxidants - ozone, radicals - properties, sources, environmental effects and abatement techniques	2
Le5	Carbon monoxide and carbon dioxide - properties, sources, environmental effects and abatement techniques	2
Le6	Methane and VOCs - properties, sources, environmental effects and abatement techniques	2
Le7	Particulate matter - properties, sources, environmental effects and abatement techniques	2
Le8	Assignment	1
Total hours		15

Form of classes - laboratory		Number of hours
La1	Source of air pollution and its impact.	2
La2	Introduction to dedicated software.	2
La3	Mathematical description of outdoor air pollution sources.	2
La4	Simulation of pollution sources impact on outdoor air; point source.	2
La5	Mathematical description of indoor air pollution sources.	2
La6	Simulation of pollution sources impact on indoor air; constant emission source.	2
La7	Simulation of pollution sources impact on indoor air; instantaneous emission source.	2
La8	Assignment	1
Total hours		15

TEACHING TOOLS USED	
N1	Lecture
N2	Problem solving exercises

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01, PEU_W02	Written assignment
P2	PEU_U01, PEU_U02	Individual analysis of a selected problem

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	A. C. Stern, R. W. Bonbel, D. B. Turner, and D. L. Fox. (1984) Fundamentals of air pollution, (2nd Edition). Academic Press
2	Vallero, Daniel (2008). Fundamentals of Air Pollution (4th Edition). Elsevier.
Secondary literature	
1	Cheremisinoff, Nicholas P. (2002). Handbook of Air Pollution and Control. Elsevier
2	Hester, R.E. Harrison, R.M. (1998). Air Pollution and Health. Royal Society of Chemistry.
3	Seinfeld, John H. Pandis, Spyros N. (2006). Atmospheric Chemistry and Physics - From Air Pollution to Climate Change (2nd Edition). John Wiley & Sons.
4	Pepper, Darrell W. Carrington, David (2009). Modeling Indoor Air Pollution. World Scientific.

SUBJECT SUPERVISOR

Name and surname:	Andrzej Szczurek
E-mail:	andrzej.szczurek@pwr.edu.pl

Automatyka w inżynierii środowiska (n/d)

Faculty	**Environmental Engineering**
Name in Polish	**Automatyka w inżynierii środowiska**
Name in English	**Automation in environmental engineering**
Main field of study	**Environmental Quality Management**
Level	**II**
Form	**full-time**
Kind of subject	**optional**
Subject code	
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)			15		
Number of hours of total student workload (CNPS)			60		
Form of crediting			Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points			2		
including number of ECTS points for practical(P) classes			2		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)			0.8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1	Has a fundamental knowledge of automation and characteristics of system elements for automatic regulation applied in environmental engineering

SUBJECT OBJECTIVES

C1	The acquisition of skills in information and communication technologies to the development of appropriate control algorithms and programming of programmable controllers for typical applications in environmental engineering
C2	Learn how to evaluate the suitability and usability of devices and computer systems for monitoring and controlling processes in environmental engineering

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:	
Relating to skills:	
PEU_U01	Able to use information and communication technologies to the development of appropriate control algorithms and programming of programmable controllers for typical applications in environmental engineering
PEU_U02	Able to assess the suitability and applicability of computer equipment and systems for
Relating to social competences:	

PROGRAMME CONTENT

Form of classes - laboratory		Number of hours
La1	Introduction, overview of the scope of laboratory practice and rules of implementation. Overview of safety rules in the computer laboratory. Introduction to the engineering tool.	2
La2	Programming of a field equipment controller for the technological system, according to the previously developed algorithm. The development of control algorithms for simple technological system, in the field of environmental engineering.	2
La3	Individual work on the automation of technological systems in the field of environmental engineering. Development of technological schemes, describing the functions of regulation and control, and programming the controller.	2
La4	Individual work on the automation of technological systems in the field of environmental engineering. Development of technological schemes, describing the functions of regulation and control, and programming the controller.	2
La5	Individual work on the automation of technological systems in the field of environmental engineering. Development of technological schemes, describing the functions of regulation and control, and programming the controller.	2
La6	Individual work on the automation of technological systems in the field of environmental engineering. Development of technological schemes, describing the functions of regulation and control, and programming the controller.	2
La7	Individual work on the automation of technological systems in the field of environmental engineering. Development of technological schemes, describing the functions of regulation and control, and programming the controller.	2
La8	Presentation and review of results for each particular team	1
Total hours		15

TEACHING TOOLS USED	
N1	Preparing control algorithms
N2	Programming of field equipment controllers
N3	Multimedia presentation

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F - forming during semester), P - concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P	PEU_U01, PEU_U02	100% of attendance; Multimedia presentation of the work outcome
	P2 = 0.2F1+0.2F2+0.2F3+0.2F4+0.2F5	

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	Lewermore G.J.: Building Energy Management Systems. New York, London 2000
2	Dorf R.C., Bishop R.H.: Modern Control Systems (12th ed.), Prentice Hall,
3	Automation of Wastewater Treatment Facilities - MOP 21 (Wef Manual of Practice), McGraw-Hill Professional, 2006
4	Raven F. H.: Automatic Control Engineering, McGraw-Hill, New York, 1961.
5	Regelungs- und Steuerungstechnik in der Versorgungstechnik. C.F. Muller. 2002
Secondary literature	
1	Love J.: Process Automation Handbook: A Guide to Theory and Practice, Springer, 2007

SUBJECT SUPERVISOR

Name and surname:	Marta Laska
E-mail:	marta.laska@pwr.edu.pl