POLITECHNIKA CZĘSTOCHOWSKA

Załącznik 2

SYLABUSY

dla zakresu: Intelligent Energy for Environmental Protection

do PROGRAMU STUDIÓW
nazwa kierunku: INŻYNIERIA ŚRODOWISKA

Cykl kształcenia rozpoczynający się
od roku akademickiego 2020/2021

Poziom: **studia drugiego stopnia**
Profil: **ogólnoakademicki**
Forma studiów: **stacjonarne**
Tytuł zawodowy: **magister inżynier**

Course title: **Atmosphere Protection and Flue Gas Cleaning** Ochrona powietrza i oczyszczanie gazów		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **lecture, laboratory**	Number of hours: **15L, 30Lab**	ECTS Credit points: **3**

SYLLABUS

COURSE OBJECTIVES

C.1. Understand and describe the environmental impact of combustion processes and related regulations
C.2. Know and describe the flue gas cleaning processes for different combustion techniques

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge on the fundamentals of chemistry and combustion
2. Ability for independent study of the literature and technical papers

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Knowledge on the environmental impact of combustion processes.
EU 2 - Knowledge on flue gas cleaning processes.

COURSE CONTENT

Form of classes - lectures	Hours
Introduction to Air Pollution. Environmental Effects of Air Pollution (Greenhouse effect. Smog. Acid rain. Stratospheric Ozone depletion). Legislation related to emissions reduction.	3
Low-stack emission	3
Global warming. Carbon dioxide emission. Carbon dioxide removal technologies	3
Reduction technologies: Nitrogen Oxides (SCR process for catalytic NOx reduction, SNCR process for non-catalytic NOx reduction).	1
Reduction technologies: Sulfur oxides (Flue gas desulphurisation, absorption processes, FBC	2

Reduction technologies: particulate matter (Dust removal -Fabric filters, Electrostatic precipitators, Wet electrostatic precipitators).	1
Reduction technologies: unburned hydrocarbons, halogen, trace elements.	1
Discussion and written test.	1
Form of classes - laboratory	**Hours**
Introduction. Info on the rules to pass the classes. Principles of thermal analysis. Methods to investigate sorbent regeneration.	4
Thermogravimetric tests of sulphur dioxide removal using solid sorbents.	6
Use of TGA for testing adsorbents (sorption capacity).	4
Use of TGA for testing adsorbents for CO_2 capture (sorption capacity adsorption/desorption profiles, lifetime of the adsorbents using multiple adsorption and regeneration cycles, long-term tests to determine the chemical and physical stability of the sorbents.	4
CO_2 separation by adsorption method.	10
Reporting and discussion	2

COURSE STUDY METHODS

1. multimedia presentation
2. laboratory: analysis of methodological materials, experimental investigations, discussion and analysis of the results.

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

F1. - assessment self-preparation for classes
F2. - assessment of student's activity during the classes
S1. - verification of student's knowledge (exam, test)

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	15 h
Participation in classes	- h
Laboratory	30 h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	1 h
Entrance test for laboratory classes	3 h
Project's defence	- h
Exam	2 h
Consultation hours	9 h
DIRECT TEACHING, hours/ ECTS	**60 h / 2 ECTS**
Preparation for tutorials	- h
Preparation for laboratories	15 h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h

Working on project Preparation for tests Preparation for exam	- h 3 h 12 h
SELF-STUDY, hours/ ECTS	**30 h / 1 ECTS**
TOTAL (hours)	**∑ 90**
TOTAL ECTS	**3 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Tan Z.Ch., Air Pollution and Greenhouse Gases: From Basic Concepts to Engineering. Springer 2014.
Cooper-Alley, Air Pollution Control: A Design Approach, Waveland Press, Fourth Edition, 2011.
Dullien F.A.L. Industrial gas cleaning, Acad. Press, Uniwersytet Michigan, 1989.
Schmitz H.P., Dictionary of Boiler, Firing System and Flue-gas Cleaning Technology (English and German Edition) (German) Hardcover, 2007.
Kobyłecki R., Wichliński M., Wielgosz G., Bis Z.; Emission of mercury from polish large-scale utility boilers, Journal of Ecological Engineering, 17, 128–131, 2016.
Majchrzak-Kucęba I., Wawrzyńczak D., Ściubidło A., Zdeb J., Smółka W., Zajchowski A., Stability and regenerability of acivated carbon used for CO2 removal in pilot DR-VPSA unit in real power plant conditions, Journal of CO_2 Utilization 29, 1–11, 2019.
Majchrzak-Kucęba I., Wawrzyńczak D., Ściubidło A., s, Application of metal-organic frameworks in VPSA technology for CO_2 capture, Fuel, 255,1157-73, 2019.

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

1. Izabela Majchrzak-Kucęba, izabela.majchrzak-kuceba@pcz.pl

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

1. Izabela Majchrzak-Kucęba, izabela.majchrzak-kuceba@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W01, K_W10, K_U05, K_U06, K_K01**	**C1, C2**	lecture, laboratory	**1, 2**	**F1, F2, S1**
EU 2	**K_W01, K_W10, K_U05, K_U06, K_K01**	**C1, C2**	lecture, laboratory	**1, 2**	**F1, F2, S1**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Biochar for Advanced Polygeneration** Biowęgiel dla zaawansowanej poligeneracji		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **III**	Course language: **English**
Course type: **lecture, laboratory**	Number of hours: **30L, 30Lab**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Getting acquainted with technologies of thermal treatment of solid fuels for advanced technologies
C.2. Knowledge on practical and environmental aspects of the application of biochar

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge on the fundamentals of chemistry, combustion and heat transfer
2. Ability for independent study of the literature and technical papers

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Knowledge on the fundamentals of thermolysis of solid substances
EU 2 - Knowledge on biochar properties and applications

COURSE CONTENT

Form of classes - lectures	Hours
Environmental aspects of human activity. Energy resources. Sustainable development and circular economy. Climat changes and current policy	4
Biomass production, properties and possible use	2
Pyrolysis. Parameters, technologies and products	4
Biochar production and properties	2
Energy conversion possibilities. Polygeneration - idea and system features.	4
Some chosen application of the biochar for classical and advanced applications	4
Energy – environment – agriculture: symbiosis for sustainable development	2
Reduction of the emission of pollutants and nutrient leaching by the application of the biochar	2

Water resources and conservation. Water preparation for anthropogenic activity	2
Economical and legal aspects associated with biochar production and application. CO_2 emission avoided	2
Discussion and written test	2
Form of classes - laboratory	**Hours**
Introduction. Info on the rules to pass the classes. Methods to investigate fuel parameters	2
Investigation and calculation of biomass parameters and properties. Wood charring and analysis of product properties	4
Investigation of biomass processing and biochar production. Effect of temperature, particle size and residence time on biochar yield and properties	6
Investigation of biochar porosity, structure and morphology – some chosen cases	6
Investigation of biochar parameters on nutrient leaching, water retention and pollutant capture – some chosen cases	6
Biochar particle size. Attrition and ignition	4
Reporting and discussion	2

COURSE STUDY METHODS

1. blackboard, interactive whiteboard
2. multimedia presentation
3. e-learning platform
4. laboratory: Analysis of methodological materials, experimental investigations, discussion and analysis of the results

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

F1. - assessment self-preparation for classes
F2. - assessment of student's activity during the classes
S1. - verification of student's knowledge (reports and discussion)

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30 h
Participation in classes	- h
Laboratory	30 h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	2 h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	8 h
DIRECT TEACHING, hours/ ECTS	**70 h / 2,8 ECTS**

Preparation for tutorials	- h
Preparation for laboratories	15 h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	15 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**30 h / 1,2 ECTS**
TOTAL (hours)	**∑ 100**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Lehmann J. and Joseph S., Biochar for Environmental Management, Earthscan, 2009
Taylor P., McLaughlin H., The Biochar Revolution: Transforming Agriculture & Environment, 2010
Singh B., Camps-Arbestain M., Lehmann J., Biochar: A Guide to Analytical Methods, Csiro Publishing, 2017
Books, newspapers and magazines available via internet, as well as those found in the Science Library, particularly: Bioresource Technology, Biomass & Bioenergy, Climate Policy, etc.

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

1. Rafał Kobyłecki, rafal.kobylecki@pcz.pl

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

1. Rafał Kobyłecki, rafal.kobylecki@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W08, K_U03, K_U04, K_U05, K_K01**	**C1, C2**	lecture, laboratory	**1, 2, 3, 4**	**F1, F2, S1**
EU 2	**K_W08, K_U03, K_U04,**	**C1, C2**	lecture, laboratory	**1, 2, 3, 4**	**F1, F2, S1**

	K_U05, K_K01				

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Biomass Harvesting and Utilization** Pozyskiwanie i zastosowanie biomasy		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **I**	Course language: **English**
Course type: **lecture, project**	Number of hours: **30L, 30P**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Providing basic knowledge about different sources of biomass, cropping systems, harvesting methods, and utilization
C.2. Providing of basic knowledge about biomass energetic applications and alternative conversion technologies
C.3. Providing knowledge about basic economic analysis, calculations, biomass utilization case studies

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge from chemistry and biology
2. Basic knowledge from environmental protection
3. Skills in using specialist literature

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Knows biomass harvesting sources, methods and costs
EU 2 - Has the knowledge about biomass supply assessments
EU 3 - Knows how to measure biomass and apply conversion factors
EU 4 - Has the knowledge about biomass heating and power applications, knows the alternative conversion technologies
EU 5 - Can prepare basic economic analysis, calculate case studies to create biomass utilization projects

COURSE CONTENT

Form of classes - lectures	Hours
Introduction, biomass types, sources, energetic plants and cropping systems	4
Physical and chemical parameters of biomass and other properties	4
Rules and recommendations affecting biomass harvesting	2
Certification systems	2
Biomass utilization; energetic and other purposes	4
Ecological sustainability of biomass harvesting	4
Waste and by products biomass utilization	4
Physical, chemical properties and ash utilization	2
Holistic assessment of environmental aspects	2
Knowledge test	2
Form of classes - project	**Hours**
Biomass harvesting and utilisation- introduction	2
Case study project: Examining the social, environmental and economic aspects of forest biomass harvesting and utilization	8
Case study project: Biomass production and allocation in crops with implications for straw harvesting and utilization	7
Case study project: Biomass from residual sources; examining the social, environmental and economic aspects	7
Projects presentations and evaluation	6

COURSE STUDY METHODS

1. blackboard, interactive whiteboard
2. multimedia presentation
3. e-learning platform
4. lliterature from on-line bibliographic databases

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

F1. - activity in classes
S1. - test from the lectures
S2. – evaluation and presentation of the projects
S3. – activity during projects creation

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	28- h
Participation in classes	- h
Laboratory	- h
Participation in project classes	24- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	2- h
Entrance test for laboratory classes	- h
Project's defence	6- h
Exam	- h
Consultation hours	10- h
DIRECT TEACHING, hours/ ECTS	**70 h / 2,8 ECTS**
Preparation for tutorials	- h
Preparation for laboratories	- h
Preparation for projects	15- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	15- h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**30 h / 1,2 ECTS**
TOTAL (hours)	**∑ 100**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Matovic, M.D. ed., 2011. Biomass: Detection, Production and Usage
Name of journal, type of journal (quarterly, monthly) – *for journals* Agbor, V.B., Cicek, N., Sparling, R., Berlin, A. and Levin, D.B., 2011. Biomass pretreatment: fundamentals toward application. *Biotechnology advances*, *29*(6), pp.675-685.
Dodds, D.R. and Gross, R.A., 2007. Chemicals from biomass. Science, 318(5854), pp.1250-1251.
Rosillo-Calle, F., Groot, P.D., Chandra, V.V. and Hemstock, S.L., 2015. General introduction to the basis of biomass assessment methodology. Routledge.
Rosendahl, L. ed., 2013. Biomass combustion science, technology and engineering. Elsevier

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

1. Anna Grobelak, anna.grobelak@pcz.pl

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

1. Anna Grobelak, anna.grobelak@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W05, K_U01, K_U02, K_U05, K_U06, K_K01**	C1, C2	lecture, project	**1, 2, 3**	**S1**
EU 2	**K_W05, K_U01, K_U02, K_U05, K_U06, K_K01**	C1, C2	lecture, project	**1, 2, 3**	**S1**
EU 3	**K_W05, K_U01, K_U02, K_U05, K_U06, K_K01**	C3	project	**1, 2, 3**	**F1, S2, S3**
EU 4	**K_W05, K_U01, K_U02, K_U05, K_U06, K_K01**	C3	project	**1, 2, 3**	**F1, S2, S3**
EU 5	**K_W05, K_U01, K_U02, K_U05, K_U06, K_K01**	C3	project	**1, 2, 3**	**F1, S2, S3**

OTHER USEFUL INFORMATION

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2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Business and Innovation in Environmental Protection** Biznes i Innowacje w Ochronie Środowiska		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **lecture, project**	Number of hours: **15L, 15P**	ECTS Credit points: **2**

SYLLABUS

COURSE OBJECTIVES

C.1. Familiarize students with the knowledge of business and innovation in environmental protection.
C.2. Understanding the principles of project creating.
C.3. Familiarize students with the presentation of the project.

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge in the fields of biology, ecology
2. Knowledge in the fields of environmental protection

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Student knows the principles of projects creating.
EU 2 - Student knows the principles of research results preparation.
EU 3 - Student has knowledge about the presentation of the project.

