SUBJECT	ECTS	WINTER SEMESTER	SUMMER SEMESTER
HEATING, VENTILATION, AIR CONDITIONING DEPARTMENT (HVAC DEPARTMENT) / Katedra Ciepłownictwa, Ogrzewnictwa i Wentylacji			
Heat and mass transfer	**6**	**W**	**-**
(dr inż. Tomasz Teleszewski)	**FCEE-00146**		
Required knowledge: Students should have passed the subjects: Mathematic			
Description: Introduction to heat transfer, general differential equation of heat conduction, cartesian and polar coordinates, Fourier's Law, fundamentals of convection, continuity, N-S and energy equations, one dimensional steady state heat conduction, conduction with internal heat generation , extended surfaces, unsteady heat conduction, numerical methods in conduction, basic radiation theory, Kirchhoff's Law. Basic notions of the heat and mass transfer, steady conduction in multidimensional configurations, unsteady heat conduction in one or more dimensions, numerical simulation of conduction; forced convection in laminar and turbulent flows; natural convection in internal and external configurations; heat transfer during condensation and boiling; mass transfer at low rates, evaporation; thermal radiation, spectral and solar radiation, heat exanger. **Skills:** This course introduces to the basic principles underlying the behavior heat transfer and mass transfer. Students will develop a strong physical and conceptual understanding of heat transfer processes and learn about their application to energy systems. Student will know heat losses calculation. Students will have problem solving abilities applied to energy transfer. Students will develop a strong physical and conceptual understanding of heat and mass transfer processes and learn about their application to energy systems. They will involve theory, modelling, design exercises and laboratory exercises.			
Minimum number of students needed for a group class to convene: 4			
Renewable energy sources	**4**	**W**	**-**
(drinż. Tomasz Teleszewski, dr inż. Piotr Rynkowski)	**FCEE-00105**		
Required knowledge:			
Subject Description: The course of Renewable Energy Sources will undertake to introduce basic aspects of renewable energy sources presenting fundamental characteristics of the resource base and principles of related technical systems (photovoltaic, wind, hydroelectric power, generation, etc.). An economic and environmental analysis of supply technologies is undertaken. Student is able to know about main sources of energy, renewable energy resources and selected solutions to the supply and environmental issues associated with renewable energy resources. **Range of lectures:** - alternative and renewable energy – classification and characteristics,using of wind energy,using of surface waters,using of geothermal energy (among others as low sources of energy to heat pump systems)solar radiation and how to use it, - passive systems - solar architecture, - active systems - systems with solar collectors,installation of photovoltaic cells,types of heat pumps and the principle of their operation,methods of low-energy environment,types and uses of biomass.			
Minimum number of students needed for a group class to convene: 2			
Fluid mechnics	**6**	**W**	**-**

(dr inż. Piotr Rynkowski, dr inż. Tomasz Teleszewski)	**FCEE-00027**

Required knowledge: The students should have passed the subjects: Mathematic

Description:

Lectures**:** Basic notions of the mechanics of liquids. The statics of liquids. The dynamics of flows. The model of the continuous substance. The model of the physical phenomenon. The mathematical description of the model. Continuity of the substance equation. Basic equations describing the movement of the ideal liquid. Seminar**:** The content of mathematical exercises agreeable with the content of lectures. Laboratory**:** The marking of measuring equipments to the measurement of the pressure in fluid flow and velocity of liquid. The research of the physical proprieties of flows.

Lecture:Hydrodynamics of the viscous fluid. The viscosity of liquid. The Newton hypothesis. Navier-Stokes equations. The Bernoulli equation for the real liquid. The flow of liquid through pipelines. The flow of liquid in open channels. Seminar:The content of mathematical exercises agreeable with the content of lectures. Laboratory:Venturi tube. Prandtl tube. The delimitation of the laminar flow in the capillary pipe. The delimitation of the coefficient of local losses. The delimitation of the coefficient of losses on the length. The energy line. Marking of hydraulic resistances on the ground of the line of energy.

