The title of course	**Chemistry for Civil Engineering** **(no. 1**/I_21/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lecture, 15 h
Language of instruction	English
The number of ECTS	3
Teacher	Monika Basiura-Cembala, PhD
The aims of the course (maximum 500 characters)	The aim of the course is to provide the basic concept of chemistry and systematic information inevitable to students to grasp principles of chemical sciences and understand relationships between building materials properties and their chemical and mineralogical composition.
The content of the course: main topics and key ideas	Topics include: · Structure of atoms. Atomic nucleus; radioactivity, radon in buildings. Electron shell of atoms. Chemical bonds and intermolecular forces. · States of matter. Colloids. · Thermochemistry. Heat evolution in chemical reactions of building materials. · Chemistry of water and water solutions. · Chemistry of inorganic building materials. · Degradation of concrete and metals. Basics of electrochemistry. · Basics of polymer science.
Didactic methods	Multimedia presentation
Course requirements	Written exam
Literature (basic and supplementary)	*Basic:* 1. "Inorganic Chemistry" by Shriver & Atkins 2. "Physicaal chemistry" by Peter Atkins and Julio de Paula *Supplementary:* 1. "Cement and Concrete Chemistry" by Wieslaw Kurdowski

The effects of education - Knowledge - Skills - Social competences	*Knowledge:* · Understand the process of chemical bonding; · Identify the intramolecular forces that can exist between atoms within a chemical compound or molecule and the intermolecular forces that occur between molecules; · Describe and compare the properties of gases, liquids and solids; · Demonstrates knowledge of reaction energies, equilibrium, and Le Chatelier's principle as applied in chemical reactions · Understand the main reactions between the different cement minerals and water; *Skills:* · Solve quantitative problems (stoichiometric) involving chemical formulas and equations; *Social competences:* · The student understands the importance of chemistry as the integral part of society and environment.

The title of course	**Polymer Physics** **(no. 2**/I_21/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lecture, 15 h
Language of instruction	English
The number of ECTS	3
Teacher	Monika Basiura-Cembala, PhD
The aims of the course (maximum 500 characters)	The aims of this course are: · to provide introductory level of the theoretical foundations of structure-property relationships in solid polymers and polymer blends; · to provide explanations of how to extract microstructural information from x-ray diffraction /scattering data.
The content of the course: main topics and key ideas	This course introduces polymer physics and its applications in engineering. Topics include: · conformation and molecular dimensions of polymer chains in solutions, melts, blends, and block copolymers; · an examination of the structure of glassy, crystalline, and rubbery elastic states of polymers; · thermodynamics of polymer solutions, blends, crystallization and phase separation. · the course also addresses experimental methods for the study of structure via x-ray scattering methods as an integral component of polymer physics.
Didactic methods	Multimedia presentation
Course requirements	Seminar paper

Literature (basic and supplementary)	*Basic:* 1. "Polymer Physics" by Ulf Gedde 2. "Introduction to polymer physics" by David Bower *Supplementary:* 1. "The Physics of Polymers: Concept for Understanding Their Structures and Behavior" by Gert Strobl 2. "Methods of X-ray and Neutron Scattering in Polymer Science" by Ryong-Joon Roe
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* The student has general knowledge on macromolecular structure – polymer property relationship. *Skills:* The student analyzes x-ray diffractograms of different polymers *Social competences:* The student understands the impact of polymers on society.

The title of course	**X-ray Scattering Methods in Material Science** **(no. 3**/I_21/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lecture, 15h
Language of instruction	English
The number of ECTS	3
Teacher	Monika Basiura-Cembala, PhD
The aims of the course (maximum 500 characters)	This course explains x-ray diffraction and related phenomena in a context that leads to an understanding of how x-ray methods are presently being used at synchrotrons and x-ray tube sources to determine structural properties of materials.
The content of the course: main topics and key ideas	Topics include: · fundamentals of x-ray diffraction /scattering; · sources of X-rays; · single crystal and powder diffraction methods; · wide- and small angle x-rays scattering (WAXS/SAXS) methods; · scattering by non-crystalline solids; · common methods for microstructure analysis as quantification of texture, evaluation of internal stresses and strains and line profile analysis; · interpretation of the position of diffraction peaks and the diffracted intensity; · real and reciprocal space constructions of the conditions for diffraction;
Didactic methods	Multimedia presentation
Course requirements	Seminar paper

Literature (basic and supplementary)	*Basic:* 1. "X-Ray Diffraction Procedures: For Polycrystalline and Amorphous Materials" by Harold Klug and Leroy Alexander 2. Applications of Synchrotron Radiation to Materials Analysis" by H. Saisho and Y. Gohshi *Supplementary:* 1. "X-ray diffraction in crystals, imperfect crystals and amorphous bodies" by Andre Guinier 2. "Small angle scattering by X-rays" by Andre Guinier and Gerard Fournet
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* · The student has general knowledge about the different x-ray scattering techniques with focus on a chosen special application; · The student knows the differences between laboratory x-ray equipment and synchrotron sources; *Skills:* · The student presents and discuss results of measurements with laboratory equipment or from synchrotron experiments based on literature or own data. *Social competences:* · The student understands how X-rays affect the human body.

The title of course	**Clothing Technology** **(no. 4**/I_21/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lectures/ 15 hours
Language of instruction	English
The number of ECTS	3
Teacher	Monika Bogusławska-Bączek, PhD
The aims of the course (maximum 500 characters)	The aim of the course is to familiarize students with the construction of garments from the point of view of their technology as well as to familiarize with the technological and materials design and familiarization with the principles of technological methods and lines designing.
The content of the course: main topics and key ideas	Primary issues related to clothing technology. Designing sewing connections. Design of technologcal knots. Selection and optimization of process in clothing. Block design methods. Technological graphs in clothing technology. A chronological procedures and assemble process for selected garments. Apparel production systems.
Didactic methods	Lecture with multimedia presentation
Course requirements	written exam and multimedia presentation
Literature (basic and supplementary)	H. Eberle, H. Hermeling and more, "Clothing Technology - from fibre to fashion" Verlag Europa - Lehrmittel, 2002 Kapsali, Veronika and Dunamore, P. (2008) *Biomimetic principles in clothing technology.* In: Biologically Inspired Textiles. Woodhead Publishing in Textiles. Woodhead Publishing Limited, Boca Raton, FL, USA, ISBN 9781845692476 Fibres & Textiles in Eastern Europe Journal of Clothing Technology
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* - At the end of the learning process the student is able to describe the construction of garments from the point of view of production technology, describe the methods and techniques of

	process design in some article of clothing, demonstrate basic methods and techniques for the design of technological graphs of clothing. *Skills:* - At the end of the learning process the student is able to communicate using the techniques and symbols used in clothing technology , design and execute technology knots used in clothing, develop a mounting scheme for selected garments and perform on the basis the garment *Social competences:* - At the end of the learning process the student is able to correctly identify and resolve the dilemmas associated the clothing profession

The title of course	**Special Clothing** **(no. 5**/I_21/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lectures / 15 hours
Language of instruction	English
The number of ECTS	2
Teacher	Monika Rom, PhD
The aims of the course (maximum 500 characters)	The aim of the course is to acquaint the student with the assortment, application, structure, properties and technology of special clothing. The aim of the practical course is to develop by the student the documentation of project for the special kind of garment, taking into account the standards and regulations in the range the requirements of these garments.
The content of the course: main topics and key ideas	Assortments and classification of special clothing. Requirements and functional properties of special clothing depending on the purpose and function. Design features, materials technology and determining the functionality of special clothing. Special garments as personal protection. Hazard identification and determination of occupational risks for personal protection. Development of the art, material and technological project of selected special clothing, taking into account the standards and regulations in the range the requirements of this garment.
Didactic methods	Lecture with multimedia presentation
Course requirements	Written exam
Literature (basic and supplementary)	H. Eberle, H. Hermeling and more, "Clothing Technology - from fibre to fashion" Verlag Europa - Lehrmittel, 2002 R Scott , Textiles for Protection, 1st Edition, Woodhead Publishing, ISBN: 9781845690977, 2005 Wang & Gao Protective Clothing, Managing Thermal Stress, 1st Edition, 2014 Fibres & Textiles in Eastern Europe

	Journal of Clothing Technology
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* At the end of the learning process the student is able to: - present the classification of special clothing; - describe the special clothing requirements from the point of view of its purpose and function; - describe the basic properties for different types of special clothing. *Skills:* At the end of the learning process the student is able to: - carry out the selection of materials and accessories for the selected assortment of special clothing - identify requirements and occupational hazards for the selection of clothing - design and prepare documentation for special clothing *Social competences:* At the end of the learning process the student is able to interact and work in a group taking in the different roles.

The title of course	**Project of the Special Clothing (no. 6**/I_21/ **P** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/summer
The form of classes and number of hours	Project / 15 hours
Language of instruction	English
The number of ECTS	1
Teacher	Monika Rom, PhD
The aims of the course (maximum 500 characters)	The aim of the course is to acquaint the student with the assortment, application, structure, properties and technology of special clothing. The aim of the practical course is to develop by the student the documentation of project for the special kind of garment, taking into account the standards and regulations in the range the requirements of these garments.
The content of the course: main topics and key ideas	Assortments and classification of special clothing. Requirements and functional properties of special clothing depending on the purpose and function. Design features, materials technology and determining the functionality of special clothing. Special garments as personal protection. Hazard identification and determination of occupational risks for personal protection. Development of the art, material and technological project of selected special clothing, taking into account the standards and regulations in the range the requirements of this garment.
Didactic methods	Interactive classes, during which students with the teacher's help realize each stages of the project.
Course requirements	Evaluation of documentation realized in the writing form and as a multimedia presentation.
Literature (basic and supplementary)	H. Eberle, H. Hermeling and more, "Clothing Technology - from fibre to fashion" Verlag Europa – Lehrmittel, 2002 R Scott , Textiles for Protection, 1st Edition, Woodhead Publishing, ISBN: 9781845690977, 2005

	Wang & Gao Protective Clothing, Managing Thermal Stress, 1st Edition, 2014 Fibres & Textiles in Eastern Europe Journal of Clothing Technology
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* At the end of the learning process the student is able to: - describe the special clothing requirements from the point of view of its purpose and function; - describe the basic properties for different types of special clothing. *Skills:* At the end of the learning process the student is able to: - identify requirements and occupational hazards for the selection of clothing - design and prepare documentation for special clothing *Social competences:* At the end of the learning process the student is able to interact and work in a group taking in the different roles.

The title of the course	**Fibre science (lecture)** **(no. 7**/I_21/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lectures/ 15 hours
Language of instruction	English
The number of ECTS	3
Teacher	Assoc. Prof. Jan Broda
The aims of the course (maximum 500 characters)	The aim of the course of Fibre science is to familiarize students with the fundamental knowledge relating to fibres used in textile industry, especially methods of their obtaining, their structure, properties and application. The course of Fibre science provides essential base for other courses on textile engineering.
The content of the course: main topics and key ideas	Definition and classification of fibres. The molecular and supermolecular structure of fibres. Electrical and thermal properties of fibres. The mechanical properties of fibres – deformability and strength. Cotton – growth, degree of maturity, chemical composition, morphology and properties. Bast fibres (hemp, flax, jute) - stem structure, fibres properties and application. Animal fibres. Origins and morphology of wool. Properties and application of wool. Production, structure and properties of silk. Viscose fibres – structure, properties and application. Formation of synthetic fibres. Structure and properties of synthetic fibres.
Didactics methods	Lecture and multimedia presentation
Course requirements	Exam
Literature (basic and supplementary)	1. M. Lewin: Handbook of fiber chemistry 2. R. Mather, R.Wardman: The Chemistry of Textile Fibers RSC Pulishing 2011 3. R. Franck: Silk, mohair, cashmere and other luxury fibers, CRC Woodhead Publishing 2001
The effects of the education - knowledge - skills - social competences	Student is able: - to present the classification of fibres - to describes fibres structure and properties - to identify fibres - to track and understand the lecture