COURSE CONTENT

Form of classes - lectures	Hours
Introduction to the lectures.	1
Innovation in environmental protection	3
How is scientific research funded?	4
Projects' proposals examples.	4

Scientific articles to read.	2
Final conclusion	1
Form of classes - tutorials	**Hours**
Course content in compliance with the study programme	0
Form of classes - laboratory	**Hours**
Course content in compliance with the study programme	0
Form of classes - project	**Hours**
Introduction.	1
Leadership. The basic rules for projects creating.	2
The most commonly used scientific research methods.	2
Features of research methods.	2
The method of analysis and critique of the literature.	2
Application of statistical methods in scientific research.	2
Scientific research conducting.	2
Preparation of the research results and their presentation.	2

COURSE STUDY METHODS

1. blackboard
2. multimedia presentation
3. e-learning platform

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

F1. - activity in classes
F2. - Evaluation of student's preparation for classes
S1. - Project realization
S2. - test

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	15 h
Participation in classes	- h
Laboratory	- h
Participation in project classes	15 h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	5 h
DIRECT TEACHING, hours/ ECTS	**35 h / 1,2 ECTS**

Preparation for tutorials	- h
Preparation for laboratories	- h
Preparation for projects	15 h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	5 h
Preparation for tests	5 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**25 h / 0,8ECTS**
TOTAL (hours)	**∑ 60**
TOTAL ECTS	**2 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Innovation and entreprenurship, available at http://www.untag-smd.ac.id/files/Perpustakaan_Digital_1/ENTREPRENEURSHIP%20Innovation%20and%20entrepreneurship.PDF
Brychan Thomas , Christopher Miller , Lyndon Murphy, Innovation and small business – volume 1, available at http://bookboon.com/en/innovation-and-small-business-volume-1-ebook
Websites: Inwestycje w innowacje, http://www.inwestycjewinnowacje.pl/ Innovation ebook, http://www.innovationmain.com/eBook.html

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

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

1. Magdalena Zabochnicka-Świątek, magdalena.zabochnicka@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	K_W02, K_W03, K_W04, K_U05, K_K01	**C1**	lecture, project	**1**	**F1, S1**

EU 2	K_W02, K_W03, K_W04, K_U05, K_K01	**C2**	lecture, project	**1**	**F1, S1**
EU 3	K_W02, K_W03, K_W04, K_U05, K_K01	**C3**	lecture, project	**1, 2**	**F1, S1**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Carbon Management in the Environmental Processes** Zarządzanie węglem w procesach środowiskowych		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **lecture, project**	Number of hours: **30L, 30P**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Providing basic knowledge about the main climate changes and its interaction with greenhouse gas fluxes in managed and natural ecosystems around the world
C.2. Providing basic knowledge of changing land usage and climate change mitigation
C.3. Providing knowledge and awareness about emissions of the greenhouse gases, emissions from agriculture, then carbon fluxes in the environment

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge from chemistry and biology of the environment
2. Basic knowledge from the main nature cycles
3. Basic knowledge from environmental protection and management and anthropogenic emissions

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Student knows the basic climate changes and the interaction with greenhouse gas fluxes in managed and natural ecosystems around the world
EU 2 - knows how changing land use can either accelerate or mitigate future climate change,
EU 3 - knows how land use can be made more resilient to the future impacts of climate changes; knows (soil) carbon sequestration processes
EU 4 - investigates emissions of the greenhouse gases, emissions from agriculture, industry, then carbon capture in plants

COURSE CONTENT

Form of classes - lectures	Hours
Emissions baseline & projections; Measurement, Recent trends emissions	4
Main cycles connected with carbon	4
Changes of carbon emissions	4
Recent strategies and initiatives for reducing carbon emissions	4
Carbon management plan	4
Responsibility for carbon management; Carbon management framework,	4
Carbon emissions reduction targets	4
Knowledge test	2
Form of classes - project	**Hours**
Carbon Management in the Environmental Processes - introduction	2
Case study project: Carbon footprint analysis as a tool for energy and environmental management in small and medium-sized enterprises	8
Case study project: Making Advances in Carbon Management Best practice from the Carbon Information Leaders	7
Case study project: Towards a universal carbon footprint standard: A case study of carbon management in academia	7
Projects presentations and evaluation	6

COURSE STUDY METHODS

1. blackboard, interactive whiteboard
2. multimedia presentation
3. e-learning platform
4. lliterature from on-line bibliographic databases

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

F1. - activity in classes
S1. - test from the lectures
S2. – evaluation and presentation of the projects
S3. – activity during projects creation

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	28 h
Participation in classes	- h
Laboratory	- h
Participation in project classes	24 h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	2 h
Entrance test for laboratory classes	- h
Project's defence	6 h
Exam	- h
Consultation hours	10 h
DIRECT TEACHING, hours/ ECTS	**70 h / 2,8 ECTS**
Preparation for tutorials	- h
Preparation for laboratories	- h
Preparation for projects	15 h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	15 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**30 h / 1,2 ECTS**
TOTAL (hours)	**∑ 100**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Matthew John Franchetti, Defne Apul , Carbon Footprint Analysis: Concepts, Methods, Implementation, and Case Studies, 1st Edition, CRC Press , Published June 18, 2012
Rohinton Emmanuel, Keith Baker, Carbon Management in the Built Environment, 1st Edition, Routledge Published June 7, 2012
Busch, T. and Shrivastava, P., 2017. The global carbon crisis: Emerging carbon constraints and strategic management options. Routledge.
Ashton, M.S., Tyrrell, M.L., Spalding, D. and Gentry, B. eds., 2012. Managing forest carbon in a changing climate. Springer Science & Business Media.
Carbon Management, type of journal (quarterly)

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

1. Anna Grobelak, anna.grobelak@pcz.pl

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

1. Anna Grobelak, anna.grobelak@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W02, K_W06, K_W10, K_U03, K_U04, K_U05, K_K02**	**C.1, C2**	lecture, project	**1, 2, 3**	**S1**
EU 2	**K_W02, K_W06, K_W10, K_U03, K_U04, K_U05, K_K02**	**C1, C2**	lecture, project	**1, 2, 3**	**S1**
EU 3	**K_W02, K_W06, K_W10, K_U03, K_U04, K_U05, K_K02**	**C.3**	project	**1, 2, 3**	**F1, S2, S3**
EU 4	**K_W02, K_W06, K_W10, K_U03, K_U04, K_U05, K_K02**	**C.3**	project	**1, 2, 3**	**F1, S2, S3**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Circular Economy in Environment** Gospodarka obiegu zamkniętego w środowisku		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **lecture, tutorials**	Number of hours: **30L, 15T**	ECTS Credit points: **3**

SYLLABUS

COURSE OBJECTIVES

C.1. an understanding of the core concepts of circular economy, supply chains and waste,
C.2. use of critical thinking in practical applications of circular economy concepts in business settings
C.3. provide experience in the expectations of a business environment

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge about biogeochemistry
2. Basic knowledge about waste management and recycling
3. Basic knowledge concerning economy and management

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Student knew core concepts of circular economy, rules, advantages and disadvantages
EU 2 - Student has the specialist knowledge about practical applications of circular economy concepts into management of different waste
EU 3 - Student is able to design of example taking into consideration of relationship between industrial ecology, business, policy and innovation

COURSE CONTENT

Form of classes - lectures	Hours
Course themes, consumer goods, introduction into the supply chains	2
Intro to life cycle thinking, circular economy and circular systems	4
Review product life cycles and material flows	4
Supply chain vs value chain, supply chain waste	2
Distribution, end-of-first use	2
Producers and customers and extended producer responsibility	2
Flows, stocks, and reservoirs in a CE	2
Examples of CE, strategies for achieving CE	2
Current challenges/barriers with CE	2
Regulatory policy and incentives	2
Circular Economy and economic status who gets involved in making these systems work?	2
Circular economy and capitalism – monetary value drives systems	2
Test of knowledge	2
Form of classes - tutorials	**Hours**
Waste: What is waste? Where is waste generated? Does waste have an economic value? - discussion panel	1
Discussion: What solutions exist to keep waste out of the landfill?	1
Groups report out on supply chain map	2
Student led Discussion: Why does something become waste? Relationship with customers? Why is this? Price points? Reparability? Identity (defining your personality)?	2
Circular systems thinking. Student led discussion: what should be taught in education to suport circular systems.	2
Role of consumers in CE. Discussion (break into your assignment groups) – What do you want to know about your customers to design products that fit a circular system and what do your customers need to do to participate in a circular system?	2
Product/Design and Development for a circular economy, in class time to work on circular economy assignment	4
Test of competence	1

COURSE STUDY METHODS

1. blackboard, interactive whiteboard
2. multimedia presentation
3. e-learning platform

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

F1. – activity in classes
S1. – test from the lectures
S2. – evaluation created reports from tutorials
S3. – test comptetence

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	29- h
Participation in classes	14 h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	2- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	- h
DIRECT TEACHING, hours/ ECTS	**55 h / 1,9 ECTS**
Preparation for tutorials	20- h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	10- h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**30 h / 1,1 ECTS**
TOTAL (hours)	**∑ 85**
TOTAL ECTS	**3 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Stockholm Resilience Centre, "Planetary Boundaries: A Safe Operating Space for Humanity," 2015Name of author (authors), initials, title, publisher, place and year of publication – *for books*
Rutqvist J., Lacy P. 2015. Waste to wealth: the circular economy advantage
Charter M., 2018. Designing for the circular economy
Hazell J., Benton D., Hill J. 2018 The quide to the Circular Economy. Capturing value and managing material risk

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

1. Małgorzata Kacprzak, malgorzata.kacprzak@pcz.pl

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

1. Małgorzata Kacprzak, malgorzata.kacprzak@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W02, K_W06, K_W11,**	**C1, C2**	lecture	**1, 2, 3**	**S1**
EU 2	**K_W02, K_W06, K_W11, K_U05, K_U06, K_K02**	**C1, C2**	lecture	**1, 2, 3**	**S1**
EU 3	**K_U05, K_U06, K_K02**	**C3**	tutorial	**1, 2, 3**	**F1, S2, S3**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Computer Modelling of Environmental Processes** Modelowanie komputerowe Procesów Środowiskowych		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **I**	Course language: **English**
Course type: **project**	Number of hours: **60P**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Providing students with knowledge on computer modeling rules and applications of modeling for solving engineering problems
C.2. Providing students with knowledge on engineering software capabilities, functionalities, limitations, etc.

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge on mathematics, physics and fluid mechanics Basic knowledge on mathematics, physics and fluid mechanics
2. Basic knowledge on performing engineering calculations
3. The ability to use literature

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Student knows rules of computer modeling and has ability to apply them to solving engineering problems
EU 2 - Student knows how engineering software works and is able to select appropriate software for solving desired problem
EU 3 - Student is able to properly asses results of computer modeling process

COURSE CONTENT

Form of classes - project	Hours
Introduction to computer modeling. Providing students with course concept and individual project data sets	4
Introduction to MathCad software	4
Calculations of cyclone geometry	12
Introduction to Ansys – Fluent.	4
Preparation of cyclone geometry for fluid flow calculations	12
Generation of mesh and boundary conditions setup	4
Performing calculations.	12
Analysis of results and report preparation.	8

COURSE STUDY METHODS

1. Blackboard, interactive whiteboard
2. Multimedia presentation
3. e-learning platform
4. Technical engineering software

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

F1. - The assessment of students' preparation for classes
F2. - The assessment of individual students works during classes
S1. - The assessment of project report prepared by student

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	- h
Participation in classes	- h
Laboratory	- h
Participation in project classes	60 h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	15 h
DIRECT TEACHING, hours/ ECTS	**75 h / 2,5 ECTS**

Preparation for tutorials	- h
Preparation for laboratories	- h
Preparation for projects	30 h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	15 h
Preparation for tests	- h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**45 h / 1,5 ECTS**
TOTAL (hours)	**∑ 120**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Juan Pérez Á.A., Computer Modeling & Simulation, Universitat Oberta de Catalunya, http://openaccess.uoc.edu/webapps/o2/bitstream/10609/57344/1/Computer%20Modeling%20%26%20Simulation.pdf
Rousseau R.W., Handbook of Separation Process Technology, John Wiley & Sons, 1987 New York
Wen-Ching Yang, Handbook of Fluidization and Fluid-Particle Systems, CRC Press, 2003 New York
Mizonov V.E., Ushakov S.G., Aerodynamic separation powders (Chemistry, Moscow, 1989)
Zarzycki R., Panowski M., Analysis of the flue gas preparation process for the purposes of carbon dioxide separation using the adsorption methods, Journal of Energy Resources Technology 140 (3), 2018, pp. 032008-1 - 032008-7
Wawrzyńczak D., Panowski M., Majchrzak-Kucęba I., Possibilities of CO2 purification coming from oxy-combustion for enhanced oil recovery and storage purposes by adsorption method on activated carbon, Energy 180, 2019, pp. 787-796
ANSYS Fluent documentation and help

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

1. Maciej Mrowiec, maciej.mrowiec@pcz.pl

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

1. Maciej Mrowiec, maciej.mrowiec@pcz.pl
2. Marcin Panowski, marcin.panowski@pcz.pl
3. Robert Zarzycki, robert.zarzycki@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W12, K_U05, K_U06, K_K01**	**C1, C2**	project	**1, 2, 3**	**F1, F2, S1**
EU 2	**K_W12, K_U05, K_U06, K_K01**	**C1, C2**	project	**1, 2, 3**	**F1, F2, S1**
EU 3	**K_W12, K_U05, K_U06**	**C1, C2**	project	**1, 2, 3**	**F1, F2, S1**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Creativity & innovative thinking** Kreatywność i myślenie innowacyjne		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy For Environmental Protection**	Semester: **I**	Course language: **English**
Course type: **tutorials**	Number of hours: **30T**	ECTS Credit points: **2**

SYLLABUS

COURSE OBJECTIVES

C.1. To provide the students with new approaches towards understanding the role of creativity in developing new ideas in environmental engineering.
C.2. To help the students to better understand new strategies and techniques used for developing innovations.
C.3. To foster creativity and innovative thinking skills among the students.

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Skills of logical thinking and open mindset.

SUBJECT EDUCATIONAL EFFECTS

EU 1 - The students have the understanding of the role of creativity and innovative thinking in problem solving and developing new ideas.
EU 2 - The students will improve the skills necessary to analyse complex problems and to develop innovative solutions.