Skills. This course introduces to the basic principles underlying the behavior of liquids and gases at rest and in motion. Students will be prepared to understand the foundations of mechanical systems - the flow of liquid through pipelines. They achieve basic knowledge of modeling pipelines system. The lecture is a prerequisite to other courses in civil and energy engineering.

Minimum number of students needed for a group class to convene: 4

Gas installations and networks	**4**	**-**	**S**
(dr hab. inż. Mariusz Adamski)	**FCEE-00144**		

Required knowledge:

Subject Description: Types of gas. Elements of gas installations. Elements of the gas network. Calculation of demand for gas; conduct and types of gas pipes Calculation of pressure losses in the installation / gas network. Installation of gas meters, gas cookers and other gas appliances.

Flue gas appliances and ventilation of rooms. Laws concerning the installation / gas networks. Rules for the implementation and acceptance of installation / gas network.

Operation and installation of gas appliances. Risks associated with the operation of the gas installation, Maintenance and caulking gas installations.

Skills:

The student knows the standards, guidelines, principles of gas installations and networks design, knows and uses computer tools to support the calculation and design of gas installations and networks.

Minimum number of students needed for a group class to convene: 2

Thermodynamics	**6**	**-**	**S**
(dr inż. Grzegorz Woroniak)	**FCEE-00145**		

Required knowledge: physics, mathematics

Description

Principles of thermodynamics. Transitions of perfect gases (homogeneous and mixtures), heat engines, steam engine circuits, Combustion, humidification, cooling circuits.

Skills

Graduate knows principles of thermodynamics

Minimum number of students needed for a group class to convene: 2

Heating systems I	**4**	**W**	**-**
(dr hab. inż. Dorota Krawczyk)	**FCEE-00077**		
Required knowledge: Basic knowledge in the fundamental area of Thermodynamics			
Description Information about the basic elements of the heating systems and heat sources. Methods of heat losses calculation and choosing radiators, pipes and regulation elements. The advantages and disadvantages of different HVAC systems. The system schemes and implementation rules. The ways to reduce energy consumption. The energy audits. **Skills:** Student has an elementary knowledge about the materials used in heating systems (pipes, radiators, insulation, boilers, valves). Student knows the rules connected with heat losses calculation and energy consumption estimation. Student is able to make the heating installation design, prepare the technical description and explain the scope of the project.			
Minimum number of students needed for a group class to convene: 2			
Heating systems II	**4**	**W**	**-**
(dr hab. inż. Dorota Krawczyk)	**FCEE-00078**		
Continuation of Heating systemsavaliable for Master students			
Minimum number of students needed for a group class to convene: 2			
Ventilation systems	**4**	**W**	-
(dr hab inż. Dorota Krawczyk)	**FCEE-00108**		
Required knowledge: Basic knowledge in the fundamental area of Thermodynamics			
Description Information about the basic elements of the ventilation systems. Methods of ventilation air calculation in different types of buildings. The air change rate values. Choosing elements of systems such as ventilation ducts, ventilators, main units, air intake, exhaust air terminal devices. The advantages and disadvantages of different ventilation systems. The most popular schemes of systems and implementation rules. **Skills:** Student has an elementary knowledge about the materials used in ventilation systems. Student knows the rules connected with ventilation air flow calculation and energy consumption estimation. Student is able to make the ventilation system design, prepare the technical description and explain the scope of the project			
Minimum number of students needed for a group class to convene: 2			
Economy of energy consumption	**4**	**W**	-
(dr hab. inż. Dorota Krawczyk, dr inż. Piotr Rynkowski)	**FCEE-00109**		
Required knowledge: Basic knowledge in the fundamental area of Building Physics			
Description Information about the most popular ways to reduce energy consumption for heating, air conditionings, warm water preparation. Methods of energy consumption calculation in different types of buildings The examples of improvements connected with the building envelope. The possibilities of HVAC systems' efficiency increasing. The energy certificates. **Skills:**			

Student has a knowledge about different ways of energy consumption reduction. Student knows the connections between buildings envelope parameters, HVAC systems' efficiency and energy consumption level. Student is able to propose improvements for existing buildings to reduce energy usage.