The title of the course	**Fibre science (laboratory)** **(no. 8**/I_21/ **L/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Laboratory/ 15 hours
Language of instruction	English
The number of ECTS	2
Teacher	Assoc. Prof. Jan Broda
The aims of the course (maximum 500 characters)	The aim of the course is to familiarize students with the fundamental knowledge relating to fibres used in textile industry and to acquire the skills to identify fibres. The course provides essential base for other courses on textile engineering.
The content of the course: main topics and key ideas	Cotton – morphology and chemical properties. Bast fibres (hemp, flax, jute). Animal fibres – wool, silk. Identification of natural fibres. Viscose fibres. Synthetic fibres – polyamide, polyester, polyacrylonitryle and polypropylene. Identification of synthetic fibres. Fibres orientation – birefringence.
Didactics methods	Laboratory
Course requirements	Test
Literature (basic and supplementary)	1. M. Lewin: Handbook of fiber chemistry 2. R. Mather, R.Wardman: The Chemistry of Textile Fibers RSC Pulishing 2011 3. R. Franck: Silk, mohair, cashmere and other luxury fibers, CRC Woodhead Publishing 2001
The effects of the education - knowledge - skills - social competences	Student is able: - to describes fibres properties - to identify fibres - to work in the group taking different roles

The title of the course	**High-performance fibres** **(no. 9**/I_21/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lectures/ 15 hours
Language of instruction	English
The number of ECTS	3
Teacher	Assoc. Prof. Jan Broda
The aims of the course (maximum 500 characters)	The aim of the course is to familiarize students with the structure and properties of high-performance fibres used in the production of technical and special purpose textiles.
The content of the course: main topics and key ideas	Modification of natural fibres. Bamboo fibres. Physical and chemical modification of man-made fibres. Micro and nanofibres – formation, properties and application. Special synthetic fibres: Kevlar and Lycra. Fibres from renewable raw materials – polylactide. Carbon fibres – formation, structure and properties. Glass and basalt fibres. Ceramic fibres. Conductive polymers and conductive fibres – polyaniline. Composite fibres.
Didactics methods	Lecture and multimedia presentation
Course requirements	Exam
Literature (basic and supplementary)	1. M. Lewin: Handbook of fiber chemistry 2. R. Mather, R. Wardman: The Chemistry of Textile Fibers RSC Pulishing 2011 3. J.W.S. Hearle: High Performance Fibres
The effects of the education - knowledge - skills - social competences	Student is able: - to present the classification of high-performance fibres - to describe production methods, structure and properties of high-performance fibres - to identify fibres - to track and understand the lecture

The title of course	**Biomimetics** **(no. 10**/I_21/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)/Postgraduate (MA) - all
Semester	Winter/Summer - both
The form of classes and number of hours	Lecture 15h
Language of instruction	English
The number of ECTS	3
Teacher	Monika Rom, PhD
The aims of the course (maximum 500 characters)	As the biomimetic refers to human-made processes, substances, devices, or systems that imitate nature, the aim of the course is to give the student the overview of the wide possibilities of applications of biomimetics in different sectors/industries such as chemistry, nanotechnology, the medical industry, the military and textile industry.
The content of the course: main topics and key ideas	1. The term of biomimetics and areas of applications 2. Biologic surfaces and functions 3. Self organization and hierarchical structures in nature, polymer and hybrid structures 4. Superhydrophobicity and self cleaning materials, including textiles 5. Adhesion and adhesive materials 6. Self-healing materials 7. Ultra-high tenacity materials and fibres 8. Isolation and protection from cold 9. Tissue engineering and synthetic muscles
Didactic methods	Lectures with presentations, discussion
Course requirements	Basic knowledge of chemistry
Literature (basic and supplementary)	Biomimicry: Innovation Inspired by Nature, Benyus Janine. New York, USA: William Morrow & Company;1997 Biomimetics: Biologically Inspired Technologies Yoseph Bar-Cohen CRC Press; 2005. Biomimetics: Nature-Based Innovation Yoseph Bar-Cohen, CRC, 2011
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* Students are able to study the state of the art on a selected biomimetic application and

	can explain the working principles and fabrication methods. *Skills:* Students can describe the principles of using biology to inspire designs as well as biological mechanisms as models for technology. They can explain how scientists are using experience from nature across many different fields of engineering. They are able to explore nature's solutions for analogous problems when solving an engineering problem. *Social competences:* Students are aware about the possibility of using more ecological systems.

The title of course	**Ceramic processes (lecture)** **(no. 11**/I_21/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lectures 15h
Language of instruction	English
The number of ECTS	2
Teacher	Monika Rom, PhD
The aims of the course (maximum 500 characters)	The aim of the course is to give to student the knowledge and experience on fabrication of ceramics for various application, from the beginning of the process, that is preparation of raw materials, up to finishing of ceramic goods.
The content of the course: main topics and key ideas	1. Raw materials and preparation of raw materials 2. Shaping/fabrication of ceramic materials 3. Drying of ceramics 4. Furnaces for ceramic processes 5. Sintering 6. Finishing of ceramic goods
Didactic methods	Lectures/tutoring with presentations, discussion
Course requirements	Basic knowledge of chemistry, Basic of ceramic materials
Literature (basic and supplementary)	Introduction to metal-ceramic technology, W. Patrick Naylor, 2009 Advanced Ceramic Technologies & Products, Springer 2012 Ceramic Technology and Processing: A Practical Working Guide (Materials and Processing Technology) Alan G. King, William Andrew Publishing, 2002
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* A student has a knowledge on processes used in the ceramic materials technology. Student knows the physical and chemical aspects of ceramic. A student has the knowledge on factors affecting application properties of the polycrystalline ceramics. *Skills:* A student has the skill to select a ceramic process which is the best one to obtain the established set of application properties of a ceramic material. *Social competences:*

	Student is able to gather the knowledge from different sources, such as literature, databases, and use it in the engineering practice.

The title of course	**Ceramic processes** **(no. 12**/I_21/ **L/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Summer
The form of classes and number of hours	laboratory 30h
Language of instruction	English
The number of ECTS	3
Teacher	Monika Rom, PhD
The aims of the course (maximum 500 characters)	The aim of the course is to give to student the knowledge and experience on fabrication of ceramics for various application, from the beginning of the process, that is preparation of raw materials, up to finishing of ceramic goods.
The content of the course: main topics and key ideas	Experimental: 1. Fabrication of gypsum mould 2. Rheological properties of ceramic slurries 3. Drying of ceramic mass 4. Formation of glass 5. Compactation of ceramic powders 6. Paricle size analysis of ceramic powders.
Didactic methods	Experimental laboratory course
Course requirements	Basic knowledge of chemistry, Basic of ceramic materials, Own protective glasses and apron
Literature (basic and supplementary)	Introduction to metal-ceramic technology, W.Patrick Naylor, 2009 Advanced Ceramic Technologies & Products, Springer 2012 Ceramic Technology and Processing: A Practical Working Guide (Materials and Processing Technology) Alan G. King, William Andrew Publishing, 2002
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* A student has a practical knowledge on processes used in the ceramic materials technology. Student knows the physical and chemical aspects of ceramic. A student has the knowledge on factors affecting application properties of the polycrystalline ceramics. *Skills:*

	A student has the skill to select a ceramic process which is the best one to obtain the established set of application properties of a ceramic material. *Social competences:* Student is able to gather the knowledge from different sources, such as literature, databases, and use it in the engineering practice.

The title of course	**Polymers (lecture)** **(no. 13**/I_21/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Summer
The form of classes and number of hours	Lectures 15h
Language of instruction	English
The number of ECTS	2
Teacher	Monika Rom, PhD
The aims of the course (maximum 500 characters)	The aim of the course is to give to students the knowledge regarding the most current studies in the area of polymer materials, synthesis, processing and application, base on the current papers from the high quality journals in the topic of polymer materials
The content of the course: main topics and key ideas	The monographic lecture will comprise the most recent information on synthesis, analysis and processing of polymer materials, based on current literature and databases.
Didactic methods	Lecture, discussion
Course requirements	Polymers, polymer processing, organic chemistry
Literature (basic and supplementary)	Papers from: Science direct journals, Springer journals, Taylor-Francis, Wiley and American Chemical Society collections
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* - Students have the knowledge on the current trends and achievements of material engineering in the area of polymer materials. *Skills:* - Can use scientific literature, data bases and the other sources to apply the results in engineering practice and innovative solutions. *Social competences:* - Students understand the results of engineering activity and the footprint of this activity on the environment.

The title of course	**Polymers (project)** **(no. 14**/I_21/ **P** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Summer
The form of classes and number of hours	Project 15h
Language of instruction	English
The number of ECTS	3
Teacher	Monika Rom, PhD
The aims of the course (maximum 500 characters)	The aim of the course is to give to students the knowledge regarding the most current studies in the area of polymer materials, synthesis, processing and application, base on the current papers from the high quality journals in the topic of polymer materials
The content of the course: main topics and key ideas	The project will consist of analysis of possible applications of polymers described in current literature on the polymers, based on processing and properties of described materials.
Didactic methods	case-studies, project
Course requirements	Polymers, polymer processing, organic chemistry
Literature (basic and supplementary)	Papers from: Science direct journals, Springer journals, Taylor-Francis, Wiley and American Chemical Society collections
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* - Students have the knowledge on the current trends and achievements of material engineering in the area of polymer materials. *Skills:* - Can use scientific literature, data bases and the other sources to apply the results in engineering practice and innovative solutions. *Social competences:* - Students understand the results of engineering activity and the footprint of this activity on the environment.

The title of course	**Organic Chemistry (laboratory)** **(no. 15**/I_21/ **L/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Winter/Summer
The form of classes and number of hours	Laboratory – 15 hours
Language of instruction	English
The number of ECTS	2
Teacher	Beata Fryczkowska, PhD
The aims of the course (maximum 500 characters)	Introduction to the safe and economical operation in the organic chemistry lab. Methods of describing and conducting chemical experiments, compilation of laboratory equipment. Become familiar with selected types of chemical reactions and the associated phenomena.
The content of the course: main topics and key ideas	Introduction to techniques for the purification and separation of organic compounds (crystallization, distillation, extraction). Esterification, condensation, addition, electrophilic substitution (substitution phenols) and nucleophilic (substitution alcohols), oxidation and reduction (Canizzaro reaction), diazotization and coupling reactions (synthesis of pigments) retrieving organic compounds and examining their physical characteristics.
Didactic methods	Carried out in the laboratory synthesis of selected organic compounds.
Course requirements	General chemistry
Literature (basic and supplementary)	Basic literature: – A. I. Vogel, *A Text-Book of Practical Organic Chemistry*
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* – use proper chemical reaction – define the purpose of the exercise *Skills:* – carry out chemical experiments in accordance with the safety rules – present the results of the experiment in the form of a report *Social competences:* – be aware of the risks associated with the use of organic compounds, the need for their responsible use

The title of course	**Design thinking** **(no. 16**/I_21/ **L/S/P** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Winter
The form of classes and number of hours	Lecture: 15 h + project: 15 h = 45 hours
Language of instruction	English
The number of ECTS	5
Teacher	Monika Rom
The aims of the course (maximum 500 characters)	Team creativity and innovative thinking are the driving forces and key elements that drive business success. The aim of the course is to stimulate creative thinking and to seek innovative solutions by students working in groups. The aim of the course is to prepare students for creative problem solving, to develop a culture of teamwork, to delegate tasks, to accept differences of opinion, to stimulate creative discussions and to present their solutions and product concepts in line with the idea of an elevator pitch.