COURSE CONTENT

Form of classes - tutorials	Hours
Understanding the role of creativity and innovative thinking in the process of creation.	2
Creating a culture for innovation: conditions for creativity in engineering and science	2
Creativity, fixed mindset vs. growth mindset	2
Innovative thinking approaches and strategies	2

Design thinking as a strategy for developing an innovation	2
TRIZ method for creative problem solving in engineering	4
Employing and fostering innovative thinking in research projects	2
Leadership challenge to foster innovation	4
Group work: Problem brief	2
Group work: Idea generation activities	2
Group work: Problem solving	2
Group work: Solution presentations	2
Course summary	2

COURSE STUDY METHODS

1. multimedia presentation
2. group work

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

F1. – activity in classes
F2. – problem solving assignment

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	- h
Participation in classes	30 h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	5 h
DIRECT TEACHING, hours/ ECTS	**35 h / 1,4 ECTS**
Preparation for tutorials	15 h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	- h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**15 h / 0,6 ECTS**
TOTAL (hours)	**∑ 50**
TOTAL ECTS	**2 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Lau, Joe. Y. F. 2011. An Introduction to Critical Thinking and Creativity: Think More, Think Better, John Wiley & Sons, Inc., Hoboken, NJ, USA
Arnold J.E., Clancey W.J. Creative Engineering: promoting innovation by thinking differently. William J. Clancey, 2016
Dweck C.S. Mindset. The New Psychology of Success. Ballantine Books Trade 2008
Brown T. Design Thinking. Harvard Business Review, June 2008, 84-95

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

1. Krystyna Malińska, krystyna.malinska@pcz.pl

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

1. Krystyna Malińska, krystyna.malinska@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W13, K_U03 K_U04, K_K01**	**C1, C2, C3**	tutorials	**1, 2**	**F1**
EU 2	**K_W13, K_U03 K_U04, K_K01**	**C1, C2, C3**	tutorials	**1, 2**	**F2**

OTHER USEFUL INFORMATION

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2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Diploma Project** Praca dyplomowa		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **III**	Course language: **English**
Course type: **project**	Number of hours: **P**	ECTS Credit points: **20**

SYLLABUS

COURSE OBJECTIVES

C.1. Preparation of diploma project

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge in the area of subject realized during course of study

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Student has knowledge and skills for preparing diploma project
EU 2 - Student is prepared for professional realization of independent and team tasks and also is aware of the necessity to develop professionally, follow ethical rules and care about tradition of the profession

COURSE CONTENT

Form of classes - project	Hours
Diploma project procedure on the Faculty of Infrastructure and Environment of Technical University of Częstochowa	…

COURSE STUDY METHODS

1. Laboratory or analytical activity
2. Computer
3. Original materials – dependently on Diploma subject

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

F1. – revives of diploma project
S1. – diploma exam
S2. – diploma defence

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	- h
Participation in classes	- h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	1 h
Consultation hours	99 h
DIRECT TEACHING, hours/ ECTS	**100 h / 4 ECTS**
Preparation for tutorials	- h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	350 h
Preparation for tests	- h
Preparation for exam	50 h
SELF-STUDY, hours/ ECTS	**400 h / 16 ECTS**
TOTAL (hours)	**∑ 500**
TOTAL ECTS	**20 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Textbooks – dependently on Diploma subject
Original reports in journals – dependently on Diploma subject
Standards – dependently on Diploma subject
Legislation acts - – dependently on Diploma subject

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

Responsible teacher

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

1. First name and last name, ……@pcz.pl
2. …
3. …
4. …

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W07, K_W11, K_U02, K_U04, K_U05, K_U06**	**C1**	project	**1, 2, 3**	**F1, S1, S2**
EU 2	**K_K03, K_K04**	**C1**	project	**1, 2, 3**	**F1, S1, S2**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Diploma Seminar** Seminarium dyplomowe		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory**	Semester: **III**	Course language: **English**
Course type: **seminar**	Number of hours: **30S**	ECTS Credit points: **2**

SYLLABUS

COURSE OBJECTIVES

C.1. Providing knowledge on substantive and formal preparation of engineering works and presentation of research results
C.2. Acquisition of the ability to prepare and self-present, as well as to participate, discuss and evaluate the presentation of other speakers

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge in the field of energy and environmental engineering obtained during the studies
2. Ability for independent study of the literature and technical papers

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Able to compile and analyze information obtained from various sources, as well as present the results it in a clear way and formulate conclusions
EU 2 - Can prepare and give a presentation in the field of study with the use of audiovisual means
EU 3 - Can take an active part in the substantive discussion
EU 4 - Understands the need to distribute engineering knowledge, also with the use of mass media

COURSE CONTENT

Form of classes - lectures	Hours
The purpose and goals of the writing of engineering works, reports and/or thesis. Structure and logical organization of work chapters (subject, introduction, literature review, scope of work, research methodology, analysis of results, conclusions, proposals for further research). Proper presentation of tables, equations, drawings. References to literature.	4
The most common formal errors. Elements necessary and unnecessary in the diploma thesis. The correct use of thematic literature. Ethics of writing: plagiarism. Confidentiality	2
Principles of the preparation and presentation of papers taking into account the type of the recipient and his expectations. The structure, content and presentation method, time and detail levels of the presentation, the need to emphasize and highlight the most important issues and conclusions. Attractiveness of the presentation and contact with the auditorium, articulation and gesturing. The essence and method of asking questions correctly, answering questions and participating in a substantive discussion	4
Individual presentations of the students: literature survey, work plan, summary of the thesis. Discussion, indication of errors and omissions and evaluation of the presentation by the listeners	18
Individual discussion and credit	2

COURSE STUDY METHODS

1.	blackboard, interactive whiteboard
2.	multimedia presentation
3.	e-learning platform
4.	works in the library and survey and selection of the literature. Multimedia presentations prepared by the students. Questions and discussion

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

F1. - assessment self-preparation for classes
F2. - assessment of student's activity during the classes
S1. - verification of student's knowledge (presentation and discussion)

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	- h
Participation in classes	- h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	30 h
Preparation course on e-learning	- h
Test	- h
Entrance test for laboratory classes	- h
Project's defence	4 h
Exam	- h
Consultation hours	6 h

DIRECT TEACHING, hours/ ECTS	40 h / 1,5 ECTS
Preparation for tutorials	- h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	15 h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	- h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**15 h / 0,5 ECTS**
TOTAL (hours)	**∑ 55**
TOTAL ECTS	**2 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Bolton R., People Skills: How to Assert Yourself, Listen to Others, and Resolve Conflicts, Simon & Schuster Inc., First Touchstone Ed., 1986, ISBN-13: 978-0671622480
Web informations on how to talk to other people, can be found e.g. at: http://www.peopleskillsdecoded.com/how-to-talk-to-people/

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

1. Rafał Kobyłecki, rafal.kobylecki@pcz.pl

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

1. Rafał Kobyłecki, rafal.kobylecki@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W06, K_W07, K_W08, K_U04, K_U05, K_U11, K_U12, K_K03, K_K04**	**C1, C2**	seminar	**1, 2, 3, 4**	**F1, F2, S1**

EU 2	**K_W06, K_W07, K_W08, K_U04, K_U05, K_U11, K_U12, K_K03, K_K04**	**C1, C2**	seminar	**1, 2, 3, 4**	**F1, F2, S1**
EU 3	**K_W06, K_W07, K_W08, K_U04, K_U05, K_U11, K_U12, K_K03, K_K04**	**C1, C2**	seminar	**1, 2, 3, 4**	**F1, F2, S1**
EU 4	**K_W06, K_W07, K_W08, K_U04, K_U05, K_U11, K_U12, K_K03, K_K04**	**C1, C2**	seminar	**1, 2, 3, 4**	**F1, F2, S1**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Energy Conversion Technologies** Technologie konwersji energii		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **lecture, tutorials**	Number of hours: **30L, 30T**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Getting acquainted with fundamentals of energy conversion technologies
C.2. Knowledge on practical aspects of modern and efficient energy conversion

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge on the fundamentals of physics, chemistry and thermodynamics
2. Ability for independent study of the literature and technical papers

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Knowledge on the fundamentals of various technologies of energy conversion
EU 2 - Knowledge on practical aspects of power, heat and chill generation

COURSE CONTENT

Form of classes - lectures	Hours
Energy sources and fundamentals of energy conversion. Laws of thermodynamics.	4
Phase changes. p-v, i-v, i-s, T-s, i-X diagrams and their applications	4
Carnot cycle. Heat pump cycle. Power generation cycles	2
Main elements of the power generation system. System design criteria	3
Cycle efficiency. Increase of the cycle efficiency and availability	2
Heat transfer. Balance calculations	3
Hybrid and advanced systems for energy conversion	4
Energy storage	2
Energy conversion byproducts and pollutants. Environmental aspects. Circular economy and sustainable development	4

Discussion and written test	2
Form of classes - tutorials	**Hours**
Introduction. Info on the rules to pass the classes. Basic engineering calculations (thermodynamics, fluid flow, mass and energy balances)	4
Thermodynamic calculations of energy conversion systems	4
Balance and engineering calculations (efficiency, emisssion, etc.)	4
Engineering calculations based on the data from i-s, p-i, T-s, i-X diagrams	4
Cycle efficiency and efficiency increase – engineering calculations. Calculation of the system availability	2
Heat transfer – engineering calculations	5
Pollutant emission and environmental issues – some fundamental engineering calculations	5
Written test	2

COURSE STUDY METHODS

1. blackboard, interactive whiteboard
2. multimedia presentation
3. e-learning platform
4. Tutoring: Analysis of methodological materials, calculation of some example cases, discussion of the results

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

F1. - assessment self-preparation for classes
F2. - assessment of student's activity during the classes
F3. - ……
S1. - verification of student's knowledge (discussion and written test)
S2. - exam
S3. - ……

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30 h
Participation in classes	30 h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	4 h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	4 h
DIRECT TEACHING, hours/ ECTS	**68 h / 2,6 ECTS**

Preparation for tutorials	15 h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	5 h
Preparation for exam	15 h
SELF-STUDY, hours/ ECTS	**35 h / 1,4 ECTS**
TOTAL (hours)	**∑ 103**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Rasul M. (ed.), Thermal power plants: advanced applications, InTech, 2013
Weston K., Energy Conversion, PWS, 1992
Petrecca G., Energy Conversion and Management. Principles and Applications, 2014
Books, newspapers and magazines available via internet, as well as those found in the Science Library, particularly: Energy, Bioresource Technology, Biomass & Bioenergy, Fuel Processing Technology, etc..
IEA and EPA publications, EU Directives and technical papers

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

1. Rafał Kobyłecki, rafal.kobylecki@pcz.pl

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

1. Rafał Kobyłecki, rafal.kobylecki@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W05, K_W06, K_U03, K_U04, K_U05, K_K01**	**C1, C2**	lecture, tutorials	**1, 2, 3, 4**	F1, F2, S1, S2

EU 2	**K_W05, K_W06, K_U03, K_U04, K_U05, K_K01**	**C1, C2**	lecture, tutorials	**1, 2, 3, 4**	F1, F2, S1, S2

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **History of inventions** Historia wynalazków		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **lecture, tutorials**	Number of hours: **15L, 15T**	ECTS Credit points: **2**

SYLLABUS

COURSE OBJECTIVES

C.1. To learn about the history of the ground-breaking inventions and their impact on the humankind.
C.2. To have better understanding of the ideas and processes behind the creation of inventions.
C.3. To learn about the rights, obligations and problems of inventors.

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. None

SUBJECT EDUCATIONAL EFFECTS

EU 1 - The students will learn about the most ground-breaking inventions in the history of the humankind.
EU 2 - The students will be able to discuss the most recent topics related to innovations and innovators such as intellectual property rights, successes and failures of inventions, rights and obligations of inventors, changes in the patent systems and IPR laws.

COURSE CONTENT

Form of classes - lectures	Hours
Introduction to the course	1
The most ground-breaking inventions in the history of the humankind	5
Inventors of all times: passion, hard work, luck or a mistake?	2
History of Polish inventors and inventions over the time.	3
Development of patent systems and laws worldwide.	1
The rights, obligations and problems of inventors.	2

Course summary	1
Form of classes - tutorials	**Hours**
Group discussion: The process of invention now and then.	2
Group discussion: Invention success stories.	5
Group discussion: Inventions that failed.	3
Group discussion: Role of academia in encouraging inventions.	2
Group discussion: Patent systems and IPR laws – to patent or not to patent?	2
Course summary	1

COURSE STUDY METHODS

1. multimedia presentation
2. group work

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

F1. – activity in classes
F2. – group performance

STUDENT WORKLOAD

Form of activity	**Workload (hours)**
Participation in lectures	15- h
Participation in classes	15- h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	5- h
DIRECT TEACHING, hours/ ECTS	**35 h / 1,4 ECTS**
Preparation for tutorials	15- h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	- h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**15 h / 0,6 ECTS**
TOTAL (hours)	**∑ 50**
TOTAL ECTS	**2 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Challoner J., 1001 inventions that changed the world, B.E.S. Publishing, 2009
Watson P., A history of thought and invention, from fire to Freud, Harper Parennial, 2006
Górski J., Polskie wynalazki techniki XX i XXI wieku, Horyzonty, 2020
Gribbin J., Naukowcy i ich odkrycia. XVI-XX wiek, Sel, 2019

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

1. Krystyna Malińska, krystyna.malinska@pcz.pl

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

1. Krystyna Malińska, krystyna.malinska@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W13, K_U02 K_U03 K_K01 K_K02**	**C1, C2, C3**	lecture, tutorials	**1, 2**	**F1, F2**
EU 2	**K_W13, K_U02 K_U03 K_K01 K_K02**	**C1, C2, C3**	lecture, tutorials	**1, 2**	**F1, F2**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Industrial Wastewater Technologies** Technologie ścieków przemysłowych		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **first-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **tutorials, laboratory**	Number of hours: **30L, 30Lab**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Knowledge regarding the treatment of industrial wastewater
C.2. The skills of laboratory tests

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Instrumental methods in chemistry
2. Water and wastewater technology

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Qualitative characteristics of industrial wastewater
EU 2 - Technologies for treatment of industrial wastewater
EU 3 - Laboratory skills in wastewater technology