Minimum number of students needed for a group class to convene: 2

Heat Centres	**4**	**W**	**-**
(dr hab.inż. Dorota Krawczyk)	**FCEE-00143**		

Required knowledge: physics or thermodynamics or heat transfer

Description

Familiarize students with the methods of calculation and design of the Heat Centres and heating systems. Complete with module content: Balancing the energy demand for heating or cooling. Computational schemes of the Heat Centres.

The used equipment; the choice of appropriate equipment and pipe diameters. Pressure drop calculations and pumps selection. Presentation of the Heat Centres and heating systems in the drawings: diagrams, plans and sections.

Skills:

The student knows the standards, guidelines, principles of heating centres design, knows and uses computer tools to support the calculation and design of heating centres

Minimum number of students needed for a group class to convene: 2

Air conditioning systems	**4**	**W**	-
(dr hab. inż. Dorota Krawczyk)	**FCEE-00107**		

Required knowledge: Basic knowledge in the fundamental area of Fluid Mechanics, Thermodynamics

Description

Information about the basic elements of the air conditioning systems. Methods of cold calculation in different types of buildings according to European standards. Choosing elements of systems such as ducts, main air conditioning units and other devices. The advantages and disadvantages of different air conditioning systems. The most popular schemes of systems and implementation rules.

Skills:

Student has an elementary knowledge about the materials used in air conditioning systems.
Student knows the rules connected with cold calculation and energy consumption estimation.
Student is able to make the air conditioning system design, prepare the technical description and explain the scope of the project.

Minimum number of students needed for a group class to convene: 2

Application of computer software in the design of heating systems	**6**	**W**	**-**
(prof. dr hab. inż. Mirosław Żukowski)	**FCEE-00-136**		

Required knowledge: Basic knowledge in the heating systems

Description: Familiarize students with the use of computer programmes in designing of central heating systems. Draw a 3D model of the building with use of computer tool.

Calculation of building seasonal energy demand depending on climatic conditions, angle of rotation and characteristics of external partitions.
The preparation of energy certificate of the building with use of computer tool.

Design of central heating system with use of computer tool.

Skills:

Student has practical knowledge about designing heating systems using computer programs

Minimum number of students needed for a group class to convene: 2

DEPARTMENT OF CHEMISTRY, BIOLOGY AND BIOTECHNOLOGY

Chemistry	**6**	**W**	**-**
(dr Monika Kalinowska)	**FCEE-00022**		

Required knowledge: The students should have passed the subjects:

Subject Description:

The fundamentals of general, inorganic and organic chemistry. Basic chemical laws. Structure of atom and molecule. Elements of quantum mechanics: chemical bonds and intermolecular interactions. Characterization of main groups' and transitional elements. Inorganic compounds - properties and application. Chemical reaction in electrolyte solution. pH. Chemical kinetics and catalysis. Elements of electrochemistry. Corrosion. Analytical chemistry. Elements of quantitative analysis. Alkacymetry, manganometry, complexometry. Precipitative titration and gravimetric analysis. Organic compounds - nomenclature, physical and chemical properties, Z and E isomerism. Types of organic reactions.

Skills: Students acquire basic knowledge about general, inorganic and organic chemistry, understand the interactions that exist in solid state and solution of chemical compounds.