The content of the course: main topics and key ideas	Topics include: Lecture: Creativity and innovation as the key drivers of success of leading companies- design thinking as product innovation. Culture of creative innovation. Change through the design thinking. Mental models of creativity. Methods, processes and stimulation of creative thinking. Prototyping. Design thinking in business. The concept of presentation of new ideas- rules of elevator pitch. Project: he project will consist of whole chain of elements used in design thinking such as: In-field observation; Constructive questions that help to deepen everyone's understanding; research and informal intercept interviews; Definition of the problem; Ideation, sharing ideas, collaboration; Prototyping, choosing, implementation and learning. Group will be divided into teams, each team will work on particular problem and innovation. Group will present their project according to roles of elevator pitch.
Didactic methods	Lecture, case-study, discussion, teamwork, brainstorm
Course requirements	English level B2
Literature (basic and supplementary)	*Basic:* 3. Robert A. Curedale, Design Thinking: process and methods manual. Design Community College Inc. (February 1, 2013) 4. Thomas Lockwood; Design Thinking: Integrating Innovation, Customer Experience, and Brand Value; Allworth Press; 1 edition; November 10, 2009 5. Tim Brown; Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation ; Harper Business (September 29, 2009) 6. Gavin Ambrose, Paul Harris; Basic design. Design thinking. AVA Publishing SA 2010

The effects of education - Knowledge - Skills - Social competences	*Knowledge:* - can give the examples of companies in which tailor-made design was an important factor in the success of the company. - has knowledge on prototyping and production techniques. - knows the rules for preparing a short presentation of a company / product according to the eleator pitch idea *Skills:* - has the ability to critically evaluate product customization to the needs of the ordering party - can ask questions to identify the problem and find an innovative solution - is able to select the materials suitable for the purpose of the end product and meet customer requirements *Social competences:* - recognizes the benefits of well-thought-out design and proper material management - he is aware of the impact of science and technology on the quality of the environment - he can take responsibility for teamwork, he can perform various roles in the design team - appreciates the importance of effective communication in teamwork

The title of the course	**Water and Wastewater Technology (lecture)** **(no. 17**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lectures: 15 h
Language of instruction	English
The number of ECTS	3
Teacher	Assoc. Prof. Bożena Mrowiec
The aims of the course (maximum 500 characters)	Students become familiar with the commonly applied processes (mechanical – physical treatment and chemical treatment) used for water and municipal wastewater treatment.
The content of the course: main topics and key ideas	**Lectures:** 1. Quality characteristics of surface and ground waters - 1h. 2. Basic indicators of water quality – national and EU requirements - 1h. 3. Surface water intake, sewage discharge systems to treatment plants - 1h. 4. Grates and bar screens. Removal processes of grains - grit chambers - 1h. 5. Theoretical principles of suspended solids sedimentation - depending on the hydraulic conditions - 1h. 6. Basic principles of settlers designing - 1h. 7. Coagulation of water and wastewater, processes of colloids destabilization, coagulants used - 2h. 8. Filtration processes and filter types; slow filters; rapid filters; fillings used in gravity and pressure filtration - 1h. 9. Preparation of cooling waters - removal of carbonate hardness, decarbonisation, corrosion, counteraction of the microorganisms growth – 1h. 10. Treatment of boiler feed water: chemical processes of water softening, process conditions, performance, reactions - 1h. 11. Softening and demineralization of water - ion exchange methods: properties of mass ion-exchange properties, effectiveness and process

	conditions, regeneration of ion exchangers, removal of CO_2 - 1h. 12. Methods of biological wastewater treatment – selected issues - 2h 13. Water and wastewater disinfection; chlorination; ozonation, UV rays - 1 h. 14. Summary, revision - 1h.
Didactics methods	Lecture: presentation
Course requirements	Lecture: Exam
Literature (basic and supplementary)	Lectures: 1. Jördening H.J. and Winter J.: Environmental Biotechnology. Concepts and Aplications. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2005. 2. N.F. Gray, Ph.D., Sc.D.An Introduction for Environmental Scientists and Engineers, 2010 Publisher's Note: Transferred to Taylor & Francis as of 2012 3. Water Supply. Alan C. Twort, BSc, FICE, FCIWEM, Don D. Ratnayaka, BSc, DIC, MSc, FIChem E, FCIWEM, and Malcolm J. Brandt, BSc, MICE, MCIWEM
The effects of the education - Knowledge - Skills - Social competences	*Knowledge:* - can describe and characterize the basic processes of water and wastewater treatment - can explain the design and operation of equipment used for water and wastewater treatment *Skills:* - can apply methods of natural water and wastewater treatment *Social competences:* - understand the importance of water and wastewater treatment

The title of the course	**Water and Wastewater Technology (laboratory classes)** **(no. 18**/I_22/ **L/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Laboratory classes: 15 h
Language of instruction	English
The number of ECTS	3
Teacher	Lucyna Przywara, PhD; Mariusz Kuglarz, PhD
The aims of the course (maximum 500 characters)	Students perform laboratory tests to characterize the quality of water and wastewater as well as evaluate the effectiveness of selected technologies on the basis of studies carried out on model stands.
The content of the course: main topics and key ideas	**Laboratories:** Introductory classes: health and safety rules, regulations in chemistry laboratory, first aid instructions, the scope and schedule of the course. 1h 1. Coagulation of water (part 1) - determination of optimum dosage of the coagulant and the flocculation time. After familiarizing with the water coagulation process, students determine practically the most appropriate dosage of coagulant ($FeCl_3$) and the flocculation time for established (assumed) - optimum pH of the reaction. Analysis of the results achieved - 3h. 2. Coagulation of water (part 2) - determination of the most appropriate pH value ensuring the effective coagulation process. Determination of the optimum pH value of the coagulation (specifically flocculation) based on physical and chemical analysis carried out for the raw and treated water with a given dose of ferric chloride - 3h. 3. Water Softening by means of phosphate method. The hardness of water and the disposal methods. Determination of reagent (sodium phosphate); the effect of temperature on the effectiveness of the process - based on physical and chemical analysis of the raw and treated water - 4h.

	4. Water degassing - de-oxidation by means of sodium sulfite. Introducing students with de-oxidation methods combined with practical eliminating of oxygen by means of chemical method (using sodium sulfite). Assessment of the process effectiveness as regard dosage (excess) used and the initial pH of water - 3h. Final assessment of laboratory classes - 1h.
Didactics methods	Laboratories: performing experiments
Course requirements	Laboratories: attendance, written reports based on knowledge (connected with particular experiments) and performed experiments
Literature (basic and supplementary)	Course materials provided.
The effects of the education - Knowledge - Skills - Social competences	*Knowledge:* - can explain the design and operation of equipment used for water and wastewater treatment - can justify the selection and calculation of parameters used in equipment for water treatment equipment *Skills:* - can conduct experiments in lab scale *Social competences:* - understand the importance of water and wastewater treatment - work independently and as a member of team on the specific research task

The title of the course	**Water and Wastewater Technology (project)** **(no. 19**/I_22/ **P** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Project: 15 h
Language of instruction	English
The number of ECTS	2
Teacher	Assoc. Prof. Bożena Mrowiec
The aims of the course (maximum 500 characters)	Students become familiar with the commonly applied processes (mechanical - physical treatment and chemical treatment) used for water and municipal wastewater treatment.
The content of the course: main topics and key ideas	**Project:** 1. Water coagulation - Determination of coagulants dosages and supporting substances based on water quality parameters (2h). 2. Removal of corrosive properties and stabilization of water after coagulation. Determination of calcium dosage binding aggressive carbon dioxide from the water – calculations based on monograms showing calcium carbonate balance in water (2h). 3. Equipment used for sedimentation. Designing of horizontal flow clarifier by means of method based on the surface of the settler and the length of the settler (3h). 4. Equipment used for sedimentation. Designing of vertical flow water clarifiers (2h). 5. Water filtration. Calculating gravity (rapid) filters (2h). 6. Sorption of micro-pollutants. Calculation of height and working time of sorption bed filters in a dynamic system (2h). 7. Credit course: calculation of reagent's dosages, designing of parameters (selected device) according to individual data (2h).
Didactics methods	Project: calculations, team work
Course requirements	Project: attendance, final report (based on calculations)

Literature (basic and supplementary)	1. Jördening H.J. and Winter J.: Environmental Biotechnology. Concepts and Aplications. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2005. 2. N.F. Gray, Ph.D., Sc.D.An Introduction for Environmental Scientists and Engineers, 2010 Publisher's Note: Transferred to Taylor & Francis as of 2012 3. Water Supply. Alan C. Twort, BSc, FICE, FCIWEM, Don D. Ratnayaka, BSc, DIC, MSc, FIChem E, FCIWEM, and Malcolm J. Brandt, BSc, MICE, MCIWEM
The effects of the education - Knowledge - Skills - Social competences	*Knowledge:* - can explain the design and operation of equipment used for water and wastewater treatment - can justify the selection and calculation of parameters used in equipment for water treatment equipment *Skills:* - can select and calculate the appropriate the parameters of water and wastewater treatment *Social competences:* - understand the importance of water and wastewater treatment

The title of course	**Biomass and Bioenergy Technologies (no. 20**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lectures/tutorials 15 hrs
Language of instruction	English
The number of ECTS	3
Teacher	Mariusz Kuglarz, PhD
The aims of the course (maximum 500 characters)	The course provides in-depth knowledge of biomass utilization for energy processes, including: fuel characterisation, treatement and conversion technologies. The course gives insight into different bioenergy technologies (systems), including biopower, biogas, bioethanol and their combinations, with consideration of process integration for energy and heat recovery.
The content of the course: main topics and key ideas	1. Biomass types and characteristics 2. Thermochemical conversion of biomass for energy application 3. Biochemical conversion of biomass for energy application 4. Techno-economic analysis of bioenergy systems 5. Innovative technologies, biorefinery systems.
Didactic methods	Lecture: presentation, seminar: student's presentation
Course requirements	Attendance, seminar with discussion
Literature (basic and supplementary)	Shibu Jose, Thallada Bhaskar. Biomass and Biofuels: Advanced Biorefineries for Sustainable Production and Distribution, 2015 by CRC Press Lijun Wang. Sustainable Bioenergy Production, 2014 by CRC Press. Sergio Capareda. Introduction to Biomass Energy Conversions, 2013 by CRC Press.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* - can describe and characterize the basic biomass types - can describe basic thermochemical and biochemical conversion routes *Skills:* - can explain the equipment design and process conditions of different biomass conversion routes

	- can analyze bioenergy systems as a whole chain from supply to end users, including technological, environmental, economic aspects. *Social competences:* - understand the importance of energy production from biomass - can work with cross-cutting problems related to bioenergy as a team member

The title of course	**Solid Wastes Management** **(no. 21**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engin Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
The level of studies	
Semester	Winter/Summer
The form of classes and number of hours	Lectures/seminars 15hrs
Language of instruction	English
The number of ECTS	3
Teacher	Mariusz Kuglarz, PhD
The aims of the course (maximum 500 characters)	Students become familiar with chosen aspects of solid (municipal and industrial) wastes utilization and management.
The content of the course: main topics and key ideas	1. Waste definition, general background, sources, quantities and composition. 2. Anaerobic digestion, anaerobic digestion of MSW, composting. 3. Incineration. 4. Reuse and recycling. Recycling technologies. 5. Landfill site design and management. 6. Industrial waste complex strategies. 7. Municipal Solid Waste strategies. 8. Solid Waste as a renewable source
Didactic methods	Lecture: presentation, seminar: student's presentation
Course requirements	Attendance, seminar with discussion
Literature (basic and supplementary)	John Pichtel. aste Management Practices: Municipal, Hazardous, and Industrial, Second Edition, 2014 by CRC Press. Jimmy Alexander Faria Albanese, M. Pilar Ruiz. Solid Waste as a Renewable Resource: Methodologies, 2015 by Apple Academic Press. Frank Kreith, George Tchobanoglous. Handbook of Solid Waste Management. 2002, Mc Graw –Hill.
The effects of education Knowledge Skills Social competences	*Knowledge:* - can describe and characterize the basic processes of solid wastes treatment - can describe relationships between inappropriate waste management s and impacts on environment *Skills:* - can explain the design of equipment used for solid wastes treatment - can select an appropriate method of solid wastes treatment *Social competences:* - understand the importance of wastes disposal and treatment

The title of course	**Environmental Chemistry (lecture)** **(no. 22**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer – both possible
The form of classes and number of hours	Lecture, 15 h
Language of instruction	English
The number of ECTS	2
Teacher	Mirosław Wyszomirski, Ph D
The aims of the course (maximum 500 characters)	You will study selected topics on the chemistry of the air, water, and soil, as well as the effects of anthropogenic activities on their chemistry. You will also learn about sustainability, organic pollutants and biofuels.
The content of the course: main topics and key ideas	✓ an introduction to the lithosphere and its erosion and pollution; ✓ the chemistry of the atmosphere and its pollution; ✓ the properties of natural waters and their pollution; ✓ organic chemicals and their environmental effects; ✓ biofuels – production, environmental impact.
Didactic methods	Oral lecture, discussion, student's presentation.
Course requirements	Basic general chemistry and physics
Literature (basic and supplementary)	1. Baird C., Cann M., *Environmental Chemistry,* 5th ed., W. H. Freeman and Company. 2. Mahahan S. E., *Fundamentals of Environmental and Toxicological Chemistry,* 4th ed, CRC Press.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* has ability to understand chemical transformations and mass transfer occurring in the environment. *Skills:* knows the methods and their extent to measure important environmental parameters. *Social competences:* can work and cooperate in a group during experimental activities.