COURSE CONTENT

Form of classes - lectures	Hours
Characteristic of industrial wastewater	2
Legal regulation regarding the treatment of industrial wastewater	2
Physical methods of industrial wastewater treatment (filtration, flotation, coagulation, adsorption)	4
Physical methods of industrial wastewater treatment (stripping, membrane separation processes)	4
Chemical methods of industrial wastewater treatment	4
Photochemical methods of industrial wastewater treatment	4
Biological methods of industrial wastewater treatment	4
Application of integrated methods of industrial wastewater treatment	4

Test	2
Form of classes - laboratory	**Hours**
Fundamentals of laboratory research	4
Chemical oxidation of organic compounds in industrial wastewater	6
Photo-chemical oxidation of organic compounds in industrial wastewater	6
Treatment of industrial wastewater in integrated processes	6
Removal of specific pollutants (toxic, persistent and priority compounds) from selected industrial wastewater	6
Test	2

COURSE STUDY METHODS

1. blackboard, interactive whiteboard
2. multimedia presentation
3. e-learning platform
4. laboratory activities

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

F1. - activity in classes
F2. - evaluation of independent preparation for tasks
F3. - assessment of group work in solving tasks in class
S1. - final test of lectures
S2. - training session

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30- h
Participation in classes	- h
Laboratory	30- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	2- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	10- h
DIRECT TEACHING, hours/ ECTS	**72 h / 2,4 ECTS**
Preparation for tutorials	- h
Preparation for laboratories	24- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	24- h
Preparation for exam	- h

SELF-STUDY, hours/ ECTS	**48 h / 1,6 ECTS**
TOTAL (hours)	**∑ 120**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Woodard F., Industrial Waste Treatment Handbook, British Library Cataloguing-in-Publication Data Butterworth–Heinemann, 2001
Jern W., Industrial Wastewater Treatment, Imperial College Press, London, 2006
Wang L.K., Pereira N.C., Young-Tse H., Biological treatment processes, Handbook of Environmental Engineering, vol. 8, Humana Press, Mill Spring 2009
Mielczarek K., Bohdziewicz J., Włodarczyk-Makuła M., Smol M., Comparison of post-process coke wastewater treatment effectiveness in integrated and hybrid systems that combine coagulation, ultrafiltration and reverse osmosis, Desalination and Water Treatment, 52, 19-21, 2014, 3879-3888
Bajdur W.M., Włodarczyk-Makuła M., Idzikowski A., A new synthetic polymers used in removal of pollutants from industrial effluents, Desalination and Water Treatment, 57, 3, 2016, 1038 - 1049
Włodarczyk-Makuła M., Simultaneous oxidation and adsorption of PAHs in effluents from industrial treatment plant, Desalination and Water Treatment, 117, 2018, 329-339
Macherzyński B., Włodarczyk-Makuła M., Wojewódka D., Control of PAHs degradation under reduction conditions, Desalination and Water Treatment, 117, 2018, 290-300
Archives of Environmental Protection - journal
Polish and UE legislation documents

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

1. Maria Włodarczyk-Makuła, maria.wlodarczyk-makula@pcz.pl

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

1. Maria Włodarczyk-Makuła, maria.wlodarczyk-makula@pcz.pl
2. Agnieszka Popenda, agnieszka.popenda@pcz.pl

Learning outcome	In relation to the learning outcomes specified for	Course objectives	Course content	Course study methods	Methods of assessment

	the field of study				
EU 1	**K_W08, K_U05**	**C1**	lecture	**1**	**F1**
EU 2	**K_W08, K_U05**	**C1**	lecture	**1**	**F1**
EU 3	**K_U02, K_U05**	**C2**	laboratory	**1**	**F2, F3, S1, S2**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Instrumental Methods in Environment** Metody Instrumentalne w Środowisku		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **I**	Course language: **English**
Course type: **lecture, laboratory**	Number of hours: **30L, 30Lab**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Providing students with knowledge transfer of the basics of instrumental analysis and apparatus used in the analytical laboratory
C.2. Preparation students for work with apparatus for determination of constituents of water, sewage, soil and waste
C.3. Providing students with skills in the perform determinations of the examined chemical parameters

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of mathematics, unit processes in the environmental engineering
2. Basic skills of literature sources using
3. Basic skills of logic thinking
4. Basic manual skills during laboratory classes

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Student has knowledge of the basics of instrumental analysis and apparatus used in the analytical laboratory

EU 2 - Student has the ability to select the right instrumental analytical techniques and the use of instrumental equipment
EU 3 - Student can prepare samples for determinations using instrumental methods deling process
EU 4 - Student is able to develop results and draw conclusions from laboratory experiments
EU 5 - Student is aware of importance of acquired knowledge in the aspect of engineering activity, is able to critically access the results of experiment and on the base of them formulate appropriate conclusion

COURSE CONTENT

Form of classes – lectures	**Hours**
Introduction to instrumental methods in environment	4
Spectroscopic methods of analysis: emission spectroscopy absorption spectroscopy (atomic absorption, UV-Visible) atomic absorption flame chemistry	4
Spectroscopic methods of analysis: fluorescence, phosphorescence and chemiluminescence spectroscopy	4
Spectroscopic methods of analysis: X-ray spectroscopy methods (absorption, diffraction, fluorescence) vibrational spectroscopy (FT-IR, Raman)	2
Other instrumental analysis methods: atomic and molecular mass spectrometry	2
Other instrumental analysis methods: electrochemical analysis (polarography, pulse polarographic methods, anodic stripping voltammetry) thermal methods (thermogravimetric and differential thermal analysis)	2
Other instrumental analysis methods: stripping voltammetry) thermal methods (thermogravimetric and differential thermal analysis)	2
Chromatography theory liquid chromatography modes and mechanisms: ion-exchange, adsorption, partition and permeation modes as practiced in high-pressure liquid chromatography, open column, thin layer and paper chromatography	4
Gas chromatography theory, instrumentation and operation supercritical fluid and capillary methods	6
Form of classes – laboratory	**Hours**
Introductory classes for laboratory classes	4
Errors in chemical analysis and methods of their evaluation Iron determination by spectrophotometric method - comparison to the standard	2
Determination of the oxygen content dissolved by the Winkler method	2
Determination of chlorides and COD (Mn) by titration	2
Determination of mineral nitrogen by spectrophotometric methods	2
Determination of COD with the dichromate method and BOD5 with the respirometric method	2
Composting: pile design	2
Determination of sulfates by nephelometric method	2
Determination of total organic carbon (TOC)	2

Determination of biogas composition on a gas chromatograph	2
Determination of PAHs and / or PCBs on a gas chromatograph coupled with a mass detector	2
Determination of heavy metal ions by atomic absorption spectrometry (AAS)	2
Determination of organic nitrogen in mineralized samples	2
Final test	2

COURSE STUDY METHODS

1. Lecture with multimedial presentations
2. Laboratory sets and devices

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

F1. - The – assessment of individual preparation to classes
F2. - The assessment of working in the group
S1. – Credit test
S2. – The assessment of laboratory exercises

STUDENT WORKLOAD

Form of activity	**Workload (hours)**
Participation in lectures	30 h
Participation in classes	- h
Laboratory	30 h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	- h
Entrance test for laboratory classes	3 h
Project's defence	- h
Exam	- h
Consultation hours	12 h
DIRECT TEACHING, hours/ ECTS	**75 h / 2,5 ECTS**
Preparation for tutorials	- h
Preparation for laboratories	25 h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	20 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**45 h / 1,5 ECTS**
TOTAL (hours)	**∑ 120**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Sawyer D. T.; Chemistry experiments for instrumentals methods; IWA Publishing 2007.
Skoog D.A., Principles of Instrumental Analysis; Cengage Learning; 6 edition 2006.
Barbooti M. (Editor); Environmental Applications of Instrumental Chemical Analysis; Apple Academic Press; 1 edition 2015.
Chatwal G. R., Anand S.K., Instrumental Methods of Chemical Analysis, Himalaya Publishing House, 2018.
Andrade-Garda J.M., Carlosena-Zubieta A., Gómez-Carracedo M.P., Maestro-Saavedra M.A., Prieto-Blanco M.C., Soto-Ferreiro R.M., Problems of Instrumental Analytical Chemistry; Word Scientifics, 2017.
Rakocz K., Rosińska A., Changes in selected quality parameters during the treatment and distribution of water, Desalination and Water Treatment, 57 (3), 971-981, 2016.

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

1. Agata Rosińska, rosinska@is.pcz.czest.pl

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

1. Agata Rosińska, rosinska@is.pcz.czest.pl
2. Beata Karwowska, beata.karwowska@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W01, K_W07**	**C1**	lecture	**1**	**S1**
EU 2	**K_W01, K_W07**	**C1**	lecture	**1**	**F1, F2, S1**
EU 3	**K_U01, K_U05, K_K01**	**C2**	laboratory	**2**	**F2, S2**
EU 4	**K_U01, K_U05, K_K01**	**C2**	laboratory	**2**	**F2, S2**
EU5	**K_K01**	**C2**	laboratory	**2**	**F2, S2**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.

2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Intelligent Technologies in Environmental Engineering** Inteligentne technologie w inżynierii środowiska		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **I**	Course language: **English**
Course type: **lecture, tutorials**	Number of hours: **30L, 30T**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. To relay to student's knowledge on intelligent technologies and processes in environmental protection
C.2. To learn skills on processes necessary for designing technology of environmental treatment
C.3. To develop competence in understanding issues of technological and processes of environmental protection

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The students are expected to have background knowledge in the fields of environmental protection at level of I-st degree cycle
2. Students are expected to have basic competences in engineering calculations
3. They are also expected to have ability to work in a team

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Student has a knowledge in methods of treatment of wastewater, soil and sediments, can critically evaluate technological processes

EU 2 - Student is able to point out and evaluate the proper methods for removal of organic and inorganic contaminants from wastewater
EU 3 - Student is able to indicate and compare novel treatments for polluted sediments and soil

COURSE CONTENT

Form of classes - lectures	Hours
Hazard from the presence of inorganic and organic contaminants in selected environmental elements	4
Intelligent processes applied in the treatment of wastewater	6
The removal of organic and biogenic pollutants from wastewater	4
Innovative methods of sludge treatment	4
Novel treatments of polluted sediments	6
New methods of soil treatment	4
Colloquium	2
Form of classes - tutorials	**Hours**
Examples of innovative environmental technologies	12
Group discussion on a selected topic	8
Presentation on a selected topic	8
Course summary	2

COURSE STUDY METHODS

1. lectures with the use of multimedia presentation
2. tutorials

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

F1. – performance during the tutorials
F2. – evaluation of laboratory work and preparation of laboratory report
S1. – colloquium

STUDENT WORKLOAD

Form of activity	Workload (hours)

Participation in lectures	30 h
Participation in classes	15 h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	5 h
DIRECT TEACHING, hours/ ECTS	**50 h / 2 ECTS**
Preparation for tutorials	25 h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	25 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**50 h / 2 ECTS**
TOTAL (hours)	**∑ 100**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Tchobanoglous G., Burton F., Stensel H.D. Wastewater Engineering Treatment and Reuse Reuse,2004 2200200 Reuse,Met Metcalf & Eddy, Inc, 2004
Ochrona Środowiska, GUS, Warszawa 2018
Miksch K., Sikora J. (red.): Biotechnologia ścieków, Wydawnictwo Naukowe PWN, Warszawa 2010
Popenda A, Włodarczyk-Makuła M., Hazard from sediments contaminated with persistent organic pollutants (POPs), *Desalination and Water Treatment, 2018, vol.* 117, 318–328 20
Popenda A., M. Włodarczyk-Makuła, The application of biosurfactants into removal of selected micropollutants from soils and sediments, Desalination and Water Treatment, Volume 57, Issue 3, 2016, 1255-1261.D**OI:**10.1080/19443994.2014.996007
Popenda A, Włodarczyk-Makuła M., Sediments contamination with organic micropollutants: current state and perspectives, Civil and Environmental Engineering Reports CEER 2016; 21 (2): 089-107 DOI: 10.1515/ceer-2016-0025
Włodarczyk-Makuła M., Wiśniowska E., Popenda A., Monitoring of Organic Micropollutants in Effluents as Crucial Tool in Sustainable Development Monitoring mikrozanieczyszczeń organicznych jako ważne narzędzie realizacji zrównoważonego rozwoju– *Problems of Sustainable Development* 2018, vol. 13, no 2, 191-198
Janosz-Rajczyk M. (red.): Badania wybranych procesów oczyszczania ścieków, Wydawnictwo Politechniki Częstochowskiej, Częstochowa 2008

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

1. Agnieszka Popenda, agnieszka.popenda@pcz.pl

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

1. Agnieszka Popenda, agnieszka.popenda@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W06 K_W08 K_W13 K_K01 K_U05**	**C1**	lecture	**1**	**S1**
EU 2	**K_W08 K_W13 K_U01 K_U05**	**C2**	lecture	**1**	**S1**
EU 3	**K_W08 K_U01, K_U05, K_K01**	**C3**	tutorial	**2**	**F1, F2, S1**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Intelligent Heating, Ventilation and Air Conditioning** Inteligentne ogrzewnictwo, wentylacja i klimatyzacja		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **I**	Course language: **English**
Course type: **lecture, project**	Number of hours: **30L, 30P, E**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Transfer of knowledge about thermal-physiological, hygienic and meteorological-climatic bases in the range of HVAC.
C.2. Transfer of knowledge about engineering solutions of HVAC systems and their components.
C.3. Defining energy balances for heating, ventilation and air-conditioning needs of systems.

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge in the range of mathematics, physics, fluid mechanics, technical thermodynamics, building and the technical drawing.
2. Ability of solving problems in the environmental engineering with using of mathematical methods.
3. Ability to independently use of literature.

SUBJECT EDUCATIONAL EFFECTS

EU 1 - student has knowledge about conditions of thermal comfort in the building
EU 2 - student has knowledge of theoretical foundations and methods of practical operation in the field of construction and operation of heating and cooling equipment used in power engineering, heat engineering, ventilation and air conditioning
EU 3 - student has the ability to design renewable and conventional energy sources in building and installation systems
EU 4 - is aware of the importance of the acquired knowledge in the aspects of engineering activity and critical approach towards practical and theoretical problem-solving.