Minimum number of students needed for a group class to convene: 2

Biochemistry	**4**	**-**	**S**
(dr Agata Jabłońska-Trypuć)	**FCEE-00021**		

Required knowledge: Basic knowledge in the fundamental area of Biochemistry in the field of Microbiology, Agriculture and Environmental Management

Subject description:

Methods of isolating nucleic acids: DNA and RNA, from biological material; the principle of the nucleic acid separation method from nucleoproteid with concentrated salt solutions; the use of detergents in the process of nucleic acid isolation. The advantages and disadvantages of various methods of nucleic acid isolation; limitations in DNA and RNA isolation processes. Definition, division, structure of nucleoproteins; some properties of nucleoproteins: cell location, chemical composition, solubility, bond types; DNA-related proteins; RNA-related proteins. Colloids - definition, types of colloid systems, sols, gels; solubility and protein shedding; protein denaturation. What are the reduction reactions of sugars; principle of the method with Benedict's reagent, principle of the Barfoed reagent method; principle of acid hydrolysis reaction of starch and hydrolysis of cellulose - a reaction compound with the structure of analyzed sugars. Physicochemical properties of lipids; water-soluble vitamins.

Minimum number of students needed for a group class to convene: 2

Biochemistry of proteins	**4**	**-**	**S**
(dr Agata Jabłońska-Trypuć)	**FCEE-00135**		

Required knowledge:

1. Student understands hygiene and safety rules during work in biochemical laboratory
2. Student knows and understand biochemical and molecular basis of cell functioning.
3. Student possess a knowledge concerning advanced laboratory, measuring and imaging techniques which are used for research and biotechnological purposes.
4. Student knows a variety of techniques and research tools which are used in biochemical laboratory.
5. Student is able to collect an empirical data and interpret them.

Skills: Student learned the basic biochemical techniques. Basic equipment in biochemical laboratory. Proteins as colloids. Protein solubility and protein excretion. Protein denaturation. Protein content in various biological samples. Structural and metabolic proteins in Eucaryota and Procaryota cells. Quantitative quantification of the protein content by using Lowry method, the ultraviolet absorbance method and the Bradford method in various biological samples. Electrophoretic separation of proteins from various biological samples by vertical polyacrylamide gel electrophoresis (SDS-PAGE method). Isolation of ribonucleoproteins from bovine (or pancreas).

Laboratories

1. Health and Safety Rules. Introduction to the organization of biochemical laboratory. Preparation of hydrophilic colloid solutions. Examination of the solubility of globulins in water and diluted saline solutions. Protein thermal denaturation and protein coagulation.

2. Isolation of total protein from different types of biological samples: in vitro culture of human cells, bacterial cells and sewage sludge. Quantitative determination of protein in biological samples by using Lowry method.

3. Determination of protein content in biological samples by ultraviolet absorbance measurement. Determination of protein content in biological samples by using Bradford's method.

4. Electrophoretic separation of proteins from various biological samples by vertical polyacrylamide gel electrophoresis

5. Extraction of ribonucleoproteins from fresh thymus or pancreatic bovine tissue.

Minimum number of students needed for a group class to convene: 4

Biotechnology	**4**	**W**	**-**
(dr Marzena Matejczyk)	**FCEE-00072**		

Required knowledge: Basic knowledge in the fundamental area of Biochemistry in the field of Microbiology, Agriculture and Environmental Management

Description: Cells structure (prokaryota and eukaryota).Structure of DNA, RNA and proteins; Ways of synthesis of DNA, RNA and protein. Methods for genome analysis and DNA integration. Problems of mutagenesis. Methods for transgenesis in plant and animals. Cloning systems (DNA, somatic). Methods for biochemical components analysis. Problems connected with some biochemical ways in the organisms. Basic ways of carbohydrate, protein and fat metabolism in the cell. Some problems connected with biotechnology in the environment. Laboratories: Aminoacids, peptides and proteins, structure and function. Spectrophotometry in protein analysis. Nucleic acides, main methods of analysis of DNA and RNA. Genes transformation

Minimum number of students needed for a group class to convene: 4

Biotechnology of plant	**4**	**W**	**-**
(dr inż. Elżbieta Wołejko)	**FCEE-00132**		

Skills: Students acquire basic knowledge about methods and equipment used in biotechnology laboratory. Student knows the rules connected with the understanding of the dependence between the structure and functions of plants on different levels of their organization, interactions between plants and the environment and knowledge of reaction of plants on factors of environment.