The title of course	**Environmental Chemistry (laboratory) (no. 23**/I_22/ **L/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Summer
The form of classes and number of hours	lab experiments, 15 h
Language of instruction	English
The number of ECTS	2
Teacher	Mirosław Wyszomirski, PhD
The aims of the course (maximum 500 characters)	You will study selected topics on the chemistry of the air, water, and soil, as well as the effects of anthropogenic activities on their chemistry. You will also learn about sustainability and organic pollutants.
The content of the course: main topics and key ideas	✓ the chemistry of the atmosphere and its pollution; ✓ the properties of natural waters and their pollution; ✓ organic chemicals and their environmental effects;
Didactic methods	Lab experiments.
Course requirements	Basic general chemistry and physics
Literature (basic and supplementary)	Ibanez J. G. et al., *Environmental Chemistry Microscale Laboratory Experiments,* Springer. Gopalan R., Anand A., Sugumar R. W., *A Laboratory Manual for Environmental Chemistry*, IK International, 2008.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* has ability to understand chemical transformations and mass transfer occurring in the environment. *Skills:* knows the methods and their extent to measure important environmental parameters. *Social competences:* can work and cooperate in a group during experimental activities.

The title of course	**Organic Chemistry (lecture)** **(no. 24**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Summer
The form of classes and number of hours	Lecture, 15 h
Language of instruction	English
The number of ECTS	2
Teacher	Mirosław Wyszomirski, Ph D
The aims of the course (maximum 500 characters)	You will study selected topics on relations between electronic and atomistic structures of organic compounds and their properties. You will learn nomenclature of important organic compounds groups.
The content of the course: main topics and key ideas	✓ Electronic structure of organic compounds. ✓ Isomerism. ✓ Main functional groups. ✓ Types of reactions in organic chemistry. ✓ Important groups of organic compounds, nomenclature, synthesis, properties, their impact on the environment.
Didactic methods	Oral lecture, discussion, student's presentation.
Course requirements	Basic general chemistry
Literature (basic and supplementary)	1. Patrick G., *Instant Notes. Organic Chemistry,* BIOS Scientific Publishers, 2005. 2. Bruice P.Y., *Essential Organic Chemistry*, 2nd ed., Prentice Hall, 2010.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* ability in formulating and solving simple problems in organic part of environmental engineering, *Skills:* competence to acquire information from literature, data bases and other; to integrate and interpret it, *Social competences*: knowledge how to work individually and in a group over a specified problem.

The title of course	**Hydrobiology and water chemistry (no. 25**/I_22/ **L/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	laboratory exercises 15 h
Language of instruction	English
The number of ECTS	3
Teacher	Ewa Jachniak, PhD
The aims of the course (maximum 500 characters)	The cognition of plant and animal world of water ecosystem, knowledge of indicators organisms for polluted water and different trophy levels, importance of these organisms in nature and economy, the cognition of eutrophication problems in water ecosystems and acquisition of knowledge allowing for the protection of aquatic ecosystems.
The content of the course: main topics and key ideas	**The planktonic algae and the recognition of chosen phytoplankton species** (the microscopic observations of different groups of algae, the cognition of species creating water blooms, the realization of microscopic slides and schematic draws together with descriptions by students); **The using of algae as bioindicators and other maeaning of algae** (life meaning and using by people); **Waterweeds - the texture of cells and tissues, functions and adaptation** (the basic information and the realization of schematic draws of waterweeds (i. a. Elodea canadensis, Nymphaea alba, Lemna sp., Typha sp.) together with descriptions by students, the meaning and using of waterweeds, the using of waterweeds as bioindicators); **The review of bottom macroinvertebrate occuring in the streaming and stagnant water** (the anatomic and morfologic texture of bottom invertebrate animals, the using of invertebrate bottom animals as bioindicators, the evaluation of trophy state and quality of water ecosystems);

	The application biological methods in the evaluation of the purity of surface water (based on algae, waterweeds and bottom macroinvertebrate); **The methodology of taking samples of these water organisms and the methodology of carrying out of analyses** (equipment for collecting of the samples, quantitative and qualitative analyses); **The biotic and abiotic factors, which influence on a variability of abundance and biomass of water organisms** (biotic factors (i. a. competition, pathogens) and abiotic factors (i. a. the strength of irradiance, the temperature, the biogenic substances)).
Didactic methods	The self realization of fresh microscopic slides by students, using solid microscopic slides, the self realization schematic draws of microscopic slides together with descriptions by students, showing water organisms photos and pictures (algae, waterweeds, bottom macroinvertebrate), the interest of students in the broad subject area of the biology of water, by indicating its practical values for nature and people – based on lecture and presentation.
Course requirements	Attendance of the course, discussion with students, **the evaluation the** exercise reports given by students, the **estimation of qualification of conduction and evaluation the biological water analysis, by students.**
Literature (basic and supplementary)	The basic literature: • Cox E. J.: Identification of Freshwater Diatoms from Live Material. Chapman and Hall, London 1999 • Sigee D.C., Bellinger E.G.: Freshwater Algae:Identification, Enumeration and Use as Bioindicators (2nd Revised edition), 2015 the supplementing literature: • Sardet Ch.: Plankton : Wonders of the Drifting World, Chicago 2015 • Sommer U., Lampert W.: Limnoecology: The Ecology of Lakes and Streams (2nd Revised edition), 2007
The effects of education - Knowledge - Skills	The students can determine the water quality and trophy level by using water organisms. *Knowledge:*

- Social competences	- knowledge of indicators organisms for polluted water and different trophy levels, knowledge importance of these organisms in nature and economy, the cognition of eutrophication problems in water ecosystems and possibilities of the protection and decreasing trophy of water ecosystems; *Skills:* - the students are able to recognize water organisms and using their to evaluation of water quality (as bioindicators); *Social competences:* - the students are more aware of the protection our environment for better and healthier life, - the students acquire the skills to work in a group.

The title of course	**Devices and technologies for treatment of biogas (no. 26**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)/Postgraduate (MA)
Semester	Summer
The form of classes and number of hours	Lectures 15 h
Language of instruction	English
The number of ECTS	3
Teacher	Mariusz Kuglarz, PhD
The aims of the course (maximum 500 characters)	Students take a closer look at the treatment of biogases technologies. Will learn with the physical, chemical and biological processes occurring during treatment of biogases.
The content of the course: main topics and key ideas	Lectures: 1. Main problems of cleaning biogases – 2 h 2. Biochemical processes occurring during methane fermentation – 3h 3. Substances, which are useful for biogas production – 2h 4. Characteristic of landfill biogas – 2h 5. Characteristic of agricultural biogas – 2h 6. Technologies removal of sulphur compounds from biogases – 2h 7. Removal of carbon dioxide from biogases – 1h 8. Removal of ammonia from agriculture biogas – 1h
Didactic methods	Lecture: presentation
Course requirements	Lecture: exam, presentation
Literature (basic and supplementary)	1. L. Kohl, R. B. Nielsen. Gas purification. Elsevier 1997 2. T. Al Seadi, D. Ritz, H. Prassl, M. Kotner, T. Finsterwalder, S. Volk, R. Janssen. Biogas Handbook. Published by University of Southern Denmark Esbjerg. Denmark 2008 3. A. Schnurer, A. Jarvis. Microbiological Handbook for Biogas Plants. Malmo 2009 4. M. Paterson. V. Kuhn. Guide to Biogas. From production to use. Guzlow 2012
The effects of education - Knowledge	*Knowledge:*

- Skills - Social competences	- is able to describe and characterize the processes methane fermentation of organic matter, - can characterize the components of biogas plants, - can describe the types of contaminants occurring in various types of biogases. *Skills:* - can apply the method of purifying biogases, - can recognize differences in the technologies for producing and purifying biogases. *Social competences:* - understand the importance of purifying biogases before use.

The title of the course	**Hydrology** **(no. 27**/I_22/ **P** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Summer
The form of classes and number of hours	Project 15 h
Language of instruction	English
The number of ECTS	3
Teacher	Marek Madzia, PhD Ewa Suchanek, MSc
The aims of the course (maximum 500 characters)	The aim of the course is to familiarize with the issues and phenomena in the field of hydrology. Provide basic information about resources, circulation and water balance in nature. In addition, students will be familiarized with the calculation methods used to determine the parameters, hydrological characteristics and flow characteristics.
The content of the course: main topics and key ideas	Ist project: Calculation parameters of physiographic and geomorphological catchment area (6h): 1. appointment border catchment main stream 2. growth profile of the catchment area 3. calculation of catchment physiographic parameters (decrease catchment, the average decrease in slope) 4. the calculation of the average annual flow 5. hydrological profile of the average annual flow IInd project: Determination of flow curve in controlled cross-sectional (4h): 1. determination of flow curve by method divided trough 2. determination of flow curve by method averaged roughness coefficient
Didactics methods	Discussion of issues calculation in accordance with the theme of the exercise. Perform calculations by students in part with the help of an Excel spreadsheet and other instruments (AutoCAD, map measurer).
Course requirements	Credit with grade on the basis of assessment with the projects. On the assessment is also affected by systematic work, activity and attendance.

Literature (basic and supplementary)	1. Stream hydrology: an introduction for ecologists", Nancy D. Gordon, Thomas A. McMahon, Brian L. Finlayson 2. Environmental Management of Water Projects" eds. Edward O. Gangstad, Ronald A. Stanley
The effects of the education - Knowledge - Skills - Social competences	*Knowledge:* - understands the need for hydrological observations and presents the possibility of their use *Skills:* - knows how to draw a dividing line the catchment and its basic parameters - know how to determination of flow curve in controlled cross-sectional *Social competences:* - aware of the significance of the use and selection of appropriate calculation methods - can to work in a group by sharing various insights

The title of the course	**Water Management** **(no. 28**/I_22/ **P** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Summer
The form of classes and number of hours	Project 15 h
Language of instruction	English
The number of ECTS	3
Teacher	Marek Madzia, PhD Ewa Suchanek, MSc
The aims of the course (maximum 500 characters)	The aim of the course is to familiarize with the subject of an action in the field of water management and water conservation. Student gains knowledge in the range: determining disposable resources, water balance of economic, water management facilities, flood protection, legal conditions of water management. In addition, is an acquired practical skill preparing documentation (report on water and law matters).
The content of the course: main topics and key ideas	1. Purpose and scope of water use (1h). 2. The calculation of the guaranteed resources (determination of the catchment area, the profile increase the catchment area; transfer of daily flows from the catchment analog, calculation the guaranteed flows) (4h). 3. Determination of flow inviolable and determination of operating resources in cross water intake (2h). 4. Determination of the capacity of the surge tank (2h). Determine the effect of water management on the surface and determine the protective zones (1h)
Didactics methods	Discussion of issues calculation in accordance with the theme of the exercise. Perform calculations by students in part with the help of an Excel spreadsheet and other instruments (AutoCAD, map measurer).
Course requirements	Credit with grade on the basis of assessment with the project. On the assessment is also affected by systematic work, activity and attendance.
Literature (basic and supplementary)	1. Institutional Aspects of Water Management: Evaluating the Experience eds. Gamini Herath

	2. Water Management and Protection eds. Iwona Skoczko, Janina Piekutin, Łukasz Malinowski
The effects of the education - Knowledge - Skills - Social competences	*Knowledge:* - performs hydrological documentation (report on water and law matters) *Skills:* - uses techniques for determining flow: guaranteed, disposable and inviolable - explains the legal conditions of water management *Social competences:* - aware of the significance of the use and selection of appropriate calculation methods - can to work in a group by sharing various insights