COURSE CONTENT

Form of classes - lectures	Hours
Basic information of hygiene associated with HVAC.	2
Meteorological-climatic basic concepts for HVAC systems.	2
Design thermal load of building.	2
Seasonal heat demand for heating.	2
Heat balance for purpose of determining stream of ventilation air.	2
Design cooling load of building.	2
Seasonal cooling demand for air conditioning.	2
Demand of thermal power and heat for domestic hot water systems.	2
Heating systems.	2
Heating systems components.	4
Basics of air treatment technique. Course content in compliance with the study programme	2
Ventilation and air conditioning systems.	2
Domestic hot water system and its components.	2
Final test.	2
Form of classes - project	**Hours**
Project of a heating system.	28
Verification, defense by students and evaluation of projects.	2

COURSE STUDY METHODS

1. Auditorium lectures using multimedia presentations
2. Calculation tutorials
3. Project tutorials

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

F1. - evaluation of the level of assimilation of lectures and preparation for classes
F2. - evaluation of work in analyzing and solving problems
S1. - test of knowledge in the form of a colloquium and calculational problems
S2. - evaluation of projects

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30 h
Participation in classes	- h
Laboratory	- h
Participation in project classes	30 h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	2 h
Entrance test for laboratory classes	- h
Project's defence	2 h
Exam	2 h
Consultation hours	2 h
DIRECT TEACHING, hours/ ECTS	**68 h / 2,3 ECTS**
Preparation for tutorials	- h
Preparation for laboratories	- h
Preparation for projects	15 h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	15 h
Preparation for tests	10 h
Preparation for exam	12 h
SELF-STUDY, hours/ ECTS	**52 h / 1,7 ECTS**
TOTAL (hours)	**∑ 120**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Koczyk H.: Ogrzewnictwo praktyczne. Wydanie II, Wydawnictwo Systherm Serwis, Poznań, 2009
Nantka. M.: Ogrzewnictwo i Ciepłownictwo. Tom I, Wydanie II, Wydawnictwo Politechniki Śląskiej, Gliwice, 2010
Nantka. M.: Ogrzewnictwo i Ciepłownictwo. Tom II, Wydanie II, Wydawnictwo Politechniki Śląskiej, Gliwice, 2010
Pełech A.: Wentylacja i Klimatyzacja. Wydawnictwa Politechniki Wrocławskiej, Wydanie II, 2009

Recknagel H., Sprenger R. i inni: Ogrzewnictwo, Klimatyzacja, Ciepła woda, Chłodnictwo. Wydawnictwo OMNI SCALA – TECNOCLIMA, 2008
Sugarman S. C.: “HVAC fundamentals”. The Fairmont Press, Inc., 2004
Gupton W.: “HVAC controls: operation & maintenance”. Marcel Dekker, 2001
Bearg D.W.: “Indoor air quality and HVAC systems”. CRC Press, 1993
Monger S.: “Testing and balancing HVAC air and water systems”. The Fairmont Press, Inc., 2000
Levenhagen J. I.: “HVAC control system design diagrams”. McGraw-Hill Professional, 1998
Turski M., Nogaj K., Sekret R. “The use of a PCM heat accumulator to improve the efficiency of the district heating substation” Energy 187 (2019) pp. 1–13 (115885) DOI: 10.1016/j.energy.2019.115885
Turski M., Sekret R. “Buildings and a district heating network as thermal energy storages in the district heating system” Energy & Buildings 179 (2018) pp. 49–56 DOI: 10.1016/j.enbuild.2018.09.015

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

1. Michał Turski, michal.turski@pcz.pl

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

1. Michał Turski, michal.turski@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	K_W07, K_U05, K_U07, K_K01	**C1**	lecture	**1**	**F1, S1**
EU 2	K_W07, K_U05, K_U07, K_K01	**C3**	lecture	**2**	**F1, S1**
EU 3	K_U05, K_U07, K_U08, K_K01	**C2**	project	**3**	**F2, S2**
EU 4	K_U05, K_U07, K_U08, K_K01	**C1, C2, C3**	lecture, project	**1,2,3**	**F1, F2, S1, S2**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.

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

Course title: **Interpersonal Communication** Komunikacja interpersonalna		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **III**	Course language: **English**
Course type: **tutorials**	Number of hours: **15T**	ECTS Credit points: **1**

SYLLABUS

COURSE OBJECTIVES

C.1. Learn to formulate career goals, present yourself and your project / idea
C.2. Learn to acquiring knowledge about communication methods, the art of negotiation

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Self-presentation skills
2. Knowledge of body language, dress code
3. Knowledge of the principles and techniques of building and maintaining contact, active listening

SUBJECT EDUCATIONAL EFFECTS

EU 1 - The student has the ability to use compromises and negotiations, knows the body language

EU 2 - The student has the ability to use compromises and negotiations, knows the body language

COURSE CONTENT

Form of classes - lectures	**Hours**
Course content in compliance with the study programme	0
Form of classes - tutorials	**Hours**
Introduction to the course, contract	1
Integrating classes- tests	1
Integrating classes- tests	1
The art of self-presentation Product presentation	1
Product presentation	1
Body language and verbal communication	1
Communication barriers	1
Communication barriers - workshop	1
Techniques for building and maintaining contact	1
Active listening	1
The art of negotiation and compromise	1
The art of negotiation and compromise – case study	1
Valuable quarrel and assertiveness	1
How to manage your stress at work and in professional life	1
Worshop – interpersonal communication	1
Form of classes - laboratory	**Hours**
Course content in compliance with the study programme	0
Form of classes - project	**Hours**
Course content in compliance with the study programme	0

COURSE STUDY METHODS

1. blackboard, interactive whiteboard
2. multimedia presentation
3. e-learning platform
4. workshop

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

F1. - activity in classes
F2. – personal test
F3. – individual preparation to classes
S1. - exam
S2. - test

STUDENT WORKLOAD

Form of activity	**Workload (hours)**

Participation in lectures	- h
Participation in classes	15- h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	2- h
DIRECT TEACHING, hours/ ECTS	**17 h / 0,7 ECTS**
Preparation for tutorials	4- h
Preparation for laboratories	- h
Preparation for projects	4- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	- h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**8 h / 0,3 ECTS**
TOTAL (hours)	**∑ 25**
TOTAL ECTS	**1 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Cwalina K., Wszytsko zaczyna się w twojej głowie, Wydawnictwo Helion, 2017
Urban M., Niekonwencjonalne metody szkoleniowe, Wrocławska Drukarnia Naukowa PAN, 2009
Grzesiak M., Psychologia zmiany, Wydawnictwo Helion, 2017
Trzeciak S., Coaching marki osobistej, czyli kariera lidera, Gdańskie Wydawnictwo Psychologiczne Sp. z o.o., 2015

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

1. Renata Włodarczyk, renata.wlodarczyk@pcz.pl

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

1. Renata Włodarczyk, renata.wlodarczyk@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W13, K_U01, K_U02, K_U05, K_U06, K_K03**	**C1, C2**	tutorials	**1, 2, 3, 4**	**F1, F2**
EU 2	**K_W13, K_U01, K_U02, K_U05, K_U06, K_K03**	**C1, C2**	tutorials	**1, 2, 3, 4**	**F1, F2**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Management of Energy Conversion By-products and Energy Efficiency** Zarządzanie ubocznymi produktami konwersji energii i efektywność energetyczna		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **lecture, project**	Number of hours: **30L, 30P**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Transfer of knowledge on fundamentals of management energy conversion by-products
C.2. Transfer of knowledge on energy conversion
C.3. Transfer of knowledge on technologies of energy conversion by-products

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge on basic concepts relating to energy conversion
2. Skill in the field of calculation of management of energy conversion by-products
3. Ability to independently use of technical literature

SUBJECT EDUCATIONAL EFFECTS

EU 1 - has knowledge on management of energy conversion by-products
EU 2 - has knowledge on energy conversion

EU 3 - has knowledge on technologies transformation of energy conversion by-products

COURSE CONTENT

Form of classes - lectures	**Hours**
Energy conversion and energy conversion by-products	6
Combustion of fuels	2
Emission of gaseous and dust pollutants	4
Calculation of pollutant emission	4
Economics of gas cleaning processes	2
Resources of industrial waste energy, recovery boilers	4
Impact of energy technologies on the environment	6
Final test	2
Form of classes - project	**Hours**
Introduction, basic physical quantities and units used in calculations	2
Calculation of project	26
Verification of project	2

COURSE STUDY METHODS

1. Lectures using multimedia presentations, blackboard
2. Demonstration of equipment, technical diagrams and methodological materials relating to the measurement methods and technologies that have been used in project
3. e-learning platform

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

F1. -assessment of response to questions and problems posed to students during lectures meetings
F2. -assessment self-preparation for classes
S1. verification of comprehension of discussed calculation examples, diagrams and technologies used in project

STUDENT WORKLOAD

Form of activity	**Workload (hours)**
Participation in lectures	30 h
Participation in classes	- h
Laboratory	- h
Participation in project classes	30 h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	5 h
Entrance test for laboratory classes	- h
Project’s defence	5 h
Exam	- h
Consultation hours	- h
DIRECT TEACHING, hours/ ECTS	**70 h / 2,3 ECTS**

Preparation for tutorials	- h
Preparation for laboratories	- h
Preparation for projects	20 h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	15 h
Preparation for tests	15 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**50h / 1,7 ECTS**
TOTAL (hours)	**∑ 120**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Janka R., Zanieczyszczenia pyłowe i gazowe, Wydawnictwo Naukowe PWN, 2014
Przemysłowa energia odpadowa, WNT, 1993
Nadziakiewicz J., Wacławiak K., Stelmach S., Procesy termiczne utylizacji odpadów, Wyd. P.Śl., 2012
Kordylewski W. Spalanie i paliwa, OWPWr, Wrocław, 2004
Sasinowski H., Energetyka a środowisko, Wyd. Polit. Białostockiej, 1996
Wichliński M., Kobyłecki R., Bis Z.; Badania zawartości rtęci w płytach gipsowo-kartonowych i gipsach; Journal of Civil Engineering, Environment and Architecture JCEEA, t. XXXIII, z. 63 (4/16), październik-grudzień 2016, s. 565-572
Kobyłecki R., Wichliński M., Bis Z.; Badania akumulacji rtęci w popiołach lotnych z kotłów fluidalnych; Energy Policies, Tom 12 Zeszyt 2/2, 2009

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

2. Michał Wichliński, michal.wichlinski@pcz.pl

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

3. Michał Wichliński, michal.wichlinski@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W08, K_U02, K_U05**	**C1**	lecture	**1, 2**	**F1, F2**
EU 2	**K_W08, K_U02, K_U05**	**C2**	lecture	**1, 2**	**F1, F2**
EU 3	**K_W08,**	**C3**	project	**1, 2**	**S1**

	K_U02 K_U05				

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **New Technologies in Water and Wastewater Treatment** Nowe technologie w oczyszczaniu wody i ścieków		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **I**	Course language: **English**
Course type: **lecture, tutorials**	Number of hours: **30L, 30T**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. To inform the students about state in the art in the field of water and wastewater treatment and developmental trends in this area
C.2. To teach students how to design water and wastewater treatment processes taking into consideration the newest trends in technology
C.3. To make students aware of the importance of increasing knowledge and being critical in engineering problem solving

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basics of water and wastewater treatment in accordance with study program at bachelors' level
2. Basics of engineering calculations

SUBJECT EDUCATIONAL EFFECTS

EU 1 - knows state of the art. in the area of water and wastewater treatment, is able to determine the trends in this regard
EU 2 - is able to design treatment technology of water or wastewater ta king into consideration state in the art in this regard
EU 3 - EU 3 – is aware of the importance of the increasing knowledge and is critical in solving of engineering problems

COURSE CONTENT

Form of classes - lectures	**Hours**
Trends in water and wastewater treatment	2
Study visit in modern water treatment plant	2
Biological processes in water treatment	2
Integrated chemical and biological treatment technologies of water treatment	2
Advanced oxidation processes in water treatment	2
Advances in coagulation of water	2
Ion exchange in water treatment	2
Use of advanced oxidation methods in wastewater treatment	2
Study visit in wastewater treatment plant	2
New technologies in waste products utilization	2
Integrated and compact systems in wastewater treatment	2
Use of algae in wastewater treatment	2
Recovery of metals in wastewater treatment	2
Use of anaerobic methods for wastewater treatment	2
Use of membrane processes in wastewater treatment	1
Colloquium	1
Form of classes - tutorials	**Hours**
Individual tutorial project on water or wastewater treatment technology	30
Form of classes - tutorials	**Hours**
Course content in compliance with the study programme	0
Form of classes - laboratory	**Hours**
Course content in compliance with the study programme	0
Form of classes - project	**Hours**
Course content in compliance with the study programme	0

COURSE STUDY METHODS

1. blackboard
2. multimedia presentation
3. computer workstation

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

F1. - activity in classes
S1. – final test
S2. – defence of project

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	29 h
Participation in classes	30 h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	1 h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	- h
DIRECT TEACHING, hours/ ECTS	**60 h / 2 ECTS**
Preparation for tutorials	30 h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	- h
Preparation for exam	30 h
SELF-STUDY, hours/ ECTS	**60 h / 2 ECTS**
TOTAL (hours)	**∑ 120**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Pizzi N.: Water Treatment, Principles and Practices of Water Supply Operations, AWWA, Denver 2010
Wiśniowska E., Włodarczyk-Makuła M., State of the Art in Technologies of the Biogas Production Increasing During Methane Digestion of Sewage Sludge, Civil and Environmental Engineering Reports, vol. 1. nr 28, 64-76, 2018
Hendrics D.: Water Treatment Unit Processes. Physical and Chemical, CRC Press, Boca

Raton 2006
Actual research and technical journals on environmental engineering, eg. Water Research, Science of the Total Environment, et.

