



FACULTY OF ENVIRONMENTAL ENGINEERING (FEE)
LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

ERASMUS+ Courses Catalogue for the academic year 2021/22

Approved by:

DEAN OF THE FACULTY OF ENVIRONMENTAL PROTECTION ENGINEERING

Prof. Beata Kowalska, Ph.D, Eng.

DEPUTY DEAN FOR STUDENT AFFAIRS

Andrzej Raczkowski, Ph.D, Eng.

FEE ERASMUS+ COORDINATOR

Magdalena Lebiocka, Ph.D, Eng.



FACULTY OF ENVIRONMENTAL ENGINEERING

GENERAL RULES

- Total amount of ECTS credits chosen by student for each semester cannot exceed 33 ECTS.
- Learning Agreement changes made at the beginning of each semester should not exceed 10 ECTS credits.
- The "During the mobility" form must be delivered to the Coordinator no later than 14 days after the organizational meeting held at the faculty.
- The Faculty Coordinator must be informed about classes taken at other Faculties of LUT.
- Total amount of ECTS credits chosen by student from other Faculties of LUT cannot exceed 10 ECTS credits.
- When the number of students applying for a given course is less than specified in the offer, the faculty will have the right to cancel the course. In this case the student should amend his/her Learning Agreement.
- Student is obliged to attend classes.
- In exceptional cases, i.e. a pandemic due to sanitary restrictions, fieldwork will be held in the form of a seminar.



WINTER SEMESTER				
SUBJECT	CODE	ECTS	HOURS	PAGE
Air Pollution and Protection	I15	5	45	5
Basics of Structural Mechanics and Strength of Materials	I02	5	45	6
Characteristic of Water Supply and Wastewater Treatments Systems	I03	5	45	7
Computer Aided Designing – 2D vector graphics	I04	5	45	8
Computer Science II	I06	5	45	9
Energy Efficiency Technologies in Waste and Wastewater Management	I07	4	30	10
Energy-saving Buildings Environmental, Energetic, Architectural and Economical Aspects of Rising and Exploiting	I08	5	45	11
Environmental Law	I09	4	30	12
Indoor Air Quality	I23	5	45	13
Sustainable Development Course	I10	4	30	14
Sustainable Domestic Water Heating Systems	I11	4	30	15
Waste Management	I13	5	45	16
Wastewater Treatment	I14	4	30	17



SUMMER SEMESTER				
SUBJECT	CODE	ECTS	HOURS	PAGE
Basics of Environmental Chemical Analysis	I16	4	30	18
Basics of Structural Mechanics and Strength of Materials	I02	5	45	6
Computer Aided Designing – 3D vector graphics	I17	5	45	19
Energy-saving Buildings Environmental, Energetic, Architectural and Economical Aspects of Rising and Exploiting	I08	5	45	11
Environmental Law	I09	4	30	12
Environmental Biology	I18	4	30	20
Environmental Chemistry	I19	5	45	21
Fundamentals of Energy Conversion	I20	4	30	22
Modeling and Simulation of Photovoltaic Systems	I24	4	30	23
Modeling of Wastewater Treatment Systems	I25	5	45	24
Ventilation and Air Conditioning	I26	4	30	25
Wastewater Treatment	I14	4	30	17
Water Treatment for Industry	I27	5	45	26



FACULTY OF ENVIRONMENTAL ENGINEERING- LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Air Pollution and Protection – I15