The title of course	**Basic ecology** **(no. 29**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lectures/seminars 15hrs
Language of instruction	English
The number of ECTS	3
Teacher	Assoc. Prof. Damian Chmura
The aims of the course (maximum 500 characters)	Students become familiar with chosen aspects, aims and scope of modern ecology.
The content of the course: main topics and key ideas	Definition of ecology and its relationships with other biological sciences and nature conservation. Earth as environment of Earth: origin of universe, solar system and Earth. Forming of biosphere. Biogenesis and history of life on Earth, evolutionary ecology. Autecology: environmental factors, species niche, tolerance to environment. Functional groups of organisms, guilds. Population ecology: types and spatial structure of population, model of population growth. Ecosystems: abiotic and biotic elements of ecological systems at various levels of organization. Definition of biocenosis, community, association. Food webs and trophic pyramids. Biogeochemical cycles.
Didactic methods	Lecture: presentation, seminar: student's presentation
Course requirements	Attendance of the course, seminar with discussion
Literature (basic and supplementary)	Chapin III, F. S., Chapin, M. C., Matson, P. A., & Vitousek, P. (2011). *Principles of terrestrial ecosystem ecology*. Springer. Townsend, C. R., Begon, M., & Harper, J. L. (2003). *Essentials of ecology* (No. Ed. 2). Blackwell Science. Jørgensen, S. E. (Ed.). (2009). *Ecosystem ecology*. Academic press.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* Student understand relations between environmental factors and functioning of living organisms *Skills:* Students can indicate and analyze ecological processes. *Social competences:* Students are aware of environmental problems due to human activity

The title of course	**Community ecology** **(no. 30**/I_22/ **L/S/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	lecture/laboratory 15 hrs
Language of instruction	English
The number of ECTS	3
Teacher	Assoc. Prof. Damian Chmura
The aims of the course (maximum 500 characters)	The course provides essential knowledge about functioning of biocenoses and methods of their study
The content of the course: main topics and key ideas	Lectures: Introduction to term: ecosystem, biocoenosis, community, assemblage. Clement's concept of climax and Gleason's The Individualistic concept of the plant association. Continuum vs. discontinuum of communities. Structure of biocenoses. Patterns in biocoenoses, assembly rules. Niche model, neutral model and null model of a community. Positive and negative interactions in biocenoses. Dynamics of biocenoses. Types of biocenoses. Methods of study of biocenoses. Concept of phytosociology. Laboratories: performing of phytosociological relevés, data analysis of phytosociological data, performing of synoptic table.
Didactic methods	Lectures, laboratories: fieldwork and analysis of obtained data.
Course requirements	Attendance of course, written reports based on fieldwork and laboratory analysis.
Literature (basic and supplementary)	Schulze ED**.,** Beck E**,** Müller-Hohenstein K. 2005. *Plant Ecology*. Springer. Verhoef H., Morin P.J. 2010. *Community ecology*. Oxford University Press
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* Students understand basic terminology applied in community ecology. *Skills:* Student can perform phytosociological relevé in the field *Social competences:* They can cooperate in a group.

The title of course	**Biological conservation** **(no. 31**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	lecture/laboratory 15 hrs
Language of instruction	English
The number of ECTS	3
Teacher	Assoc. Prof. Damian Chmura
The aims of the course (maximum 500 characters)	The main goal of the course is to provide essential knowledge about types and tools of nature conservation and awareness of environmental problem due to human activity
The content of the course: main topics and key ideas	Relations between nature conservation, nature protection and ecology; History of nature conservation in the world; Motives of nature conservation; Types and directions of nature conservation; Global and European organisations, directives, conventions about nature conservation; Active vs. conservational protection; Protection in situ and ex situ; Strict and partial protection; The types of protection of species The types of area protection; Management of protection areas.
Didactic methods	Lectures
Course requirements	Attendance of the course and student's presentation
Literature (basic and supplementary)	Askins, R. A., Dreyer, G. D., Visgilio, G. R., & Whitelaw, D. M. (2008). *Saving biological diversity: balancing protection of endangered species and ecosystems* (Vol. 110). Springer.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* Students understand and can mention various types of nature conservation *Skills:* Students recognize some protected plants and animals in the place where they come from; *Social competences:* Student are aware of consequences of human impact on environment and understand needs of nature protection.

The title of course	**Land reclamation and restoration using biological methods** **(no. 32**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lecture/laboratory 15 hrs
Language of instruction	English
The number of ECTS	3
Teacher	Assoc. Prof. Damian Chmura
The aims of the course (maximum 500 characters)	Student become familiar with basics of restoration ecology and tools applied in rehabilitation of degraded ecosystems
The content of the course: main topics and key ideas	Introduction to restoration ecology; Concept of reclamation, reallocation, rehabilitation, bioremediation, revitalization and restoration; Successional theory and its applications for rehabilitation; The case study of post-coal mine subsidence reservoirs; The case study of open cast mines reservoirs; The case study of colliery waste tips.
Didactic methods	Lecture
Course requirements	Attendance of the course and presentation for specified topic concerning the topic of lecture.
Literature (basic and supplementary)	Kangas P.C. (2004) Ecological engineering. Principles and practice. Lewis Publishers. Walker L.R., Moral R. (2003) Primary succession and ecosystem rehabilitation. Cambridge University Press.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* Students can define types of ecosystem rehabilitation; *Skills:* Students are able to indicate proper land management aiming at biodiversity protection; *Social competences:* Students are aware of degradation of environment by humans and understand needs of their reclamation.

The title of course	**Biological invasions** **(no. 33**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	lecture/laboratory 15 hrs
Language of instruction	English
The number of ECTS	3
Teacher	Assoc. Prof. Damian Chmura
The aims of the course (maximum 500 characters)	Students become familiar with economical, ecological global problem with IAS invasive alien species
The content of the course: main topics and key ideas	Introduction to terminology of synanthropic species: alien, non-native, exotic, invasion, expansion, invasiveness and invasibility; History of concept of invasion, invasion vs. ecological explosion; Famous examples of invasion worldwide, classification of synanthropic plants and animal species. Causes and theories explaining success of alien invasive species: tens rule, residence time, lag-phase, empty niche hypothesis, novel weapon hypothesis, enemy release hypothesis, Darwin's naturalization hypothesis, evolution of increased competitive ability, competitive release hypothesis etc.; Economical problem of existence of IAS, Methods of control and eradication of IAS International regulations, programmes databases concerning IAS
Didactic methods	Lecture
Course requirements	Attendance of the course and presentation for specified topic concerning IAS
Literature (basic and supplementary)	Cadotte, M.W. et al. , eds (2006). Conceptual Ecology and Invasions Biology: Reciprocal Approaches to Nature, Springer. Handbook of Alien Species in Europe Foxcroft, L. C., Pyšek, P., Richardson, D. M., & Genovesi, P. 2013. Plant Invasions in Protected Areas.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* Students understand and recognize problem of biological invasions *Skills:* Students can mention harmful invasive species and threat which they can pose *Social competences:* Student are aware of danger of biological invasions and can share their knowledge with others.

The title of course	**Geobotanical cartography** **(no. 34**/I_22/ **L/S/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/summer
The form of classes and number of hours	lecture/laboratory 15 hrs
Language of instruction	English
The number of ECTS	3
Teacher	Assoc. Prof. Damian Chmura
The aims of the course (maximum 500 characters)	The main objective is to provide essential knowledge about principles and applications of cartography in nature conservation and botany
The content of the course: main topics and key ideas	Introduction to geobotany and nature conservation; The concept of environmental valorization and expertise; Introduction to mapping and cartography; Types of maps; Chorological and floristical maps; Phytosociological maps; Sozological maps; Ecological and applied ecological maps, Use of GIS for cartography
Didactic methods	Lecture, laboratory
Course requirements	Attendance of the course, student's presentation based on work during laboratories
Literature (basic and supplementary)	Gergel, S. E., & Turner, M. G. (Eds.). (2006). *Learning landscape ecology: a practical guide to concepts and techniques*. Springer Science & Business Media.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* Students can recognize and interpret various types of maps applied in nature conservation, *Skills:* Students can transform geobotanical data into maps, *Social competences:* Student can cooperate in a group.

The title of course	**Numerical ecology** **(no. 35**/I_22/ **L/S/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/summer
The form of classes and number of hours	Lectures/laboratories 15 hrs
Language of instruction	English
The number of ECTS	4
Teacher	Assoc. Prof. Damian Chmura
The aims of the course (maximum 500 characters)	Students learn multivariate analyses in community ecology, mainly applied in vegetation sciences. They become familiar with essential and key statistical tools using various software packages in R environment.
The content of the course: main topics and key ideas	Introduction to community ecology. Methods of classification and ordination of assemblages and communities. Cluster analysis: similarities and dissimilarities (Euclidean, Bray-Curtis, Jaccard, Kulczynski, Ruzicki, Manhattan, methods of grouping (UPGM, Ward). Gradient analysis: Indirect ordination (principal correspondence analysis PCA, principal coordinates analysis PCOA, non metric multidimensional scalling NMDS, (detrended) correspondence analysis DCA). Direct ordination (vectors fitting onto ordination, constrained correspondence analysis CCA, redundancy analysis RDA). The three table methods: RLQ, double CCA. Ordination with two species matrices: cocorrespondence analysis Co-Ca. Biodiversity: alpha and betadiversity. Species richness, Shannon-Wiener, Simpson, Pielou's evenness.
Didactic methods	Lectures, computer laboratories
Course requirements	Attendance of the course
Literature (basic and supplementary)	Borcard, D., Gillet, F., & Legendre, P. (2011). *Numerical ecology with R*. Springer. Wildi, O. (2013). *Data analysis in vegetation ecology*. John Wiley & Sons.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* Students understand quantitative and statistical approach in study of communities. *Skills:* They are capable to adopt statistical tools in problem solution. *Social competences:* Students can work in a group and share their ideas.

The title of course	**Data analysis and visualization in R (no. 36**/I_22/ **L/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/summer
The form of classes and number of hours	laboratories 15 hrs
Language of instruction	English
The number of ECTS	4
Teacher	Assoc. Prof. Damian Chmura
The aims of the course (maximum 500 characters)	Students become familiar with basic statistical methods and visualisation of data using R language and environment.
The content of the course: main topics and key ideas	Introduction to R: history, installation, help pages, forums. Data import, Structure of data in R: vectors, arrays, lists, data frames; Simple calculations, distribution f variables, random number generator; Data analysis: Tests for one sample, Tests for two samples (Student's tests, Mann-Whitney, Wilcoxon paired test), Tests for more samples (ANOVA, Kruskal-Wallis tests, post-hoc tests); Normality tests, tests of variance homogenization; Contingency tables; Correlation tests, regression; Multivariate analysis, cluster analysis, principal components analysis. Data visualization: Histogram, pie plots, barplots, box and whisker plots, scatter plots.
Didactic methods	Computer laboratories
Course requirements	Attendance, written reports based on performed analyses
Literature (basic and supplementary)	*Using R for Data Analysis and Graphics - An introduction"* J.H. Maindonald; *R for beginners"* E. Paradis; *„SimpleR - Using R for Introductory Statistics"* J. Verzani
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* Students understand basic tools in data analysis *Skills:* Student can apply statistical methods to solve problem with data using available software in R *Social competences:* Students work independently and in a group on the specific research task.

The title of course	**Applied ecology** **(no. 37**/I_22/ **L/S/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Winter/summer
The form of classes and number of hours	Lectures/laboratories: 15 hours
Language of instruction	English
The number of ECTS	4
Teacher	Assoc. Prof. Damian Chmura
The aims of the course (maximum 500 characters)	Students become familiar with chosen aspects, aims and scope of applied ecology.
The content of the course: main topics and key ideas	Topics include: Introduction to the task of applied ecology. The relationship with other branch of science. Applied ecology vs. biological conservation Agro-ecosystem management Biodiversity conservation and conservation biology Biotechnology Ecosystem restoration and restoration ecology Habitat and protected areas management Invasive species management Application of dendrometry and phytoindication using Ellenberg indicator plant values.
Didactic methods	Lecture with multimedia presentation, Laboratory - interactive classes, during which students according to the instructions and with teacher perform exercises.
Course requirements	Attendance and presentation prepared by students based on their calculations
Literature (basic and supplementary)	McPherson, G. R., & DeStefano, S. (2003). *Applied ecology and natural resource management*. Cambridge University Press. Papers from: Science direct journals, Springer journals, Taylor-Francis, Elsevier journals.
The effects of education - Knowledge - Skills - Social competences	Knowledge: Students have basic knowledge about processes and phenomena in environment and how to interpret them. Skills: They can apply selected methods in dendrometry and phytoindication of environment properties. Social competences: They are aware of the usefulness of modern ecology in the nature

	conservation and monitoring of environment.