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

1. Ewa Wiśniowska, ewa.wisniowska@pcz.pl

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

1. Ewa Wiśniowska, ewa.wisniowska@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	K_W08, K_W09, K_W13, K_U05	C1	Lectures	**1, 2**	**F1., S1.**
EU 2	K_U01, K_U05	C2	Tutorial	**1, 2, 3**	**S2.**
EU 3	K_K01	C3	Tutorial	**1, 2, 3**	**F1., S2.**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Waste Heat Management and Energy Efficiency** Zagospodarowanie ciepła odpadowego i efektywność energetyczna		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **lecture, laboratory**	Number of hours: **30L, 30Lab**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Getting acquainted with thermal processing technologies and waste heat management
C.2. Knowledge on analysis and calculation of waste heat reuse

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge on the fundamentals of thermodynamics, combustion, and energy conversion
2. Ability for independent study of the literature and the use of computer software

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Knowledge on the identification of waste heat formation sources
EU 2 - Knowledge on how to solve basic problems associated with waste heat reuse

COURSE CONTENT

Form of classes - lectures	Hours
Introduction to power generation. Identification of potential waste heat production sources	2
Fundamentals on thermodynamic calculation of waste heat production	2
Low temperature waste heat recovery from the flue gases	4
Condensation of flue gas moisture. Heat exchangers for condensating fluids	4
Tools and devices for waste heat recovery from the flue gas. Heat pumps and chillers	2
Potential possibilities to reuse low temperature waste heat at power production systems (condensation, CHP, polygeneration)	4
Waste heat recovery from the cooling of steam condensers. The possibilities to reuse the heat	4
The recovery and reuse of heat from CO2 compression. Waste heat recovery from ORC systems. Waste heat recovery from off-water and sludges	4
Accumulation possibilities of low temperature waste heat	2
Discussion and written test	2
Form of classes - laboratory	**Hours**
Introduction. Info on the rules to pass the classes. Identification of waste heat generation sources. Calculation and balance of Energy conversion and power generation systems	4
Calculation of waste heat in the flue gases	2
Heat recovery from the flue gas by the condensation of moisture – calculation of some chosen cases	4
Calculation of a condensation heat exchanger	2
Modelling of thermal cycles for energy conversion and power generation – some chosen cases (basic, CHP, heat recovery, etc.)	6
Thermal calculation and modelling of the cooling system for power generation – some chosen cases (basic, CHP, heat recovery, etc.)	6
Modelling of some example systems with CO2 compression with intermittent cooling and heat recovery. Modelling of an example ORC system. Modelling of an example waste heat accumulation system	4
Discussion and Test	2

COURSE STUDY METHODS

1.	blackboard, interactive whiteboard
2.	multimedia presentation
3.	e-learning platform
4.	Laboratory activities with the use of advanced software for modeling of thermal processes. Analysis of some example cases, discussion and analysis of the results

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

F1. - assessment of the self-preparation for classes
F2. - assessment of student's activity during the classes
S1. - verification of student's knowledge (discussion and written test).

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30 h
Participation in classes	- h
Laboratory	30 h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	2 h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	15 h
DIRECT TEACHING, hours/ ECTS	**77 h / 2,9 ECTS**
Preparation for tutorials	- h
Preparation for laboratories	15 h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	15 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**30 h / 1,1 ECTS**
TOTAL (hours)	**∑ 107**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Thurmann A., Waste Heat Recovery Handbook, Spon Press, 1983
http://www.chemengonline.com/waste-heat-recovery-methods-and-technologies/?printmode=1
http://www.em-ea.org/guide%20books/book-2/2.8%20waste%20heat%20recovery.pdf
Wójs K.: Odzysk i zagospodarowanie niskotemperaturowego ciepła odpadowego ze spalin wylotowych, PWN, Warszawa 2015
Books, newspapers and magazines available via internet, as well as those found in the

Science Library

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

1. Robert Zarzycki, robert.zarzycki@pcz.pl

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

1. Robert Zarzycki, robert.zarzycki@pcz.pl
2. Rafał Kobyłęcki, rafal.kobylecki@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W08, K_U01, K_U02, K_U05, K_U06**	**C1, C2**	lecture, laboratory	**1, 2, 3, 4**	**F1, F2, S1**
EU 2	**K_W08, K_U01, K_U02, K_U05, K_U06, K_K01**	**C1, C2**	lecture, laboratory	**1, 2, 3, 4**	**F1, F2, S1**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Phytoremediation by Energetic Plants** Rośliny energetyczne w fitoremediacji		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **lecture, tutorials**	Number of hours: **30L, 30T**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Providing knowledge about phytoremediation techniques like: phytoextraction, phytostabilization, rhizofiltration, phytoaccumulation, phytodegradation, phytovolatilization.
C.2. Providing specialist knowledge about technical requirements for phytoremediation, uptake compounds by plants, control of the processes
C.3. Learning techniques how to conduct phytoremediation (i.e. phytoextraction process), calculate processes parameters, design the process and draw the right conclusions from it.

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge from chemistry
2. Knowledge from biology

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Has knowledge about phytoremediation techniques like: phytoextraction, phytostabilization, rhizofiltration, phytoaccumulation, phytodegradation, phytovolatilization

EU 2 - Has the specialist knowledge about technical requirements for phytoremediation, uptake compounds by plants, control of the processes

EU 3 - Can model, design and conduct phytoremediation (i.e. phytoextraction) process, calculate processes parameters, design the process and draw the right conclusions from it.

COURSE CONTENT

Form of classes - lectures	Hours
Phytotransformation and control of wastes	4
Green liver model – uptake and metabolism of organic compounds	4
Phytoremediation – successful technology	4
Phytostabilisation and phytoextraction technology	4
Rhizodegradation technology	4
Phytoaccumulation technology	2
Phytovolatilization/Evapotranspiration technology	2
Technical requirements for phytoremediation	2
New technologies in phytoremediation	2
Test	2
Form of classes - tutorials	**Hours**
Modeling and design of phytoremediation	4
Phytoremediation design: - technical requirements - decision tree	4
Project of phytoremediation of degraded terrain (student own work): - selection of technologies depending on the type of contamination - technology design - diagram of the phytoremediation area - calculations of remediation parameters - discussion and conclusions - passing the tutorials project passing	20
Test	2

COURSE STUDY METHODS

1. blackboard, interactive whiteboard
2. multimedia presentation
3. literature from on-line bibliographic databases

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

F1. - activity in classes
S1. – test from the lectures
S2. - evaluation created reports from tutorials
S3. – test from the tutorials

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	29 h
Participation in classes	28 h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	3 h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	- h
DIRECT TEACHING, hours/ ECTS	**60 h / 2 ECTS**
Preparation for tutorials	45 h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	15 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**60 h / 2 ECTS**
TOTAL (hours)	**∑ 120**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

McCutcheon, Steven C., and Jerald L. Schnoor. Phytoremediation: transformation and control of contaminants. Vol. 121. John Wiley & Sons, 2004
Kuhad, Ramesh Chander, and Owen P. Ward. Advances in applied bioremediation. Ed. Ajay Singh. Berlin: Springer-Verlag, 2009.
McIntyre, Terry. "Phytoremediation of heavy metals from soils." Phytoremediation. Springer Berlin Heidelberg, 2003. 97-123.

Pilon-Smits, Elizabeth. "Phytoremediation." Annu. Rev. Plant Biol. 56 (2005): 15-39.
Fijalkowski, K., Rosikon, K., Grobelak, A., Hutchison, D., & Kacprzak, M. J. (2018). Modification of properties of energy crops under Polish condition as an effect of sewage sludge application onto degraded soil. Journal of environmental management, 217, 509-519
Placek-Lapaj, A., Grobelak, A., Fijalkowski, K., Singh, B. R., Almås, Å. R., Kacprzak, M. (2019). Post–Mining soil as carbon storehouse under polish conditions. Journal of environmental management, 238, 307-314.
Kacprzak, M. J., Rosikon, K., Fijalkowski, K., Grobelak, A. (2014). The effect of Trichoderma on heavy metal mobility and uptake by Miscanthus giganteus, Salix sp., Phalaris arundinacea, and Panicum virgatum. Applied and Environmental Soil Science, 2014.

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

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Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W01, K_K01, K_U05**	**C1-2**	lecture	**1, 2, 3**	**S1**
EU 2	**K_W01, K_K01**	**C1-2**	lecture	**1, 2, 3**	**S1**
EU 3	**K_K01, K_U01, K_U05**	**C3**	tutorials	**1, 2, 3**	**F1, S2, S3**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Protection of Soil from Environmental Impact** Ochrona gleb przed niekorzystnym oddziaływaniem czynników środowiskowych		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **first-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **lecture, project**	Number of hours: **30L, 30P**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Provide the basic knowledge about soil erosion and degradation
C.2. Provide the basic knowledge about the soil protection
C.3. To acquire capabilities to choice of soil protection and rehabilitation techniques
C.4. To acquire capabilities to description of transport of contaminants in the soil

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Fundamentals of soil science, chemistry, biology, ecology, geology, and geomorphology
2. The basic knowledge in sources and types of contaminants in the environment
3. Capability of using source literature
4. Capability of software operation
5. Capability of individual work and collaboration in a group

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Knowledge on soil erosion and degradation
EU 2 - Knowledge on methods and necessity of soil protection
EU 3 - Ability to choice of soil protection and rehabilitation techniques
EU 4 - Ability to description of transport of contaminants in the soil
EU 5 - Is aware of the importance of the acquired knowledge in the aspects of engineering activity and critical approach towards practical and theoretical problem-solving in the field of environmental impact of soil degradation

COURSE CONTENT

Form of classes - lectures	Hours
Introduction to the subject. Genesis and functions of soils	2
Soil morphology. The profile of mineral and organic soil. Genetic and diagnostic soil horizons. The soil taxonomy	4
The soil texture and its influence on the water drainage, soil aeration, water holding capacity, and susceptibility to erosion	2
Physical properties of soils. Methods of determination of the soil colour, density and porosity	2
The methods of soil moisture determination. The water potential as the measure of potential energy in water. The osmotic (solute) potential	2
The soil chemistry. The detection, occurrence, and role of macroelements and microelements	2
The soil sorption (adsorption, desorption). The sorption complex, exchangeable sorption, sum of exchangeable cations	4
The soil fertility. The exchange of matter and energy in soils	2
The soil erosion and degradation	2
Transport and fate of contaminants in soils	2
The soil protection and remediation	2
The storage of energy in the soil	2
The test	2
Form of classes - project	**Hours**
Organizational class. Introduction to the projects	2
The project of the prediction of transport and fate of contaminants in the soil	8
Project of the measures for preventing the soil erosion caused by surface runoff	8
The project of the remediation of the contaminated soil and groundwater	10
The evaluation of the projects	2

COURSE STUDY METHODS

1. blackboard
2. multimedia presentation

3. computer software

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

F1. - activity in project classes
S1. - test
S2. - assessment of projects

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30 h
Participation in classes	-
Laboratory	-
Participation in project classes	30 h
Participation in seminar	-
Preparation course on e-learning	-
Test	2 h
Entrance test for laboratory classes	-
Project's defence	1 h
Exam	-
Consultation hours	4 h
DIRECT TEACHING, hours/ ECTS	**67 h / 2.6 ECTS**
Preparation for tutorials	-
Preparation for laboratories	-
Preparation for projects	10 h
Preparation for seminars	-
Preparation for e-learning classes	-
Participation in e-learning classes	-
Working on project	15 h
Preparation for tests	-
Preparation for exam	10 h
SELF-STUDY, hours/ ECTS	**35 h / 1.4 ECTS**
TOTAL (hours)	**∑ 102**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Brady N.C., Weil, R.R., Elements of the Nature and Properties of Soils (3rd Edition), Pearson Education inc., 2009
Brady N.C., Weil, R.R., The Nature and Properties of Soils (14th Edition), Prentice-Hall,

2007
Sumner M.E., Handbook of Soil Science. CRC Press LLC, 2000
Yerima B.P.K, van Ranst, E., Introduction to Soil Science: Soils of the Tropics. Trafford Publishing 2005
Chesworth W., Encyclopedia of Soil Science. Springer Science & Business Media, 2008
Millar C.E., Turk L.M., Fundamentals of Soil Science. Biotech Books, 2002
Chiang W.H., Kinzelbach, W., Processing Modflow. A simulation system for modelling groundwater flow and pollution. User Guide for computer program Processing Modflow for Windows (PMWIN). http://www.pmwin.net/programs/prevpm/pm4/doc/pmwin41.pdf
Nonner J.C., Introduction to hydrogeology. Taylor & Francis Group plc, London, UK 2006
Sanders L.L., A manual of field hydrogeology. Prentice-Hall, Inc. 1998
Baran, S., Turski, R., Degradacja, ochrona i rekultywacja gleb. Wyd. AR, Lublin 1996
Dobrzański B., Zawadzki, S., Gleboznawstwo. Wyd. IV, PWRiL, Warszawa 1999
Mrowiec M., Ociepa E., Malmur R., Deska I., Sustainable Water Management in Cities under Climate Changes. Problemy Ekorozwoju. 2018, 13(1), 133-138
Deska I., Mrowiec M., Ociepa E., Łacisz K., Investigation of the influence of the hydrogel amendment on the retention capacities of green roofs. Ecological Chemistry and Engineering S, 2018, 25(3), 373-382
Deska I., Łacisz K., The possibility of the light non-aqueous phase liquids migration in the layered porous medium. Ecological Chemistry and Engineering A, 2016, 25(3), 373-382

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Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W01, K_W10, K_U01, K_U04, K_U05, K_K01**	**C1**	lecture, project	**1**	**S1**
EU 2	**K_W01, K_W10, K_U01, K_U04, K_U05, K_K01**	**C2**	lecture, project	**1**	**S1**