FACULTY: Environmental Engineering	CLASS TYPE: lecture+seminars
NUMBER OF HOURS: 30+15	ECTS: 5
SEMESTER: winter	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	
LANGUAGE OF INSTRUCTION: English	
PRELIMINARY REQUIREMENTS: -	
CONTENTS: structure of the atmosphere, sources of major gaseous pollutants and their effects (environmental, economic and health), particulate matter in the atmosphere, odors, emission estimation from technical and combustion processes, the theory of dispersion of air pollution in the atmosphere, atmospheric stability classes, indoor air pollution and personal exposure to air pollution, air sampling and analysis, current standards and legislation	
EFFECTS OF EDUCATION PROCESS: The students gain general knowledge of the major sources of gaseous air pollutants, particulate matter and their health, environmental and economic effects. The students understand the techniques for measurement, data collection and analysis of chemicals and PM in air samples. The students can estimate emissions from industry and non-industry processes.	
LITERATURE (OPTIONAL): Lists of suitable books and papers will be provided in the lecture.	
TEACHING METHODS: multimedia lecture, class discussion, computational tasks, field trips	
ASSESSMENT METHODS: written test of knowledge seminars - student's presentation	
TEACHER (NAME, EMAIL CONTACT): Ph.D. Eng. Amelia Staszowska, a.staszowska@pollub.pl	



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Basics of Structural Mechanics and Strength of Materials – I02

FACULTY: Environmental Engineering	CLASS TYPE: lecture+seminar
NUMBER OF HOURS: 15+30	ECTS: 5
SEMESTER: winter/summer	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: Basics of physics and mathematics.
CONTENTS: Classical, Newtonian mechanics, laws of motion. External and internal forces, reaction forces. Beams, frames, trusses – determination of internal forces. Elements of strength of materials, geometry, cross-sections, moments of inertia. Stresses, normal and shear stresses. Deformations.
EFFECTS OF EDUCATION PROCESS: Ability to calculate reaction forces. Ability to determine internal forces in beams, frames and trusses. Ability to calculate normal and shear stresses in simple constructions. Ability to determine deformations of simple constructions.
LITERATURE (OPTIONAL):
TEACHING METHODS: Lectures with multimedia. Discussions. Solving practical tasks.
ASSESSMENT METHODS: Project of simple beam, frame and truss. Test of knowledge.
TEACHER (NAME, EMAIL CONTACT): Assoc. Prof , Ph.D. Eng. Zbigniew Suchorab, z.suchorab@pollub.pl



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Characteristic of Water Supply and Wastewater Treatments Systems – I03

FACULTY: Environmental Engineering	CLASS TYPE: lecture+field classes
NUMBER OF HOURS: 15+30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: Basic knowledge of chemistry and biology.
CONTENTS: Water cycle and resources of water. Water intake stations, pumping stations, water treatment stations, filters, water distribution systems and their control, sewage networks, sewage treatment plants, mechanical sewage treatment, biological sewage treatment, advanced nutrient removal, sludge management, sludge dewatering and drying.
EFFECTS OF EDUCATION PROCESS: General knowledge of functioning of water supply systems and sewage systems. Ability to recognize basic devices used in treatment processes and their functions.
LITERATURE (OPTIONAL): Handbook of Environmental Engineering Calculations by Ronald A.Walsh
TEACHING METHODS: multimedia lecture and field classes – several trips to water intake stations and wastewater treatment plant
ASSESSMENT METHODS: test of knowledge and students' written reports
TEACHER (NAME, EMAIL CONTACT): PhD. Eng. Agnieszka Żelazna, a.zelazna@pollub.pl Assoc. Prof., Ph.D. Eng. Grzegorz Łagód, g.lagod@wis.pol.lublin.pl,



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Computer Aided Designing – 2D vector graphics – I04

FACULTY: Environmental Engineering	CLASS TYPE: lecture + laboratory
NUMBER OF HOURS: 15+30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: Basic knowledge connected with 2D geometry, coordinate geometry, technical drawing and graphic documentation of engineering object.
CONTENTS: Computer Aided Designing, two dimensional vector graphics, technical drawing, drawing of environmental engineering devices by CAD tools, AutoCad, Autodesk Building System.
EFFECTS OF EDUCATION PROCESS: Knowledge about the basic and advanced functions of AutoCAD settings and options, ability of drawing of 2D engineering projects.
LITERATURE (OPTIONAL):
TEACHING METHODS: Lecture – multimedia presentations, examples of using following options for preparing technical documentation with vector graphics, laboratory – exercises with AutoCAD program using proper tools and settings for preparing technical documentation.
ASSESSMENT METHODS: Two tests of knowledge and abilities, first connected with basic settings, drawing and description of object, second with advanced settings, edition and preparation of engineering graphical documentation for printing.
TEACHER (NAME, EMAIL CONTACT): Ph.D. Eng. Grzegorz Łagód, g.lagod@pollub.pl, Ph.D. Eng. Zbigniew Suchorab, z.suchorab@pollub.pl