The title of course	**Fiber plants** **(no. 38**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Winter/summer
The form of classes and number of hours	Lectures: 15 hours
Language of instruction	English
The number of ECTS	4
Teacher	Assoc. Prof. Damian Chmura
The aims of the course (maximum 500 characters)	The goal of the course is to familiarize students with history of fiber crops use, biology and ecology of plants used for fibre.
The content of the course: main topics and key ideas	Topics include: The origin of agriculture: various hypotheses. Centers of origin for domestication of plants. The review of fiber plants: Bast fiber (stem-skin fibers) *Stipa* sp, *Corchorius* sp, *Linum* sp. Leaf fibers, *Musa* sp., *Agave* sp. Seed fibers and fruit fibers, *Cocos* sp., *Sansevieria trifasciata, Asclepias* sp. Other fibers: *Bambusa* sp.
Didactic methods	Lecture with multimedia presentation
Course requirements	Attendance and presentation prepared by students
Literature (basic and supplementary)	Fiber plants 2016. K.G. Ramawat, M.R. Ahuja (Eds.) Economic botany. Fibres, rubber, firewood, timber and bamboo. 2007. Balakrishna Gowda Fiber Plants of Africa and their Usage. 2010. Takane Tsutomu et al. Japan Association for International Collaboration of Agriculture and Forestry
The effects of education - Knowledge - Skills - Social competences	Knowledge: Students know what type of fibres can be obtained from plants. They can classify fiber plants based on type of fibre. Skills: Students are capable to mention and recognize selected fiber plants Social competences: Students are aware of importance of nature protection of fiber crops from economic point of view.

The title of course	**Anthropology and human ecology (no. 39**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Winter/summer
The form of classes and number of hours	Lectures: 15 hours
Language of instruction	English
The number of ECTS	4
Teacher	Assoc. Prof. Damian Chmura
The aims of the course (maximum 500 characters)	The goal of the course is to familiarize students with
The content of the course: main topics and key ideas	Topics include: The basic concepts, relationship of human ecology to the other scientific branches. The theories about origin of humans. Systematics of *Hominoidea*. Ecological niche of *Homo sapiens.* Evolutionary mechanisms of human adaptation. Genes and memes. Self-regulation of human population. Environmental problems of human demography. Demographic explosion. Social-cultural-economic aftermath of demography. Anthropogeography and environmental physiology. Biocultural adaptations to various geoclimatic conditions: arctic areas, mountains, dry areas, grassland areas, humid forests. Development of civilization. Past and contemporary threats to humans.
Didactic methods	Lecture with multimedia presentation
Course requirements	Attendance and presentation prepared by students
Literature (basic and supplementary)	Papers from Journal Citation Reports e.g. Human Ecology by Springer
The effects of education - Knowledge - Skills - Social competences	Knowledge: Students have the knowledge about contemporary trends in anthropology and origin of humans. Skills: They can use scientific literature and find information about specific topic Social competences: They are aware of the relationships between humans and the environment.

The title of course	**Ecological ethics** **(no. 40**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Winter/Summer
The form of classes and number of hours	Lecture: 15 h
Language of instruction	English
The number of ECTS	2
Teacher	Anna Salachna
The aims of the course (maximum 500 characters)	The main goals of the course is to provide the student with basic knowledge of ecological ethics - discipline in philosophy that investigated the moral relationships of humans with the natural environment. Environmental ethics believe that humans are a part of society as well as other living organisms, like plants animals and microorganisms. These items are functional unity - global ecosystem.
The content of the course: main topics and key ideas	Topics include: - Ecology as the basis of the philosophical and ethical system - Man and his relationship to nature - The impact of man on the biosphere. Social reactions to environmental hazards - Is the development of civilization according to the current model possible? - Philosophy of animal rights - Deep ecology - Direction of ecological ethic: anthropocentric, biocentric, ecocentric - Which ecological ethics does modern civilization needs?
Didactic methods	speech, discussion, seminar
Course requirements	-

Literature (basic and supplementary)	*Basic:* 1. Curry P.2006. *Ecological Ethics: An Introduction*. Cambridge, UK: Polity Press. *Supplementary:* 1. Rolston H. 1998. *Environmental Ethics*. Temple University Press, Philadelphia 2. Wilson, E.O., 1992. *The Diversity of Life*, Cambridge, MA: Harvard University Press.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* - Student knows values and directions of ecological ethics *Skills:* - Student can identify international environmental legislation which based on the rules of ecological ethics *Social competences:* - Student is aware of responsibility for the state of the natural environment

The title of course	**Biology** **(no. 41**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Summer
The form of classes and number of hours	Lecture: 15 h
Language of instruction	English
The number of ECTS	2
Teacher	Ewa Jachniak, PhD
The aims of the course (maximum 500 characters)	The cognition of plant and animal world of each ecosystem (land, water and soil ecosystem), importance of these organisms in nature and economy, knowledge of general biological processes occurring in the environment.
The content of the course: main topics and key ideas	Chemical structure of the different organisms (DNA, protein, lipids and sugars). Cell and tissue construction of the different organisms (cell organelles, animal and plant tissues). Nutrition of organisms (division into autotrophic and heterotrophic organisms). Breathing of organisms (aerobic and anaerobic breathing). Plant countries on the globe (f. e. australian country). Animal countries on the globe (oriental country). Characteristics of the individual groups of organisms (bacteria; thallophyte: algae, fungi, lichens; plants; animals).
Didactic methods	Multimedia presentation
Course requirements	Attendance of the course, exam.
Literature (basic and supplementary)	The basic literature: • Noguchi, T., Kawano, S., Tsukaya, H., Matsunaga, S., Sakai, A., Karahara, I., Hayashi, Y. Atlas of Plant Cell Structure, Springer Japan 2014, • Tyagi M.P., Bhatia K.N. Trueman's Elementary Biology - Vol. 1 Trueman Book Company, 2014, the supplementing literature: • Wayne R. Plant Cell Biology 1st Edition. From Astronomy to Zoology. Academic Press, Ithaca, NY, USA, 2009.

The effects of education - Knowledge - Skills - Social competences	Knowledge: - the students can define and explain the basic biological concepts - they have knowledge about different biological processes - they have knowledge about different plant and animals countries on the globe Skills: - the students are able to recognize individual groups of organisms Social competences: - the students are more aware of the protection our environment and living organisms (mainly plants and animals) for better and healthier life,

The title of course	**Biology** **(no. 42**/I_22/ **L/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Summer
The form of classes and number of hours	laboratory exercises: 15 h
Language of instruction	English
The number of ECTS	3
Teacher	Ewa Jachniak, PhD
The aims of the course (maximum 500 characters)	The cognition chemical structure of the different organisms and their cell and tissue construction.
The content of the course: main topics and key ideas	Microscopic observations of the cell organelles (f. e. plastids). Microscopic observations of the tissues (plant tissues and animal tissues). Microscopic observations of the thallophyte: algae, fungi, lichens. Microscopic observations of the plants: bryophytes and ferns (sporangia and leaves and leaflets). Microscopic observations of the plants leaves (stomatal apparatus, leaves tails, internal construction of the leaves). Microscopic observations of the plants stalks and roots (internal construction). Microscopic observations of the plants flowers and fruits (internal and external construction).
Didactic methods	The realization of fresh microscopic slides and schematic draws together with descriptions by students), using solid microscopic slides, the interest of students in the broad subject area of the biology by indicating its practical values for nature and people – based on laboratory exercises.
Course requirements	Attendance of the course, the evaluation the exercise reports given by students, work with microscope, work in groups.
Literature (basic and supplementary)	The basic literature: • Noguchi, T., Kawano, S., Tsukaya, H., Matsunaga, S., Sakai, A., Karahara, I., Hayashi, Y. Atlas of Plant Cell Structure, Springer Japan 2014, • Tyagi M.P., Bhatia K.N. Trueman's Elementary Biology - Vol. 1 Trueman Book Company, 2014.

	The supplementing literature: • Wayne R. Plant Cell Biology 1st Edition. From Astronomy to Zoology. Academic Press, Ithaca, NY, USA, 2009.
The effects of education - Knowledge - Skills - Social competences	Knowledge: - the students can define the basic cell organelles and tissues - they have knowledge about different groups of organisms Skills: - the students are able to recognize cell organelles and tissues of the plants and animals - the students are able to recognize individual groups of organisms Social competences: - the students are more aware of the protection our environment and living organisms (mainly plants and animals) for better and healthier life, - the students acquire the skills to work in a group. - the students acquire the skills to work with microscope.

The title of course	**The basics of sustainability (no. 43**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Summer
The form of classes and number of hours	Lecture: 15 h
Language of instruction	English
The number of ECTS	2
Teacher	Ewa Jachniak, PhD
The aims of the course (maximum 500 characters)	The cognition the principles of the planning economic and social development with including environmental protection and equal treatment of these elements, the cognition EU and national documents developed in municipalities and at the voivodeship level, cognition the plans of the sustainable development in individual regions (f. e. tourism, transport, architecture).
The content of the course: main topics and key ideas	The sustainable development and its goals and rules. The planning documents at the municipality and voivodeship level (f. e. Energy plans, Ecological education programs). The metrics of prosperity (f. e. HDI, LQI). The public consultation (deliberative probe, civic budget and other different methods). The sustainable tourism (greenways, ecomuseums). The sustainable architecture, transport and the use of natural resources (f. e. green roofs). Innovation in sustainable development. Ecological innovation: green building, ecological packaging.
Didactic methods	Multimedia presentation, the interest of students in the broad subject area of the sustainable development (f. e. sustainable tourism, green building), based on presentation and discussion.
Course requirements	Attendance of the course, exam.
Literature (basic and supplementary)	The basic literature: • Strange T., Bayley A. Sustainable Development. Linking Economy, Society, Environment, OECD Insights, 2008,

	• Rowe G., L.J. Frewer L.J. Public Participation Methods: A framework for evaluation. Science, Technology and Human Values, 25 (1), 2000. the supplementing literature: • Kiper T. Role of Ecotourism in Sustainable Development. Advances in Landscape Architecture, InTech, 2013.
The effects of education - Knowledge - Skills - Social competences	Knowledge: - the students can define and explain the principles of the sustainable development; - they have knowledge about different methods of the public consultations and economy in individual regions and municipalities. Skills: - the students can develop different documents at the municipalities and the voivodeship level, f. e. strategies for the development and tourism development of the individual municipality and region of the voivodeship, - the students know the different methods of the public consultations and metrics of prosperity. Social competences: - the students are more aware of the protection our environment for better and healthier life and they can join it with economy, - the students acquire the skills to work in a group.

The title of course	**The basics of sustainability** **(no. 44**/I_22/ **L/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Summer
The form of classes and number of hours	Exercise: 15 h
Language of instruction	English
The number of ECTS	2
Teacher	Ewa Jachniak, PhD
The aims of the course (maximum 500 characters)	The cognition the sustainability indicators (f. e. unemployment, migration, health care, safety), the cognition strategies for the development of a individual municipality, region of a voivodeship, cognition the plans of the spatial development and different actions of the ecological education.
The content of the course: main topics and key ideas	Sustainability indicators (indicators of the unemployment, migration,entrepreneurship). Strategies of the Europe's development (Europe 2020 strategy). Strategies for the development of a individual municipality, region of a voivodeship. Ecological education (different actions and workshop, foundations). SWOT analysis, Gantt graph. Plans of the spatial development. Plans of the recreation and tourism development of a individual cities and regions.
Didactic methods	Multimedia presentation, work in team, the interest of students in the broad subject area of the sustainable development, by indicating its practical values for nature, people and economy – based on presentation and discussion.
Course requirements	Attendance of the course, the evaluation the exercise reports given by students.
Literature (basic and supplementary)	The basic literature: • Borys T., Sustainability indicators. Economy and Environment, Białystok 1999. the supplementing literature: • Dalal-Clayton B. and Bass S. Sustainable development strategies. Earthscan Publications Ltd, London, 2002,

	• Smith. G. A., Williams D.R. Ecological education in action. On Weaving Education, Culture, and the Environment. New York Press. Albany, 1999.
The effects of education - Knowledge - Skills - Social competences	Knowledge: - the students can define and explain the sustainability indicators; - they have knowledge about different methods of the ecological education, Skills: - the students can develop different documents at the municipalities and the voivodeship level, f. e. strategies for the development and plans of the spatial development, - the students know the different methods of the ecological education. Social competences: - the students are more aware of the protection our environment for better and healthier life and they can join it with economy, - the students acquire the skills to work in a group.