This activity provides a deepening of the subject in the areas of plant physiology and plant biology and provides a basic knowledge of plant biology and biotechnology. The students will develop fundamental knowledge in Plant Biotechnology and its application in laboratory. The course is designed to: provide knowledge and understanding of plant biotechnology, the basic principles and application of tissue, cell and protoplast culture and their application to plant improvement and to acquaint students with analysis of plant biotechnology experiments. This course explores the use of biotechnology to both generate genetic variation in plants and to understand how factors at the cellular level contribute to the expression of genotypes and hence to phenotypic variation. There is an emphasis on the molecular mechanisms directing plant gene expression under diverse environmental and developmental stimuli. This knowledge is central to our ability to modify plant responses and properties for global food security.

The course will be composed of following chapters:

-Methods in plant biotechnology,

-Production of plant secondary metabolites,

-Comparison of classical and modern biotechnological methods of plant breeding,

-Methods of transformation of plants by bacteria and viruses,

-Molecular breeding for plant pest control (viruses, insects, herbicides).

Minimum number of students needed for a group class to convene: 4

Human cell and tissue culture	**4**	**W**	**-**
(dr A. Jabłońska-Trypuć)	**FCEE-00122**		

Required knowledge: Knowledge 1. Student understands hygiene and safety rules during work with human cell lines 2. Student knows and understand biochemical and molecular basis of cell functioning. 3. Student possess a knowledge concerning advanced laboratory, measuring and imaging techniques which are used for research and biotechnological purposes. 4. Student knows a variety of techniques and research tools which are used in cell and tissue culture laboratory. 5. Student is able to collect an empirical data and interpret them. Skills 1. Student learned the basic cell culture techniques. 2. Student has the ability to work with an inverted light microscope. 3. Student knows the use of cells and tissues research methods in modern biology and biotechnology. 4. Student can carried out simple research experiments and analyses under the supervisor guidance. 5. Student is able to conduct a proper reasoning according to scientific data. 6. Student knows how to work in a team, carrying out research projects using tissue or cell cultures. Social competences 1. Demonstrates ability of team working. 2. Demonstrates responsibility for his own work and entrusted equipment; displays respect to his own work and the work of others. 3. Understands a need of transfer of new achievements in biotechnology to society and is able to transfer it in understandable manner.

Subject Description: Basic equipment in cell culture laboratory. Biosafety levels in cell culture laboratory. Aseptic techniques and types of biological contamination. Characteristic of the cell culture environment with special regards to media, pH, CO2 and temperature. Basic chemical reagents used for cell culture: media and additives to the media. Basic methods in cultured cells maintaining: subculturing adherent and suspension cells, freezing and thawing cells and counting cells in hemocytometer. Selecting an appropriate cell line. Morphological types of cell lines. Cultures and cell line types (primary cultures of cells, the culture of suspension cells, the cell lines, pure cell lines, clonal cell lines, mixed cultures, the culture cells in suspension). Laboratories 1. Health and Safety Rules. Introduction to the organization of cell and tissue culture laboratory. Preparation of the materials and solutions for cell culture. Sterilization. Workplace preparation. Media change in the adherent culture. 2. Subculturing of the MCF-7/fibroblast adherent and MOLT-4 suspension culture. 3. Various methods for cell counting and basic principles for preparing MCF-7 and fibroblasts adherent cells for the experiment. 4. Freezing and thawing of adherent and suspension cells. The creation of cell banks. 5. Various methods in estimation of cells viability. Cytotoxicity tests as a basic tests in preclinical studies.