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Computer Science II - I06

FACULTY: Environmental Engineering	CLASS TYPE: lecture + laboratory
NUMBER OF HOURS: 15+30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: basic computer science course
CONTENTS: programming in C, main structure of a code, loops, arithmetic and logical operators, functions, variables, and prototypes, strings and arrays, pointers, input/output, character manipulation.
EFFECTS OF EDUCATION PROCESS: ability to program and execute a simple programs in C language, understanding of program syntax and main elements of language
LITERATURE (OPTIONAL): internet sources, manuals for C language, examples of code
TEACHING METHODS: lecture for theoretical information, laboratory for practical applications of gained knowledge
ASSESSMENT METHODS: 2 written tests, 2 demonstration programs written by each student, assessment of progress during laboratory exercises
TEACHER (NAME, EMAIL CONTACT): Assoc. Prof , Ph.D. Eng. Grzegorz Łagód, g.lagod@pollub.pl, Assoc. Prof , Ph.D. Eng. Zbigniew Suchorab, z.suchorab@pollub.pl



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Energy Efficiency technologies in waste and wastewater management – I07

FACULTY: Environmental Engineering	CLASS TYPE: lecture + field classes
NUMBER OF HOURS: 15+15	ECTS: 4
SEMESTER: winter	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: -
CONTENTS: : Solid waste types and composition. Classification of fuels. Waste to Energy Technology. Energy from Municipal Solid Waste. Utilization of Municipal Solid Waste. Waste water and sewage sludge management. Anaerobic digestion and co-digestion process. Sewage sludge utilization. Fuel from waste and wastewater treatment systems.
EFFECTS OF EDUCATION PROCESS: basic information about development of alternative fuels, new means of generating energy, energy efficiency technologies in waste and wastewater technologies.
LITERATURE (OPTIONAL): Shah, Kanti L., Basics of Solid & Hazardous Waste Management Technology, Printice Hall, 2000 Parker, Colin, & Roberts, Energy from Waste -An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985
TEACHING METHODS: multimedia presentation, discussion, field studies
ASSESSMENT METHODS: test of knowledge, student's written reports
TEACHER (NAME, EMAIL CONTACT): Ph.D. Eng. Magdalena Lebiocka, m.lebiocka@pollub.pl; Assoc. Prof , Ph.D.Eng. Grzegorz Łagód, g.lagod@pollub.pl



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Energy-saving Buildings Environmental, Energetic, Architectural and Economical Aspects of Rising and Exploiting- I08

FACULTY: Environmental Engineering	CLASS TYPE: lecture+seminar
NUMBER OF HOURS: 15+30	ECTS: 5
SEMESTER: winter/summer	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: Basic knowledge of buildings performance.
CONTENTS: Bases of building physics. Architecture of energy-saving and passive buildings. Evaluation of energy-safe and passive buildings parameters, evaluation of buildings energetic performance. Sanitary systems in energy-saving buildings. Application of renewable sources of energy in housing sector.
EFFECTS OF EDUCATION PROCESS: Ability to calculate heat parameters of the buildings. Ability to design energy-saving and passive houses. Ability to design sanitary systems in energy saving buildings. Ability to calculate energetic parameters of energy-saving buildings. Ability to calculate costs of exploitation of energy-saving buildings in comparison to the traditional houses. Ability to calculate influence of energy-saving buildings on environment in comparison to the traditional houses.
LITERATURE (OPTIONAL):
TEACHING METHODS: Lectures with multimedia. Discussions about problems of buildings performance in home countries of Erasmus students. Simplified designing of energy-safe buildings.
ASSESSMENT METHODS: Making a simplified project of energy-safe building together with calculation of energetic performance, exploitation costs and influence on environment.
TEACHER (NAME, EMAIL CONTACT): Ph.D. Eng. Zbigniew Suchorab, z.suchorab@wis.pollub.pl