EU 3	**K_W01, K_W10, K_U01, K_U04, K_U05, K_K01**	**C3**	lecture, project	**1, 2, 3**	**F1, S1, S2**
EU 4	**K_W01, K_W10, K_U01, K_U04, K_U05, K_K01**	**C4**	lecture, project	**1, 2, 3**	**F1, S1, S2**
EU 5	**K_W10, K_K01**	**C1, C2, C3**	lecture, project	**1.**	**S1**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Renewable Energy Sources** Odnawialne źródła energii		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **I**	Course language: **English**
Course type: **lecture, tutorials**	Number of hours: **30LE, 30T, E**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Getting acquainted with technologies and ways to convert energy from renewable sources
C.2. Knowledge on practical aspects of the application of RES-based technologies to produce electricity, heat and chill

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge on the fundamentals of physics and energy conversion
2. Ability for independent study of the literature and technical papers

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Knowledge on the fundamentals of energy conversion and renewable energy sources (RES)
EU 2 - Knowledge on the fundamentals of RES application

COURSE CONTENT

Form of classes - lectures	**Hours**
Introduction and energy conversion fundamentals. World energy resources. Policy and development trends	2
Solar energy and conversion systems	2
Solar panels, technologies and applications	2
Photovoltaics and PV systems	2
Hydropower	2
Geothermal energy	2
Wind energy, wind turbines and conversion technologies	2
Biomass as energy source. Requirements for plant growth. Biomass drying and mechanical processing (cutting, pellets, briquets, ballots, etc.)	4
Thermal treatment of biomass. Combustion, gasification and pyrolysis. Fermentation of organic matter. Biogas, bioetanol and biodiesel	4
Heat pumps and chillers	2
Energy balance and conservation. Energy storage. Energy efficiency. Passive buildings	4
Economical and legal aspects associated with RES. Perspectives and development trends. Sustainable development and circular economy	1
Discussion and written test	1
Form of classes - tutorials	**Hours**
Introduction. Info on the rules to pass the classes. Discussion on energy conversion fundamentalss. Basic engineering calculations of energy conversion	6
Engineering calculations and discussion of the results for some chosen energy conversion systems (solar, PV, hydro, geothermal)	6
Engineering calculations and discussion of the results for wind energy systems	2
Engineering calculations and discussion of the results for biomass energy systems	6
Engineering calculations and discussion of the results for heat pumps and chillers	4
Engineering calculations: energy balance, energy efficiency, passive buildings	4
Written test	2

COURSE STUDY METHODS

1. blackboard, interactive whiteboard
2. multimedia presentation
3. e-learning platform
4. Tutoring: Analysis of methodological materials, calculation of some example cases, discussion and analysis of the results

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

F1. - assessment self-preparation for classes
F2. - assessment of student's activity during the classes

S1. - verification of student's knowledge (discussion and written test).
S2. - exam

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30 h
Participation in classes	30 h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	2 h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	8 h
DIRECT TEACHING, hours/ ECTS	**70 h / 2,7 ECTS**
Preparation for tutorials	15 h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	5 h
Preparation for exam	15 h
SELF-STUDY, hours/ ECTS	**35 h / 1,3 ECTS**
TOTAL (hours)	**∑ 105**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Ferry R., Monoian E., **A Field Guide to Renewable Energy Technologies,** Society for Cultural Exchange, 2012.
Viswanathan B., An Introduction to Energy Sources, Indian Institute of Technology, 2006
Books, newspapers and magazines available via internet, as well as those found in the Science Library, particularly: Energy, Energy Economics, Energy Policy, Resource and Energy Economics, Climate Policy, Bioresource Technology, Biomass & Bioenergy, Fuel Processing Technology, etc..
IEA and EPA publications, EU Directives and technical papers

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Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	K_W05, K_U03, K_U04, K_U05, K_K01	C1, C2	lecture, tutorials	**1, 2, 3, 4**	F1, F2, S1, S2
EU 2	K_W05, K_U03, K_U04, K_U05, K_K01	C1, C2	lecture, tutorials	**1, 2, 3, 4**	F1, F2, S1, S2

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Smart Cities** Inteligentne miasta		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy For Environmental Protection**	Semester: **III**	Course language: **English**
Course type: **lecture, project**	Number of hours: **30L, 15P**	ECTS Credit points: **3**

SYLLABUS

COURSE OBJECTIVES

C.1. Understanding smart community concepts and being able to analyze smart city cases is important for urban planners, managers and policymakers

C.2. Knowledge about modern concepts of urban infrastructure development in key areas: water distribution, waste management, transport system, IT technologies

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic information about urban infrastructure (water, transport, waste, IT)

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Understanding the general current economic, social and environmental trends that jeopardize sustainable growth of cities

EU 2 - Ability to investigate, analyze and explore "smart city" concepts and solutions in relation to the climate mitigation challenges for important urban development sectors, such as transportation, buildings, consumption, energy production, waste management, water management

EU 3 - Student is prepared for entrepreneurial thinking and acting and for responsible acting in professional and social roles

COURSE CONTENT

Form of classes - lectures	Hours
Introduction to smart cities – philosophy and concepts	2
E-governance and citizen services	2
IT systems in smart cities	4
Waste management in smart cities	4
Green and smart buildings	4
Smart energy systems	4
Smart water and wastewater systems	4
Smart transport systems	4
Future challenges for smart cities	2
Form of classes - project	**Hours**
Introduction to smart cities	1
E-Governance and citizen services	2
Waste management in smart city	2
Water management in smart city	3
Energy management.	3
Urban mobility	2
Discussion on projects prepared by students	2

COURSE STUDY METHODS

1. Lectures using multimedia presentations
2. Videos: short talks and case study videos

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

F1. – weekly responses
F2. – classes participation
S1. – Final written paper

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30 h
Participation in classes	- h
Laboratory	- h
Participation in project classes	15 h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	2- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	3 h
DIRECT TEACHING, hours/ ECTS	**50 h / 1,7 ECTS**
Preparation for tutorials	- h
Preparation for laboratories	- h
Preparation for projects	10 h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	25 h
Preparation for tests	5 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**40 h / 1,3 ECTS**
TOTAL (hours)	**∑ 90**
TOTAL ECTS	**3 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Graham W., (2016), Dream Cities: Seven Urban Ideas That Shape the World, Harper Publishing House
Tresca S., (2015), Future Cities: 42 Insights and Interviews with Influencers, Startups, Investors
Richard T. (2014), Urban Ecology: Science of Cities,
Townsend A., (2014), Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia

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Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W04, K_W07, K_W09, K_U05**	**C1**	lecture	**1**	**F1, F2**
EU 2	**K_U05, K_U06, K_U09, K_K02**	**C2**	project	**1, 2**	**F2, S1**
EU 3	**K_K02**	**C2**	project	**1, 2**	**F2, S1**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Social Acceptance of Renewable Energy Sources RES** Społeczna akceptacja OZE		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **I**	Course language: **English**
Course type: **lecture, tutorials**	Number of hours: **30L 30T**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Providing the knowledge on RES application benefits
C.2. Explanation of social protests reasons related to application of RES
C.3. Mastering the basics of mediation

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge on RES technologies

2. Ability to work in groups
3. Ability to search, use and interpret the literature sources

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Understanding the benefits of RES application
EU 2 - Understanding the reasons of opposition against RES
EU 3 - Mastering the basics of mediation

COURSE CONTENT

Form of classes - lectures	Hours
Introduction. Role of RES in enhancing the technical progress, overcoming of fuel crisis and global climate change.	2
Global benefits of RES application.	2
Local benefits of RES application.	2
Background of social protests against RES. Most common syndromes such as NIMBY, BANANA, CAVE.	2
How to distinguish scientific publication from para-scientific work.	2
Case-study: protest against wind energy.	2
Case study: protest against biomass power plant.	2
Legal aspects of RES localization	2
Efficient and precise communication. Misunderstanding as a most often reason of conflict.	2
Role and desired skills of the mediator. Ethics in mediation.	2
Tools for mediators.	2
How to prepare and conduct a meeting with a local society.	2
Participants in RES application and acceptance process. Role of local authorities and NGO's.	2
Strategy of negotiations and win-win theory.	2
Test	2
Form of classes - tutorials	**Hours**
Efficient promotion of RES	4
Environmental impact calculation and reporting	4
Comparison of emissions for various energy technologies	4
Presentation and discussion of selected RES technology	4
Mediation techniques exercising	4
Mediation techniques exercising	4
Mediation techniques exercising	4
Summary, credit entry	2

COURSE STUDY METHODS

1. Lectures comprising of multimedia presentation
2. Tutorial
3. Discussion, co-working

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

F1 – evaluation of preparation for lectures
F2 - evaluation of preparation for tutorials
F3 – evaluation of activity during classes
P1 – test

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	28- h
Participation in classes	30- h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	2- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	5- h
DIRECT TEACHING, hours/ ECTS	**65 h / 2,5 ECTS**
Preparation for tutorials	20- h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	20- h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**40 h / 1,5 ECTS**
TOTAL (hours)	**∑ 105**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

1. Popkiewicz M., Rewolucja energetyczna. Ale po co? Wyd. Sonia Draga, 2015
2. Praca zbiorowa pod red. Księżopolski K.M. et al., Odnawialne źródła energii w Polsce. Wybrane problemy bezpieczeństwa, polityki i administracji, Dom Wydawniczy Elipsa, 2014
3. Pierpont N., Wind Turbine Syndrome: A Report on Natural Experiment, K-Selected Books, 2009
4. Etherington J., The Wind Farm Scam, Stacey International, 2009
5. Beer E.B., The Mediator's Handbook: Revised & Expanded fourth edition, New Society Publishers, 2012.
6. Alves-Pereira M., Castelo- Branco N.A.A., Vibroacoustic disease: Biological effects of infrasound and low-frequency noise explained by mechanotransduction cellular signalling, Progress in Biophysics and Molecular Biology, vol. 93, pp. 256-279, 2007.
7. Praca po red. Binsztok A., Sztuka skutecznego prowadzenia mediacji i negocjacji, zagadnienia psychologiczne i komunikacyjne, Wyd. Marina, 2013.

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Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU1	**K_W05, K_U01, K_U03, K_U05**	**C1**	lecture, tutorials	**1, 2, 3**	**F1, F2, F3, P1**
EU2	**K_W05, K_U01, K_U05, K_K01**	**C2**	lecture, tutorials	**1, 2, 3**	**F1, F2, F3, P1**
EU3	**K_U03, K_U05, K_K01**	**C3**	lecture, tutorials	**1, 2,3**	**F1, F2, F3, P1**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Strategies for the International Protection of the Environment** Strategie w Międzynarodowej Ochronie Środowiska		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **lecture, tutorials**	Number of hours: **30L, 15T**	ECTS Credit points: **3**

SYLLABUS

COURSE OBJECTIVES

C.1. Familiarize students with the knowledge of basic principles of the strategies for the international protection of the environment.
C.2. Develop competence in understanding issues of environmental protection in the context of globalization.
C.3. Familiarize students with the sustainable development goals.

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge about the environment
2. Knowledge in the fields of environmental protection

EFFECTS

EU 1 - Student is able to characterize ethical and sociological aspects of environment protection.
EU 2 - Student knows “clean production” as a philosophy
EU 3 - Student understand the role of styrategies for the international protection of the environment

COURSE CONTENT

Form of classes - lectures	Hours
Introduction to the lectures.	1
Biosphere and biocenosis.	4
Ozone deplation.	4
Ecological equilibrium.	4
Sustainable development.	4
Environmental protection.	4
Environmental technologies.	2
Clean technologies.	2
Environmental Protection Act.	1
Scientific articles to read.	3
Final conclusion.	1
Form of classes - tutorials	**Hours**
Introduction to the tutorials.	1
Globalisation.	1
Sustainable energy supply and climate change.	1
Ethical and sociological aspects of the environment protection.	1
Environmental goods (e.g., climate change, biodiversity, energy and food resources, air, water, etc.) - private, common, public or club goods?	1
“Clean production” as a philosophy and a strategy for the environmental management.	1
The ‘clean production’ certificate as a form of a voluntary ecological commitment.	1
Stakeholder strength and their priorities in a multilevel governance perspective.	2
Essays presentation and discussion - sustainable environmental strategies and technology needs assessment supporting socio-economic development.	4
Final conclusion.	2
Form of classes - laboratory	**Hours**
Course content in compliance with the study programme	0
Form of classes - project	**Hours**
Course content in compliance with the study programme	0

COURSE STUDY METHODS

1. blackboard
2. multimedia presentation
3. tutorials

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

F1. - activity in classes
F2. - Evaluation of student's preparation for classes
S1. – test for tutorials
S2. – test for lectures

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30 h
Participation in classes	15 h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	2 h
Entrance test for laboratory classes	- h
Project's defence	1 h
Exam	- h
Consultation hours	15 h
DIRECT TEACHING, hours/ ECTS	**63 h / 2,3 ECTS**
Preparation for tutorials	15 h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	5 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**20 h / 0,7 ECTS**
TOTAL (hours)	**∑ 83**
TOTAL ECTS	**3 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Renewable Energy in the Context of Sustainable Development, available at http://www.mcc-berlin.net/~creutzig/SRREN_Ch09.pdf
Brychan ThomasChristopher Miller , Lyndon Murphy UNDP, Handbook for conducting technology needs assessment for climate change, 2010, available at http://unfccc.int/ttclear/misc_/StaticFiles/gnwoerk_static/TNR_HAB/b87e917d96e94034bd7ec936e9c6a97a/1529e639caec4b53a4945ce009921053.pdf
Łunarski J., Systemy zarządzania środowiskowego, Wyd. Politechnika Rzeszowska, Rzeszów 2006
Websites: Joint Implementation Network, http://www.jiqweb.org/ United Nation Development Programme, http://www.undp.org/content/undp/en/home.html United Nation Framework on Climate Change, http://unfccc.int/2860.php Ministry of the Environment, https://www.mos.gov.pl/en

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

1. Magdalena Zabochnicka-Świątek, magdalena.zabochnicka@pcz.pl

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

1. Magdalena Zabochnicka-Świątek, magdalena.zabochnicka@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W01, K_W02, K_U01, K_U05 K_K01**	**C1**	lecture	**1**	**F1**
EU 2	**K_W01, K_W02, K_U01, K_U05 K_K01**	**C1**	lecture	**1**	**F1**
EU 3	**K_W01, K_W02, K_U01, K_U05 K_K01**	**C3**	lecture, tutorial	**1,2**	**F1, F2, S1, S2**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Training on Safe and Hygiene Education Conditions** Szkolenie dotyczące bezpiecznych i higienicznych warunków kształcenia		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory**	Semester: **I**	Course language: **English**
Course type: **lecture**	Number of hours: **4L**	ECTS Credit points: **0**

SYLLABUS

COURSE OBJECTIVES

C.1. Providing basic information on safe and hygienic conditions of education. Basic concepts. The most important legal provisions in the field of health and safety

C.2. Acquisition by students of the ability to recognize the risk for health and life. Dangerous, harmful and burdensome factors related to the education process. Counteracting threats. Collective and personal protection equipment. An accident with special restrictions.