The title of course	**Civilizations and Inventions (no. 45**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate, graduate
Semester	Winter/Summer
The form of classes and number of hours	Lecture: 15 h
Language of instruction	English
The number of ECTS	2
Teacher	Miroslaw Wyszomirski, PhD
The aims of the course (maximum 500 characters)	History of technology and engineering inventions in wide civilizational context
The content of the course: main topics and key ideas	The lecture details some of most important inventions that changed the world and more. What sets the included innovations apart and makes them noteworthy are the implications of their creation on cultures throughout the world. In order to make new inventions in communication, transportation, energy, building, medicine, military, technology, observation and measurement, and agriculture you need to know discoveries of the past in civilizational perspective.
Didactic methods	Oral lecture, discussion, student's presentation
Course requirements	No requirements
Literature (basic and supplementary)	1. Roger Smith ed., *Inventions and* Inventors, Salem Press, 2002 2. Robert Curley ed., *The Britannica guide to inventions that changed the modern world*, Britannica Educational Publishing, 2010.
The effects of education - Knowledge - Skills - Social competences	Knowledge: knows dependence between civilization (culture) and technology (innovation). Skills: competence to acquire information from literature, data bases and others, how to integrate and interpret it. Social competences: knowledge how to work individually and in a group over a specified problem.

The title of course	**Green infrastructure** **(no. 46**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Winter/summer
The form of classes and number of hours	Lectures 15 hrs
Language of instruction	English
The number of ECTS	4
Teacher	Assoc. Prof. Damian Chmura
The aims of the course (maximum 500 characters)	The main goal is to familiarize with concept of green and blue infrastructure
The content of the course: main topics and key ideas	The history of the concept of green infrastructure. Ecology of the city, anthropocenosis, urban heat island, human-made changes in ecosystems, threat to biodiversity in urban conditions, degeneration of the abiotic environment in cities. Types of urban greenery (areas designed and natural), examples. Ecosystem services of green areas in cities. Elements of green infrastructure and other forms of nature protection. Legislation and financing of the European Union (structural and cohesion funds, common agricultural policy, LIFE program and green infrastructure).
Didactic methods	Lecture with multimedia presentation
Course requirements	Attendance and presentation prepared by students
Literature (basic and supplementary)	Foster J. et al. (2011). The value of green infrastructure for urban climate adaptation. *Center for Clean Air Policy*, 750, 1-52. Tzoulas K. et al. (2007). Promoting ecosystem and human health in urban areas using Green Infrastructure: A literature review. *Landscape and urban planning*, *81*(3), 167-178.
The effects of education - Knowledge - Skills - Social competences	Students have the knowledge about contemporary trends in spatial and urban planning They can use scientific literature and find information about specific topic They are aware of the significance of ecosystem services in urban space

The title of course	**Nanotechnology in Environmental Engineering** **(no. 47**/I_22/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lectures 5 hrs/seminars classes 10 hrs = 15 hrs
Language of instruction	English
The number of ECTS	3
Teacher	Anna Rabajczyk, Assoc. Prof.
The aims of the course (maximum 500 characters)	The course provides in-depth knowledge of nanotechnology used in water and wastewater treatment processes, soils and remediation processes as well as threats resulting from the growing number of nanocompounds in the environment. The course gives insight into basic nanotechnologies using in environmental engineering, including the nanobiotechnology.
The content of the course: main topics and key ideas	6. Nanomaterials in the environment - benefits and risks. 7. Nanotechnology in building construction . 8. Nanotechnology in air protection. 9. Application of nanomaterials in the protection of waters and soils. 10. Nanobiotechnology.
Didactic methods	Lecture: presentation, seminar: discussion, problem tasks, work with text, case study; group work, individual work student's presentation
Course requirements	Attendance, project work, final exam

Literature (basic and supplementary)	Sung Hee Joo**, Applying Nanotechnology for Environmental Sustainability, Advances in Environmental Engineering and Green Technologies.** IGI Global**, 2016.** Mark R. Wiesner, Jean-Yves Bottero, Environmental Nanotechnology: Applications and Impacts of Nanomaterials, McGraw-Hill Education, 2017. Selected Articles in Journal: Nanotechnology for Environmental Engineering
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* - can describe and characterize the connections between nanotechnology and environment - can describe basic technological processes based on nanotechnology in environmental engineering *Skills:* - can explain the equipment design and process conditions of different environmental engineering - can assess the techniques and research tools of nanotechnology appropriately to the environmental problem *Social competences:* - understand the importance of nanotechnology in environmental engineering - can work with cross-cutting problems related to nanotechnology in environmental engineering as a team member

The title of course	**Migration of pollutants in the environment** **(no. 48**/I_22/ **L/S/P** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Project, Lectures/ 15 hrs
Language of instruction	English
The number of ECTS	4
Teacher	Anna Rabajczyk, Assoc. Prof.
The aims of the course (maximum 500 characters)	The course provides in-depth knowledge of modeling of transformation processes, behavior and toxicity as well as migration of pollutants in the environment. The course gives insight into international cooperation in the field of pollutants migration of in the environment and monitoring programs (eg. EMEP, GAW/WMO).
The content of the course: main topics and key ideas	1. Pollutants in the environment - behavior and toxicity. 2. Knowledges of kinetics of chemical, photochemical and biochemical reactions (air, water, soil). 3. Advective and diffusive transport. 4. Predicting air pollution caused by vehicle traffic vehicles. 5. Modeling of transformation processes (calculation, programs).
Didactic methods	Lecture: presentation, project: discussion, problem tasks, work with text, case study; group work, individual work student's presentation of project
Course requirements	Attendance, project work, final exam

Literature (basic and supplementary)	D.Petruzzelli, F.G. Helfferich, 1993, Migration and Fate of Pollutants in Soils and Subsoils, Springer-Verlag. D.P.Tripathy, B.B.Dhar, 2002, Environmental Pollution Reasearch, APH Publishing Corporation S.M.Shafi,2005, Environmental Pollution, Atlantic Publishers & Dist Hemond H.F., 2014, Chemical Fate and Transport in the Environment, Academic Press Articles relating to the migration of pollutants in water, soil and air
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* - can describe and characterize the basic ways of the migration of pollutants in surface waters and air - can explains the migration patterns of pollutants in the different parts of environment - can apply mathematical formulas to describe the transport of pollutants under environmental conditions *Skills:* - can prepare predictions of the fate of selected pollutants of environment - can design assessments of the impact of transport emissions on the state of air pollution in cities *Social competences:* - understand the importance of modelling of pollutants in environment - can work with cross-cutting problems related to migration modelling in environment as a team member

The title of course	**Highway Engineering (lacture)** **(no. 49**/I_24/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Winter
The form of classes and number of hours	Lecture 15 h
Language of instruction	English
The number of ECTS	1
Teacher	Anna Żak, Ph D
The aims of the course (maximum 500 characters)	The basic knowledge of road designing, construction and maintenance with elements of traffic engineering.
The content of the course: main topics and key ideas	Road categories and technical classes. Typical cross-sections for rural and urban roads. Design speed. Vehicles and road users. Horizontal and vertical alignment. Types of road drainage. Culverts. Soils. Earthwork. Road pavement. Intersections and interchanges. Traffic engineering. Streets. Pedestrians and sidewalks. Cyclist and bike path. Parking facilities. Mass transport in urban areas.
Didactic methods	Multimedia presentation
Course requirements	Geotechnics, Building materials, Hydrology
Literature (basic and supplementary)	- P. Right, R. Paquette: „Highway engineering", 1987 John Wiley & Sons Inc. - R. Baker: „Handbook of highway engineering". 1975 Van Nostrand Reinhold Comp.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* - The basic knowledge of road geometry designing; - Ability to describe the road structures, drainage elements and technical equipment of roads. *Skills:* Selecting the technical solutions for roads and streets. *Social competences:* Is responsible for results of his own works and decisions.

The title of course	**Highway Engineering (exercises)** **(no. 50**/I_24/ **L/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Winter
The form of classes and number of hours	Exercises 15 h
Language of instruction	English
The number of ECTS	1
Teacher	Anna Żak, PhD
The aims of the course (maximum 500 characters)	The basic knowledge of capacity
The content of the course: main topics and key ideas	Calculations of road capacity
Didactic methods	Classes with students
Course requirements	Traffic engineering
Literature (basic and supplementary)	P. Right, R. Paquette: „Highway engineering", 1987 John Wiley & Sons Inc.
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* The basic knowledge of road capacity. *Skills:* Making the basic calculations of road capacity. *Social competences:* Is responsible for results of his own works and decisions.

The title of course	**Foundations (Lectures)** **(no. 51**/I_24/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Engineer (BSc), Undergraduate (BA),
Semester	Summer
The form of classes and number of hours	Lectures: 15 hours
Language of instruction	English
The number of ECTS	2
Teacher	Assoc. Prof. Jacek Pieczyrak/Assoc. Prof. Giang Nguyen
The aims of the course (maximum 500 characters)	The aim of the course is to acquire basic skills in the fields: developing the concept of foundation of structure, depending on structure and ground conditions, theoretical modeling and dimensioning of foundation structures.
The content of the course: main topics and key ideas	Foundations classification. Foundations design. Pad foundation (types, bearing capacity calculation, checking the stability of the foundation, settlement determination, dimensioning). Strip footings (types, methods of loads calculations, bearing capacity and settlement check, dimensioning). Combined footings. Raft foundation (slabs with basement walls). Dewatering of subsoil and excavation. Pile foundations (classification, pile types, bearing capacity and settlement check). Well foundations. Caissons.
Didactic methods	Multimedia presentations and illustrative material.
Course requirements	Final written exam
Literature (basic and supplementary)	Basic literature: 1) BRAJA M. DAS, 2011. *Principles of foundation engineering*. 8th edi. Boston: Cengage Learning. 946 p. ISBN-13: 978-1-305-08155-0. 2) Donald P. Coduto, 2001. *Foundation design. Principles and practices*. New Jersay: Prentice-Hall. Inc. 883 p. ISBN: 0-13-589706-8. Supplementary literature: Journals, Standards related to Geotechnical Engineering. Literature from Internet: e. g. http://www.geotechlinks.com/
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* - Student has knowledge on foundation classification, basics of foundation design and spread foundation execution;

	- Student has knowledge on subsoil and foundation improvement as so as subsoil and excavation dewatering methods; - Student has knowledge on basics of design and execution of deep foundations. *Skills:* - Student can choose proper type of spread foundation; check standard conditions of bearing capacity and settlement for basic types of spread foundations (pad footings, strip footings) and also design them; - Student can choose proper method of subsoil or excavation dewatering. *Social competences:* - Student is aware of the responsibility for decisions related to the choice of the type of foundation and dewatering, as well as calculations performed in the field of geotechnics.

The title of course	**Soil Mechanics (Lectures)** **(no. 52**/I_24/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Engineer (BSc), Undergraduate (BA),
Semester	Winter
The form of classes and number of hours	Lectures: 15 hours
Language of instruction	English
The number of ECTS	2
Teacher	Assoc. Prof. Jacek Pieczyrak/Assoc. Prof. Giang Nguyen
The aims of the course (maximum 500 characters)	The aim of course is to familiarize students with soil, its origin, properties as so as physical laws soil subjects to. The result is that students obtain knowledge on this material, gain ability to design structures foundation correctly.
The content of the course: main topics and key ideas	Soil and its origin. Composition and structure of soil. Soil classification. Physical and mechanical properties of soil. Mohr-Coulomb failure criteria. Water in soil and phenomena associated with it. State of stress and strain in soil environment. Boussinesq problem. Spread load: a method of center points (Polszyn, Newmark), a method of corner points (Steinbrenner). Subsoil and stress in the subsoil at different stages of construction. Subsoil bearing capacity and deformability (subsoil load-deformation dependence). Uniform subsoil: critical and limit load. Layered subsoil (method of substitute foundation and Madej method). Subsoil deformation (stress method). Requirements for geotechnical documentation.
Didactic methods	Multimedia presentations and illustrative material; chalk and board.
Course requirements	Final written exam
Literature (basic and supplementary)	Basic literature: CRAIG, R. F. 1992. *Soil Mechanics*. 5th edi. London: Chapman & Hall. 427 p. ISBN 0-412-39590-8. Supplementary literature: Journals, Standards related to Geotechnical Engineering. Literature from Internet: e.g. http://www.geotechlinks.com/
The effects of education	*Knowledge:*

- Knowledge - Skills - Social competences	- Student has knowledge on soil classification based on its particle size distribution and further properties; - Student has knowledge on evaluation of subsoil bearing capacity and deformation; - Student has knowledge on clarification of tasks related to soil. *Skills:* - Student can found information from literature and databases in English; *Social competences:* - Student can track the course of conducted classes; - Student has proactive approach in carrying out delegated tasks; - Student is aware of the responsibility for teamwork.