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Environmental Law – I09

FACULTY: Environmental Engineering	CLASS TYPE: lecture+seminar
NUMBER OF HOURS: 15+15	ECTS: 4
SEMESTER: winter/summer	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: -
CONTENTS: Case study class led by USA specialist of environmental law and energy law. Elements of environmental law and energy law based on practical examples.
EFFECTS OF EDUCATION PROCESS: Basic knowledge about the regulations concerning environmental and energy issues.
LITERATURE (OPTIONAL): -
TEACHING METHODS: multimedia lecture, individual work with students on their reports
ASSESSMENT METHODS: written reports.
TEACHER (NAME, EMAIL CONTACT): visiting professor from USA



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Indoor Air Quality - I23

FACULTY: Environmental Engineering	CLASS TYPE: lecture+ laboratory
NUMBER OF HOURS: 30 +15	ECTS: 5
SEMESTER: summer	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	
LANGUAGE OF INSTRUCTION: English	
PRELIMINARY REQUIREMENTS: -	
CONTENTS: major classes of indoor air pollutants, suspended particulate matter, bioaerosols, molds, indoor dust as a sink for semi-volatile and nonvolatile compounds, health effects of personal exposure to indoor air pollution, Sick Building Syndrome, methods for improving indoor air quality: low emission building materials, air duct cleaning, photocatalysis, bioremediation, disinfection; air sampling and analysis, current standards and legislation	
EFFECTS OF EDUCATION PROCESS: The students gain general knowledge of the major sources of indoor air pollutants, particulate matter and their health effects. The students understand the techniques for measurement, data collection and analysis of chemicals and PM in air samples.	
LITERATURE (OPTIONAL): Lists of suitable books and papers will be provided in the lecture.	
TEACHING METHODS: multimedia lecture, class discussion,	
ASSESSMENT METHODS: written test of knowledge, seminars - student's presentation	
TEACHER (NAME, EMAIL CONTACT): Ph.D. Eng. Amelia Staszowska, a.staszowska@pollub.pl	



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Sustainable Development Course - I10

FACULTY: Environmental Engineering	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 4
SEMESTER: winter	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Basic knowledge from the field of protection of the environment.

CONTENTS: Background: the roads towards sustainability; Energy & climate: from fossil fuels to sustainable energy resources; Resources: Man and material flows; Urbanisation: cities and community development; Sustainable industrial production and consumption; Life, & food: sustainable agriculture, forestry and fishery; Mobility: towards sustainable transport; Welfare & lifestyle: social sustainability; Economics: the dilemma of economic growth; Politics: international cooperation for sustainable development, change & education.

EFFECTS OF EDUCATION PROCESS:
Studying sustainable development is a way to come to grips with questions concerning present and future situation of human societies. The course provides knowledge of basic issues connected with three pillars of sustainable development (ecological, economic and social). Important part is also learning of evaluation abilities concerning sustainable development issues.

LITERATURE (OPTIONAL):
Materials from the official website of the Baltic University: <http://www.balticuniv.uu.se/index.php/introduction/home>
L. Ryden, P. Migula, N. Andersson (ed.), *Environmental Science*, Uppsala Publishing House, Uppsala 2003.