C.3. Understanding the principles of preventive medical care and the rules for its provision in relation for persons undergoing education. Preparation to firs aid

C.4. Providing the information on the causes of fire and rules of acting during fire

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE,

SKILLS AND OTHER COMPETENCES

1. Basic knowledge about rules of safe conduct

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Student knows the basic concepts in the area of safety rules and principles in safe behaviour during using the university infrastructure
EU 2 - Student is able to recognize danger situation and avoid harmful consequences
EU 3 - Student is able to behave properly in the case of an accident and give first aid
EU 4 - Student has knowledge about the risk of fire and behaviour in the case of fire or other risks, analyses and solves problems related to safety and hygiene of work

COURSE CONTENT

Form of classes - lectures	Hours
Organizational information, basic concepts and legal provisions on safe and hygiene condition of education	1
Accident and health hazards that may occur in the University's environment. Dangerous, harmful and troublesome factors. Chemical, biological and psychosocial factors. Means of collective and individual protection, clothing and footwear. The concept of an accident in special circumstances. What to do in the event of an accident. Post-accident proceedings - a protocol establishing the circumstances and causes of an accident	1
Preventive medical care and the rules for its provision in relation to persons undergoing education. Providing first aid in the event of an accident, alerting and calling for help. Securing the accident site for the purposes of an accident	1
Fire protection. Causes of fire. Equipping buildings with alarm, fire-extinguishing and ventilation systems. Marking escape routes. Arrangement of fire extinguishers in the facilities. Firefighting, alerting and calling for help. Evacuation from the facility	1

COURSE STUDY METHODS

1. blackboard, interactive whiteboard
2. multimedia presentation

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

F1. - activity in classes

STUDENT WORKLOAD

Form of activity	Workload (hours)

Participation in lectures	4 h
Participation in classes	- h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	- h
DIRECT TEACHING, hours/ ECTS	**4 h / 0 ECTS**
Preparation for tutorials	- h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	- h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**0 h / 0 ECTS**
TOTAL (hours)	**∑ 4**
TOTAL ECTS	**0 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Rączkowski B., BHP w praktyce, Wydawnictwo: ODDK, rok publikacji: 2016

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

1. Monika Gałwa-Widera, monika.galwa-widera@pcz.pl

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

1. Monika Gałwa-Widera, monika.galwa-widera@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment

EU 1	**-**	**C1**	lecture	**1, 2**	**F1**
EU 2	**-**	**C2**	lecture	**1, 2**	**F1**
EU 3	**-**	**C3**	lecture	**1, 2**	**F1**
EU 4	**-**	**C1, C2, C4**	lecture	**1,2**	**F1**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Waste for Material and Energy Recovery** Odzysk materiałów i energii z odpadów		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **I**	Course language: **English**
Course type: **lecture, laboratory**	Number of hours: **30L, 30Lab**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Knowledge transfer of waste management, including sewage sludge

C.2. Skills in the range of basic parameters determination of waste management technological process

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. knowledge of mathematics, unit processes in the environmental engineering
2. skills of literature sources using
3. skills of logic thinking
4. manual skills during laboratory classes

SUBJECT EDUCATIONAL EFFECTS

EU 1 - has knowledge of waste kinds, their properties and methods of waste management
EU 2 - has knowledge of systems and installations of waste management
EU 3 - has skills of technological processes parameters determination

COURSE CONTENT

Form of classes - lectures	Hours
Introduction to waste management: definitions, classifications and legal aspects	2
Different types of wastes	2
Methods of waste collection	2
Initial methods of waste preparation before its treatment	2
Methods of waste treatment: composting, dry anaerobic digestion	2
Methods of waste utilization	2
Waste management plan: objectives, waste streams, concepts, targets, realization and management	2
Sewage sludge characterization	2
Sewage sludge conditioning	2
Sewage sludge thickening	2
Sewage sludge dewatering	2
Sewage sludge stabilization	2
Drying processes of sewage sludge	3
Sewage sludge thermal utilization processes	3
Form of classes - laboratory	**Hours**
Methods of waste and sludge analysis	2
Determination of water content, dry mass in waste and sludge	2
Physical and chemical characterization of solid organic waste	2
Biodegradability of solid organic waste	2
Toxicity tests	2
Composting: selection of substrates and bulking agents	2
Composting: pile design	2
Determination of capillary suction time	2
Sludge conditioning	2
Vacuum filtration	2

Pressure filtration	2
Centrifugation of sludge	2
Sludge properties	2
Thermal drying of sludge	2
The proximate and ultimate analyses of sludge	2

COURSE STUDY METHODS

1. blackboard, interactive whiteboard
2. multimedia presentation
3. laboratory activities

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

F1. - activity in classes
F2. - assessment of working in the group
S1. - test
S2. - assessment of laboratory exercises

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30 h
Participation in classes	- h
Laboratory	30 h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	2 h
Test	- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	- h
DIRECT TEACHING, hours/ ECTS	**62 h / 2,2 ECTS**

Preparation for tutorials	- h
Preparation for laboratories	15 h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	5 h
Participation in e-learning classes	20 h
Working on project	5 h
Preparation for tests	5 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**50 h / 1,8 ECTS**
TOTAL (hours)	**∑ 112h**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Spinosa L., Wastewater sludge: a global overview of the current status and future prospects, IWA Publishing 2007
Foladori P., Andreottola G., Ziglio G., Sludge Reduction Technologies in Wastewater Treatment Plants, IWA Publishing 2010
Pichtel J., Waste management practices: municipal, hazardous, and industrial, Taylor & Francis 2005
Lemann M. F., Waste Management; Peter Lang 2008
Actual standards in the range of subject
Wagner T.P., Sanford R., Environmental Science: Active Learning Laboratories and Applied Problem Sets. Wiley and Sons 2009
Epstein E., Industrial Composting: Environmental Engineering and Facilities Management. SRS Press Taylor and Francis Group 2011
Wolny L., Double agent method of sludge conditioning, Environmental Engineering IV, Taylor & Francis Group, London, 2013, 203 – 206
Wolny L., Dewatering of conditioned sludge in small wastewater treatment plants, Environment Protection Engineering, Vol. 41, nr 2, 2015, 99-105
William P.T.;Waste Treatment and Disposal, 2nd edition, Wiley 2005
Elsner A., Sewage Sludge: Treatment and Utilization of Sludge; The Drying of Sludge; Operation of Mechanical Sewage Plants; Sludge Treatment in the United States, 2017
Guangyin Z., Youcai Z., Pollution Control and Resource Recovery for Sewage Sludge, 2017

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

1. Lidia Wolny, lidia.wolny@pcz.pl

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

1. Krystyna Malińska, krystyna.malinska@pcz.pl
2. Jurand Bień, jurand.bien@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	K_W08, K_W09, K_U05	**C1**	L1 – L30	**1, 3**	**S1**
EU 2	K_U05, K_U10	**C1**	L1 – L30…	**1, 3**	**S1, F1, F2**
EU 3	K_U05, K_K01, K_K02	**C2**	LAB1 – LAB 30	**4**	**S2, F2**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Waste management in power industry** Gospodarka odpadami w obiektach energetycznych		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **obligatory for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **I**	Course language: **English**
Course type: **lecture, laboratory**	Number of hours: **30L, 30Lab**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. Knowledge transfer of waste management in energy sector
C.2. Skills in the range of basic parameters determination in waste management technological processes

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of mathematics
2. General knowledge of engineering processes in power industry
3. Skills of logic thinking
4. Manual skills during laboratory classes

SUBJECT EDUCATIONAL EFFECTS

EU 1 - Student has knowledge of waste generated in power sector
EU 2 - Student has knowledge of procedures and requirements in waste management
EU 3 - Student has knowledge of systems and installations of waste management
EU 4 - Student has skills of technological processes parameters determination

COURSE CONTENT

Form of classes - lectures	Hours
Steam electric power generation industry – an introduction	4
Waste source in steam electric power generation industry	2
Characterization of wastewater	2
Characterization of cooling water	2
Low-volume waste sources	4
Metal cleaning wastes	2
End-of-pipe treatment technologies	2
Solid–liquid separation technologies	4
Characterization of ash	2
Methods of ash utilisation	4
Hazardous waste management	2
Form of classes - laboratory	**Hours**
Introduction to laboratory set; safety issues	2
Local visit at the power industry facility	6
Preparation the permission to generate waste at the power facility	14
Determination of ash content	4
Determination of specific mineral content in ash	4

COURSE STUDY METHODS

1. blackboard, interactive whiteboard
2. multimedia presentation
3. e-learning platform
4. laboratory set and devices

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

F1. - assessment of individual preparation to classes
F2. - assessment of working in groups
S1. - test
S2. – assessment of laboratory report

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30 - h
Participation in classes	- h
Laboratory	30 - h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	- h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	- h
DIRECT TEACHING, hours/ ECTS	**60 h / 2 ECTS**
Preparation for tutorials	20 - h
Preparation for laboratories	25 - h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	15 - h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**60 h / 2 ECTS**
TOTAL (hours)	**∑ 120**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Lemann M. F.; Waste Management; Peter Lang 2008.
William P.T.;Waste Treatment and Disposal, 2nd edition, Wiley 2005.
Cheremisinoff N.P.; Handbook of Solid Waste Management and Waste Minimization Technologies, 2003
S. Anand Kumar Varma; Principles of Industrial Waste Management, 2017

Wang L.K, Yung-Tse Hung, Lo H.H, Yapijakis C; Waste Treatment in the Process Industries, 2005

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

1. Jurand Bien, jurand.bien@pcz.pl

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

1. Jurand Bien, jurand.bien@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	K_W08, K_W09 K_U03, K_U05 K_U10	**C.1**	W1 – W30	**1**	S1, F1, F2
EU 2	K_W08, K_W09 K_U03, K_U05 K_U10	**C.1**	W1 – W30	**1**	S1, F1, F2
EU 3	K_W08, K_W09 K_U03, K_U05 K_U10	**C.1**	W1 – W30	**1**	S1, F1, F2
EU 4	K_U10, K_K01, K_K02	**C.2**	L1 – L30	**2**	S2, F1, F2

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Course title: **Wastewater Treatment Processing Design - Project** Projektowanie procesów oczyszczania ścieków		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **second-cycle studies**	Education profile: **general academic**
Type of subject: **optional for Education in the area - Intelligent Energy for Environmental Protection**	Semester: **II**	Course language: **English**
Course type: **lecture, project**	Number of hours: **30L, 30P**	ECTS Credit points: **4**

SYLLABUS

COURSE OBJECTIVES

C.1. To provide the knowledge on the methodology of technological designing of wastewater treatment by activated sludge
C.2. To teach the students how to use computer software to design biological wastewater treatment plants

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basics of wastewater treatment technologies according to the I-st cycle (bachelor) degree
2. Basics of engineering calculations
3. To be able to use spreadsheet programs (Excel or other similar)

SUBJECT EDUCATIONAL EFFECTS

EU 1 - can, in accordance with the given specification design the process of wastewater treatment using the right method
EU 2 - can design wastewater treatment technologies using a computer program

COURSE CONTENT

Form of classes - lectures	**Hours**
Balancing quantity and quality of wastewater	4
Designing of wastewater treatment plant according to ATVA131P Method – theoretical basis of biological treatment with BNR and without BNR	25
Test	1
Form of classes - tutorials	**Hours**
Kliknij lub naciśnij tutaj, aby wprowadzić tekst.	0
Form of classes - laboratory	**Hours**
Kliknij lub naciśnij tutaj, aby wprowadzić tekst.	0
Form of classes - project	**Hours**
Project of wastewater treatment plant according to ATVA131P Method based on the given specification	29
Defense of project	1

COURSE STUDY METHODS

1. blackboard
2. multimedia presentation
3. Computer workstation

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

F1. - activity in classes
S1. – final test
S2. – defence of project

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	29 h
Participation in classes	- h
Laboratory	- h
Participation in project classes	29 h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	1 h
Entrance test for laboratory classes	- h
Project's defence	1 h
Exam	- h
Consultation hours	- h
DIRECT TEACHING, hours/ ECTS	**60 h / 2 ECTS**
Preparation for tutorials	- h
Preparation for laboratories	- h
Preparation for projects	15 h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	15 h
Preparation for tests	30 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	**60 h / 2 ECTS**
TOTAL (hours)	**∑ 120**
TOTAL ECTS	**4 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

ATV-DVWK-A 131 "Dimensioning of Single-Stage Activated Sludge Plants", Actual version
Wiśniowska E., COD Fractions in Supernatants and Leachates in WWTP, SSCHE 2014. 41st International Conference of Slovak Society of Chemical Engineering. Tatranske Matliare, Slovakia, May 26-30. Proceedings, 149-150 , 2014

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

1. Ewa Wiśniowska, ewa.wisniowska@pcz.pl

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

1. Ewa Wiśniowska, ewa.wisniowska@pcz.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	**K_W08, K_U05**	**C1**	Lectures	**1, 2**	**F1., S1.**
EU 2	**K_U01, K_U02, K_U05, K_U06, K_K01**	**C2**	Tutorials	**3**	**F1., S.2.**

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: https://is.pcz.pl/.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at https://is.pcz.pl/.
3. The information on course completion and grade is provided to students on the first class meeting.

Prorektor ds. nauczania
Prof. dr hab. inż. Tomasz Popławski

/podpisano elektronicznie/