The title of course	**Soil Mechanics (Laboratory exercises) (no. 53**/I_24/ **L/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Engineer (BSc), Undergraduate (BA),
Semester	Winter
The form of classes and number of hours	Laboratory exercises: 15 hours
Language of instruction	English
The number of ECTS	2
Teacher	Assoc. Prof. Jacek Pieczyrak/Assoc. Prof. Giang Nguyen
The aims of the course (maximum 500 characters)	The aim of course is to familiarize students with soil and its properties. The result is that students obtain knowledge on this material.
The content of the course: main topics and key ideas	Structure and classification of soil. Macroscopic analysis. Sieve test and hydrometer test. Measurement of liquid limit and plastic limit. Measurement of maximum and minimum density. Oedometer test. Direct shear test and triaxial test. Proctor test.
Didactic methods	Practical exercises carried out by students.
Course requirements	Class attendance and test from carried out practical exercises.
Literature (basic and supplementary)	JOHN T. GERMAINE, AMY V. GERMAINECRAIG. 2009. *Geotechnical laboratory measurements for engineers*. 1st edi. Hoboken: John Wiley & Sons. 351 p. ISBN 978-0-470-15093-1. Supplementary literature: Journals, Standards related to Geotechnical Engineering. Literature from Internet: e.g. http://www.geotechlinks.com/
The effects of education - Knowledge - Skills - Social competences	*Knowledge:* - Student has knowledge on soil classification based on its particle size distribution and further properties; - Student has knowledge on clarification of tasks related to soil. *Skills:* - Student can carry out basic geotechnical tests of soil; - Student can found information from literature and databases in English; - Student can draw conclusions from tests results.

	Social competences: - Student can track the course of conducted classes; - Student has proactive approach in carrying out delegated tasks; - Student is aware of the responsibility for teamwork.

The title of course	**Introduction of Quality** **(no. 54**/I_24/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Engineer (BSc)
Semester	Summer
The form of classes and number of hours	Lecture: 15 hours
Language of instruction	English
The number of ECTS	2 ECTS
Teacher	Andrzej Harat, PhD
The aims of the course (maximum 500 characters)	The aim of the lecture is to familiarize students with basic and general concepts and issues related to product, service and process quality as well as to familiarize with quality management systems and applicable standards in this field.
The content of the course: main topics and key ideas	Topics include: Definition of quality in historical and contemporary terms. Classification of quality concepts. Dimensions of quality by David Garvin. General terminology Total Quality Management Short hystory of QMS PDCA Cycle Quality assurance and management Establishing and implementing QMS General Quality Standards ISO – 9000 – past and present Industry Specific Quality Standards Other systems: SPC, SIX SIGMA
Didactic methods	Lecture with multimedia presentation
Course requirements	written exam and multimedia presentation

Literature (basic and supplementary)	*Basic:* 1. Jiang, Renyan, Introduction to Quality and Reliability Engineering, Springer-Verlag Berlin Heidelberg, 2005 2. Kaoru Ishikawa, Introduction to Quality Control, Springer, 2012 *Supplementary:* 3. D. C. Montgomery, Statistical Quality Control, Wiley, 2012 4. D. C. Montgomery, Student Solutions Manual to accompany Introduction to Statistical Quality Control, Wiley, 2013
The effects of education - Knowledge - Skills - Social competences	Knowledge: - At the end of the learning process the student is able to determine the basic issues related with quality and quality management system Skills: - At the end of the learning process the student is able to identify and analyze simple quality problems and solving primary tasks Social competences: – At the end of the learning process the student is able to properly identify and resolve the dilemmas associated with the quality and to think and act in a creative and enterprising way

The title of course	**Project of The Introduction of Quality (no. 55**/I_24/ **P** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc)
Semester	Summer
The form of classes and number of hours	Project: 15 hours
Language of instruction	English
The number of ECTS	1 ECTS
Teacher	Andrzej Harat, PhD
The aims of the course (maximum 500 characters)	The aim of the project exercises is to familiarize students with basic practical tasks related to quality issues in business, environment and society
The content of the course: main topics and key ideas	Topics include: Develop a report that assesses the quality of the selected product or service as well as the proposal for a quality management system in a selected industry field.
Didactic methods	Interactive classes during which students according to the instructions and with teacher perform and solve the quality problems
Course requirements	Attendance and made the final raport
Literature (basic and supplementary)	*Basic:* 1. Jiang, Renyan, Introduction to Quality and Reliability Engineering, Springer-Verlag Berlin Heidelberg, 2005 2. Kaoru Ishikawa, Introduction to Quality Control, Springer, 2012 *Supplementary:* 3. D. C. Montgomery, Statistical Quality Control, Wiley, 2012 4. D. C. Montgomery, Student Solutions Manual to accompany Introduction to Statistical Quality Control, Wiley, 2013

The effects of education - Knowledge - Skills - Social competences	Knowledge: - At the end of the learning process the student is able to determine the basic practical issues related with quality and quality management system Skills: - At the end of the learning process the student is able to identify and analyze simple practical quality problems and solving primary tasks Social competences: – At the end of the learning process the student is able to properly identify and resolve the dilemmas associated with the practical approach of the quality and to think and act in a creative and enterprising way

The title of course	**European Union environmental law and management** **(no. 56**/I_24/ **L/S** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Lectures (15h)
Language of instruction	English
The number of ECTS	3
Teacher	Andrzej Harat, PhD
The aims of the course (maximum 500 characters)	The course introduces students to the essentials and key factors in planning and implementation of EC`s Environmental law and Management Systems. The aim of course is to teach students to manage with interrelations among the environment, law and management systems. In particular, the students will learn to design environmental strategies that reduce environmental impact, optimise resources use, promote waste reduction and recycling and prevent pollution. Cleaner production as a preventive, company-specific environmental protection initiative will be presented. The Council Directive 96/61/EEC concerning integrated pollution prevention and control (IPPC) will be characterized. Environmental Impact Assessment (EIA) as method which identifies the impacts (both beneficial and adverse) of proposed public and private development activities.
The content of the course: main topics and key ideas	1. Environmental management law system. The management system hierarchy. Policies and Regulations on different levels. Environmental policies classification and description. 2. Fundamentals of International Environmental Law 3. European Environmental Law 4. The harmonisation of the Polish Environmental Protection Law with the law of the European Community 5. Cleaner production 6. IPPC Directive (Integrated Pollution Prevention and Control) 7. International Law of Sustainable Development

	8. The Development of Waste Management Law
Didactic methods	Power point presentation – teaching ex cathedra);
Course requirements	Exam
Literature (basic and supplementary)	*Basic:* 1. Epstein, M. J.: Making Sustainability Work. Best practices in managing and measuring corporate social, environmental, and economic impacts. Greenleaf Publishing Limited, 2008. 2. Marguglio, B. W.: Environmental Management Systems, ACQC Quality Press, Milwaukee Wisconsin, USA, 1997. 3. Jain, R., Urban, L.W.: Environmental Assessment, 2nd Edition, The McGraw-Hill Companies, 2004. 4. New Tools for Environmental Protection: Education, Information and Voluntary Measures, editors T. Dietz and P. C. Stern, National Academy of Sciences, 2002. 5. Group of Authors, Planning and Environmental Protection – A Review of Law and Policy; Hart Publishing Oxford – Portland Oregon, 2001. *Supplementary:* 1. Barrow, J. C.: Environmental management. Principles and Practice. Taylor & Francis Group, New York 2002. 2. Barrow, J. C.: Environmental management and Development. Taylor & Francis Group, New York 2005. 3. Singh, B., Theodore, L.: Handbook of Environmental Management and Technology. New York, John Wiley 2000. 4. Friedman, F.: Practical Guide to Environmental Management. Washington, D.C., Environmental Law Institute 2000. 5. Calow, P.(ed.). Encyclopaedia of Ecology & Environmental Management.
The effects of education - Knowledge - Skills - Social competences	After concluding this course the student should be able to: *Knowledge:* 1. Describe and explain motivations and driving forces behind the development of EMS, and process and product development in companies and organizations; 2. Describe and explain the processes for certification, registration and maintenance of an EMS according to ISO 14001 and EMAS and REACH system.

	3. In a written case study describe, explain and analyse the environmental and sustainability performance of selected company and critically review the goals achieved. *Skills:* 1. Implement, maintain and improve an environmental management system. 2. Assure itself of its conformance with its own stated environmental policy. 3. Ensure compliance with environmental laws and regulations. *Social competence:* 1. Understand weigh of environmental requirements, and the environmental education and training.

The title of course	**European Union environmental law and management** **(no. 57**/I_24/ **L/E** /W2 **)**
Faculty	Faculty of Materials, Civil and Environmental Engineering
The level of studies	Undergraduate (BA), Engineer (BSc), Postgraduate (MA)
Semester	Winter/Summer
The form of classes and number of hours	Exercises (15 h)
Language of instruction	English
The number of ECTS	3
Teacher	Andrzej Harat, PhD
The aims of the course (maximum 500 characters)	The course introduces students to the essentials and key factors of ISO 14000 international standards of environmental management, providing a framework for development of both the systems and the supporting audit program will be studied. The student should learn key issues of model PLAN/DO/CHECK/ACT. The Eco-Management and Audit Scheme (EMAS) as a voluntary tool design to improve companies' environmental performance. Also the new EU chemical environmental law system - REACH (Registration, Evaluation, Authorization and Restriction of Chemical substances) will be presented. In particular it would be characterized that REACH is a management system which improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. The course includes class discussion and a student individual or group project on selected topics.
The content of the course: main topics and key ideas	1. Environmental Impact Assessment (EIA). 2. Introduction to ISO 14001 for the Environmental management systems. The clauses of ISO 14001:2005. Sustainable development. 3. Deming's circle. 4. Environmental audit: scope, selecting the object, planning and performing audit, audit reporting. Environmental self-audit. 5. Study of waste management services: regulations, planning, financing, operating requirements.

	6. Establishing managements system for the maintenance and control of the environmental equipment. 7. REACH decree 8. International Climate Law
Didactic methods	Power point presentation – teaching ex cathedra, preparing seminar paper)
Course requirements	Seminar paper
Literature (basic and supplementary)	*Basic:* 1. Epstein, M. J.: Making Sustainability Work. Best practices in managing and measuring corporate social, environmental, and economic impacts. Greenleaf Publishing Limited, 2008. 2. Marguglio, B. W.: Environmental Management Systems, ACQC Quality Press, Milwaukee Wisconsin, USA, 1997. 3. Jain, R., Urban, L.W.: Environmental Assessment, 2nd Edition, The McGraw-Hill Companies, 2004. 4. New Tools for Environmental Protection: Education, Information and Voluntary Measures, editors T. Dietz and P. C. Stern, National Academy of Sciences, 2002. 5. Group of Authors, Planning and Environmental Protection – A Review of Law and Policy; Hart Publishing Oxford – Portland Oregon, 2001. *Supplementary:* 1. Barrow, J. C.: Environmental management. Principles and Practice. Taylor & Francis Group, New York 2002. 2. Barrow, J. C.: Environmental management and Development. Taylor & Francis Group, New York 2005. 3. Singh, B., Theodore, L.: Handbook of Environmental Management and Technology. New York, John Wiley 2000. 4. Friedman, F.: Practical Guide to Environmental Management. Washington, D.C., Environmental Law Institute 2000. 5. Calow, P.(ed.). Encyclopaedia of Ecology & Environmental Management.
The effects of education - Knowledge - Skills - Social competences	After concluding this course the student should be able to: *Knowledge:* 1. Describe and explain motivations and driving forces behind the development of EMS, and process and product development in companies and organizations;

	2. Describe and explain the processes for certification, registration and maintenance of an EMS according to ISO 14001 and EMAS and REACH system. 3. In a written case study describe, explain and analyse the environmental and sustainability performance of selected company and critically review the goals achieved. *Skills:* 1. Implement, maintain and improve an environmental management system. 2. Assure itself of its conformance with its own stated environmental policy. 3. Ensure compliance with environmental laws and regulations. *Social competence:* 1. Understand weigh of environmental requirements, and the environmental education and training.