TEACHING METHODS: lectures

ASSESSMENT METHODS: examination

TEACHER (NAME, EMAIL CONTACT): Prof. Ph.D., D.Sc. Artur Pawłowski, a.pawlowski@pollub.pl



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Sustainable domestic water heating systems I11

FACULTY: Environmental Engineering	CLASS TYPE: project
NUMBER OF HOURS: 30	ECTS: 4
SEMESTER: winter	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: technical design and drawings, basic knowledge on AutoCAD operating.
CONTENTS: Domestic hot water requirements, photothermal conversion of solar radiation, types of solar collectors – technology and principles of operation, water tanks dedicated for solar systems, solar control system, vapour compressor heat pumps, horizontal and vertical ground heat exchangers, technical drawing (AutoCAD).
EFFECTS OF EDUCATION PROCESS: General knowledge about the use of photothermal conversion of solar radiation for domestic hot water preparation. General knowledge about the application of heat pump for space heating and domestic hot water preparation. Ability to design simple system with solar collectors and heat pump for domestic hot water preparation.
LITERATURE (OPTIONAL):
TEACHING METHODS: multimedia presentation and student's own projects
ASSESSMENT METHODS: validation of projects
TEACHER (NAME, EMAIL CONTACT): Ph.D., Eng. Justyna Gołębiowska, j.golebiowska@pollub.pl



FACULTY OF ENVIRONMENTAL ENGINEERING- LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Waste Management – I13

FACULTY: Environmental Engineering	CLASS TYPE: lecture+seminar
NUMBER OF HOURS: 30+15	ECTS: 5
SEMESTER: winter	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS:

CONTENTS: Basic definitions, waste classification. Waste management strategies and waste utilization methods. No waste and low waste technologies. Waste minimization, material recycling, energy recovery. Waste deposition on landfills – localization, construction, management and reclamation of landfill. Thermal, chemical and biological methods of waste utilization. Thermal methods: incineration, pyrolysis, incineration in cement kilns. Biological methods: composting and methane digestions – basics of processes, installations. Chemical methods – selected processes for selected industrial wastes, no-waste technologies. Management of selected categories of wastes. Industrial and municipal wastes. Nuclear wastes.

EFFECTS OF EDUCATION PROCESS: Basic knowledge about waste management and effects of waste management strategies and utilization methods on the environment. Basic knowledge about thermal, chemical and biological methods of waste utilization. Knowledge about byproducts of various waste management methods and their influence on the environment. Detailed knowledge about the management of selected categories of wastes. The ability to assess waste management methods from the point of the influence on the environment, on the basis of the critical analysis of literature and available information. The awareness about extra-technical aspects and results of localization and building waste landfills and other installations for waste utilization.

LITERATURE (OPTIONAL): handouts plus recommended articles

TEACHING METHODS: lecture, individual work with students preparing their presentations

ASSESSMENT METHODS: lecture – two tests (midterm and final), seminar – students' presentation (oral supported by Power Point)

TEACHER (NAME, EMAIL CONTACT): Prof. Ph.D., D.Sc. Marzenna R. Dudzińska, m.dudzinska@pollub.pl



FACULTY OF ENVIRONMENTAL ENGINEERING- LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Wastewater Treatment – I14

FACULTY: Environmental Engineering	CLASS TYPE: lecture+seminar
NUMBER OF HOURS: 15+15	ECTS: 4
SEMESTER: winter/summer	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: -
CONTENTS: Wastewater classification from various points of view. Equipment of wastewater treatment plants. The technological lines of wastewater treatment and sludge disposal. Mechanical, chemical and biological stage of wastewater treatment. Pretreatment and primary stage of wastewater treatment - mechanical separators, sedimentation and flotation, settling tank. The secondary stage of wastewater treatment - activation and secondary settling tank, the basic parameters of activation, the types of aerobic bioreactors, nitrification and denitrification, phosphorus removal. Anaerobic processes - the types of anaerobic bioreactors. Treatment of sewage sludge.
EFFECTS OF EDUCATION PROCESS Knowledge about basic characteristics of wastewater, quality and quantity of wastewater, mechanical, biological and chemical ways of wastewater treatment .
LITERATURE (OPTIONAL): Wastewater treatment / edit. by David H. F. Liu, Béla G. Lipták., Wastewater treatment plant design ed/. by P. Aarne Vesilind [et al.]
TEACHING METHODS: multimedia presentation , class discussion
ASSESSMENT METHODS: test of knowledge and student’s written reports
TEACHER (NAME, EMAIL CONTACT): Ph.D., Eng. Magdalena Lebiocka, m.lebiocka@pollub.pl



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Basics of Environmental Chemical Analysis – I16

FACULTY: Environmental Engineering	CLASS TYPE: lecture+seminar
NUMBER OF HOURS: 15+15	ECTS: 4
SEMESTER: summer	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: Basics of chemistry and physics
CONTENTS: Basic concepts of novel instrumentation in the analysis of environmental contaminants. Their possibilities and limitations.
EFFECTS OF EDUCATION PROCESS: Knowledge on possibilities and limitations methods which can be used in environmental analysis.
LITERATURE (OPTIONAL): K. Danzer Analytical Chemistry – Theoretical and Metrological Fundamentals, Springer, 2007; F. Rouessac, A. Rouessac, Chemical Analysis - Modern Instrumentation Methods and Techniques, Wiley, 2007
TEACHING METHODS: lectures, demonstrations, discussions, solving real problems of environmental analysis
ASSESSMENT METHODS: demonstrations at the Laboratory of Environmental Analyses
TEACHER (NAME, EMAIL CONTACT): Assoc. Prof. Ph.D., D.Sc. Jacek Czerwiński, j.czerwinski@wis.pol.lublin.pl



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Computer Aided Designing – 3D vector graphics – I17

FACULTY: Environmental Engineering	CLASS TYPE: lecture+lab
NUMBER OF HOURS: 15+30	ECTS: 5
SEMESTER: summer	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: Basic knowledge on AutoCAD operating. Ability to work in 2D environment. Ability to use Cartesian and polar coordinates. Ability to draw and modify two-dimensional objects.
CONTENTS: Computer Aided Designing. Introduction to 3D Modeling environment of AutoCAD. Spherical and Cylindrical coordinates. User Coordinate System. Types of three-dimensional objects (wireframes, faces, solids). Solid primitives. Advanced solids. Edition of the 3D objects. Visual styles. Basics of Rendering. Drawing 3D models of the engineering objects.
EFFECTS OF EDUCATION PROCESS: Ability to use Spherical and Cylindrical coordinates. Ability to use User Coordinate Systems. Ability to draw particular types of 3D objects. Ability to draw and visualize 3D models of engineering objects.
LITERATURE (OPTIONAL): Suchorab Z., Łagód G., Computer Aided Designing – 3D Modeling of the Passive House, Monografie Komitetu Inżynierii Środowiska PAN vol. 111, 2013.
TEACHING METHODS: Visual presentation of working in AutoCAD 3D on projector. Working with students on their computers.
ASSESSMENT METHODS: Drawing an advanced model of engineering object. Showing the results in the form of vector graphics and in the form of the rendered rasters.
TEACHER (NAME, EMAIL CONTACT): Ph.D. Eng. Zbigniew Suchorab, z.suchorab@pollub.pl,



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Environmental Biology - I18

FACULTY: Environmental Engineering	CLASS TYPE: lecture+lab
NUMBER OF HOURS: 15+15	ECTS: 4
SEMESTER: summer	CLASS LEVEL: undergraduate/ master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: general knowledge about biology
CONTENTS: Biology, ecology, ecosystem, sustainability of ecosystems, biodiversity, microbial ecology, ecological biochemistry, soil microbiology, environmental factors influencing on population
EFFECTS OF EDUCATION PROCESS: comprehension of interspecies interactions in an environment and interactions between living organism and its environment, ability to identify indicator organisms and a source of pollution, ability to characterize a structure of community by biodiversity indexes
LITERATURE (OPTIONAL):
TEACHING METHODS: multimedia presentation, lecture, discussion, demonstrations
ASSESSMENT METHODS: test of knowledge, paper
TEACHER (NAME, EMAIL CONTACT): Ph.D. Mariola Chomczynska m.chomczynska@pollub.pl



FACULTY OF ENVIRONMENTAL ENGINEERING - LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Environmental Chemistry - I19

FACULTY: Environmental Engineering	CLASS TYPE: lecture+ seminars
NUMBER OF HOURS: 30+15	ECTS: 5
SEMESTER: summer	CLASS LEVEL: undergraduate/ master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS:
CONTENTS: Introduction to environmental chemistry. Technosphere. Chemistry of atmosphere - structure, sources of pollutant emissions, dispersion, transformations. Principles of photochemistry and environmental catalysis. Smog phenomena. Greenhouse effect. Acid rains. Ozone layer depletion. Water pollution. Water disinfection by-products. Soil pollution. Fundamentals of radiochemistry. Persistent organic pollutants and emerging environmental pollutants - occurrence, classification, removal and analysis. Health risk assessment.
EFFECTS OF EDUCATION PROCESS: : Students will gain knowledge about sources of pollutants in the environment, their transformation, health hazard and remediation techniques.
LITERATURE (OPTIONAL):): 1. Harrison R.M., <i>Principles of environmental chemistry</i> . 2. Manahan S., <i>Environmental chemistry</i> . Additional reading materials will be assigned before and/or after classes.
TEACHING METHODS: multimedia lectures, class discussion, computational tasks, field trips
ASSESSMENT METHODS: test of knowledge
TEACHER (NAME, EMAIL CONTACT): Ph.D. Eng. Amelia Staszowska, a.staszowska@pollub.pl



FACULTY OF ENVIRONMENTAL ENGINEERING – LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Fundamentals of Energy Conversion – I20

FACULTY: Environmental Engineering	CLASS TYPE: lecture+lab
NUMBER OF HOURS: 15+15	ECTS: 4
SEMESTER: summer	CLASS LEVEL: undergraduate/master

MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Basics of physics and chemistry

CONTENTS: Forms of energy. Photovoltaic, photothermal, photoelectrochemical conversion of solar radiation. Thermoelectric effects. Electrochemical conversion of energy.

EFFECTS OF EDUCATION PROCESS: Knowledge of physic phenomena occurring in solar cells, solar collectors, thermogenerators, electrochemical cells. Ability to measure experimentally characteristic parameters of energy conversion devices.

LITERATURE (OPTIONAL):

TEACHING METHODS: multimedia lecture, laboratory experiments

ASSESSMENT METHODS: test of knowledge and lab reports, grades on the basis of reports from particular exercises

TEACHER (NAME, EMAIL CONTACT): Assoc. Prof. Ph.D., D.Sc. Agata Zdyb, a.zdyb@pollub.pl



FACULTY OF ENVIRONMENTAL ENGINEERING – LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Modeling and Simulation of Photovoltaic Systems – I24

FACULTY: Environmental Engineering	CLASS TYPE: lecture+lab
NUMBER OF HOURS: 15+15	ECTS: 4
SEMESTER: summer	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: Basics of physics and computer programming
CONTENTS: design and optimization of photovoltaic systems, PV power output data analysis , energy calculations , simulation of solar cells and solar modules
EFFECTS OF EDUCATION PROCESS: physics of photovoltaics, programming skills in Matlab/Simulink environment, sizing of the photovoltaic system, analyze data of power and energy produced by the system, modeling of the I-V curve of the solar cells with use of one-diode and two-diode equivalent electrical circuit
LITERATURE (OPTIONAL): Antonio Luque and Steven Hegedus. Handbook of photovoltaic science and engineering. Wiley 2003
TEACHING METHODS: multimedia lecture, laboratories with use of Matlab/Simulink environment
ASSESSMENT METHODS: test of knowledge
TEACHER (NAME, EMAIL CONTACT): Ph.D. Slawomir Gulkowski, s.gulkowski@pollub.pl



FACULTY OF ENVIRONMENTAL ENGINEERING- LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Modeling of Wastewater Treatment Systems – I25

FACULTY: Environmental Engineering	CLASS TYPE: Lecture + Laboratory (with computers)
NUMBER OF HOURS: 15 + 30	ECTS: 5
SEMESTER: summer	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	
LANGUAGE OF INSTRUCTION: English	
PRELIMINARY REQUIREMENTS: Basic knowledge of wastewater treatment processes.	
CONTENTS: Basics of computer modelling, main models in wastewater treatment, use of modern modelling software package, application of selected dynamic models, interactive simulation as a tool to observe different relationships between key parameters in wastewater treatment processes, the effects of dynamic operation and control on the performance of wastewater treatment plants, simulation results analysis.	
EFFECTS OF EDUCATION PROCESS: knowledge on various processes used in modern wastewater treatment; ability to indicate relationships between key parameters in wastewater treatment processes; knowledge on basics of computer modeling; ability to use modern computer simulation program; ability to build wastewater treatment plant models; ability to simulate various configurations of the system modeled; ability to evaluate the performance of the system; ability to modify the key parameters to enhance the efficiency of the wastewater treatment plant	
LITERATURE (OPTIONAL):	
TEACHING METHODS: short lecture with multimedia presentation plus students' own work on set topics	
ASSESSMENT METHODS: test of issues raised during the lecture; written report on simulation task	
TEACHER (NAME, EMAIL CONTACT): Ph.D. Eng. Adam Piotrowicz, a.piotrowicz@pollub.pl	



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Ventilation and Air Conditioning - I26

FACULTY: Environmental Engineering	CLASS TYPE: lecture+ exercises
NUMBER OF HOURS: 15+15	ECTS: 4
SEMESTER: summer	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Basics of environmental engineering

CONTENTS: Thermal comfort in buildings. Internal and external air parameters calculations. Heat gains and losses. The quality of indoor air. The aerodynamics of air flows in rooms. Natural ventilation. Mechanical ventilation. Hybrid systems. Hydraulics in ventilation. Molier's graph and air parameters. Elements of ventilation systems.

EFFECTS OF EDUCATION PROCESS: Knowledge of systems and devices used in ventilation. Ability to calculate the basic air parameters. Basic knowledge of mechanical systems designing.

LITERATURE (OPTIONAL): Building Design and Construction Handbook by: Frederick S. Merritt, Jonathan T. Ricketts

TEACHING METHODS: : multimedia lecture, practical examples, calculation tasks

ASSESSMENT METHODS: test of knowledge, calculation task

TEACHER (NAME, EMAIL CONTACT): Ph.D. Eng. Agnieszka Żelazna, a.zelazna@pollub.pl



FACULTY OF ENVIRONMENTAL ENGINEERING- LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Water Treatment for Industry - I 27

FACULTY: Environmental Engineering	CLASS TYPE: lecture+project
NUMBER OF HOURS: 30+15	ECTS: 5
SEMESTER: winter/summer	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	
LANGUAGE OF INSTRUCTION: English	
PRELIMINARY REQUIREMENTS:	
CONTENTS: Water resources for industry. Technological concepts for industry water treatment. Best available techniques (BAT) for industry branches. Unit processes: preliminary screening, aeration, chemical pretreatment, coagulation, sedimentation, filtration, sorption, ion exchange, membrane processes, storage. Treatment systems of boiling and cooling water.	
EFFECTS OF EDUCATION PROCESS: Students will be given an overview of the water treatment technologies that are typically used in different industry branches and will learn how to design these systems.	
LITERATURE (OPTIONAL): Pal P., <i>Industrial water treatment process technology</i> . Additional reading materials will be assigned before and/or after classes.	
TEACHING METHODS: : multimedia lectures, computational tasks, field trips	
ASSESSMENT METHODS: lecture -written test of knowledge; project - technological calculation and description of water treatment technology	
TEACHER (NAME, EMAIL CONTACT): Ph.D. Eng. Amelia Staszowska, a.staszowska@pollub.pl	