Minimum number of students needed for a group class to convene: 2

DEPARTMENT OF AGRI-FOOD ENGINEERING AND ENVIRONMENTAL MANAGEMENT

Engineering geology and petrography	**4**	**-**	**S**
(dr inż. Piotr Kondratiuk)	**FCEE-**		

Required knowledge: *does not concern*

Description:

Structure of the Earth, plate tectonics, earthquake, volcanism and other mountain building processes. Surface processes (weathering; movement of slopes; fluvial processes; karst; glaciation; wind action; coasts and shorelines). Groundwater conditions (origin and occurrence of groundwater; water table; aquifers, aquicludes and aquitards; porosity and permeability; flow through rocks; groundwater quality). Rock types and stratigraphy (igneous rocks; metamorphic rocks; sedimentary rocks; stratigraphy and stratification). Geological structures (folds; faults; discontinuities). Description, properties and behavior of rocks. Geological materials used in construction.

Skills: Students can solution of the civil engineering problems in the context of geological knowledge. Students acquired the knowledge of the most important rocks and minerals and understand the relationship between rocks and engineering.

Minimum number of students needed for a group class to convene: 2

Hydrology	**4**	**W**	**-**
(dr inż. Piotr Kondratiuk)	**FCEE-00023**		

Required knowledge: *does not concern*

Description:

Water distribution on Earth, hydrological cycle. Watershed characteristics, hydrographic network, rivers, lakes, wetlands. Water budget: rainfall, evapotranspiration, infiltration, runoff and subsurface flow, surface and subsurface storage. Hydrological processes: hydrological response analysis, relation rainfall – runoff, flow hydrograph. Instrumentation and monitoring. Hydrological data. Floods. Water quality characteristics, pollution and self-purification of rivers. Groundwater. Management of water resources.

Skills: Students can describe and interpret hydrological phenomena and processes in connection with environmental conditions, determine basic hydrological parameters, identify water resource hazards. They know basics of water resource protection and basic measurement techniques.

Minimum number of students needed for a group class to convene: 2

Earth science	**2**	**W**	**-**
(dr inż. Piotr Kondratiuk)	**FCEE-00118**		

Required knowledge: hydrology

Description:

Introduction to Earth Science. Minerals. Rocks. Earth's Resources. Weathering, Soil, and Mass Movements. Running Water and Groundwater. Glaciers, Deserts, and Wind. Earthquakes and Earth's Interior. Plate Tectonics. Volcanoes and Other Igneous Activity. Mountain Building. Geologic Time. Earth's History. Ocean.

Skills: Students can describe and interpret geological phenomena and processes in connection with environmental conditions, identify geologic hazards.

Minimum number of students needed for a group class to convene: 2

Flood hazard in small urban catchment	**4**	**-**	**S**
(dr inż. Piotr Kondratiuk)	**FCEE-00119**		

Required knowledge: does not concern

Description:

Interaction man-water. Integrated management of the urban area and its surroundings. Water balance in urban area. Influence of the urban area on formation and circulation of water. Hydrological response analysis. Stormflow assessment. Determining the hazards of flooding. Flood wave model for small urban catchment.

Skills: Students can describe and interpret flood phenomena in connection with condition of urban areas, identify water flood hazard. They know basic hydrological calculations for determine flood hazard.

Minimum number of students needed for a group class to convene: 1

Nature conservation	**4**	**-**	**S**
(dr Aleksander Kołos)	**FCEE-00024**		

Required knowledge: The students should have passed the subjects: ecology.

Description:
Biodiversity and landscape diversity as the main purpose of nature protection. Methods of defining of biotic diversity. Methods of evaluation and protection of natural resources. Methods of creation of protected areas. Forms of nature protection in Poland. The United Europe strategy for the protection of nature: the Natura 2000 network.
Skills: Evaluation of natural objects; use of effective instruments of nature protection; identification of the natural environment threats.
Form of assessment: Project.

Minimum number of students needed for a group class to convene: 4

Vegetation (phytosociology and forest site classification)	**6**		**S**
(prof.nzw. dr hab. Grażyna Łaska)	**FCEE-00117**		

Required knowledge: The students should have passed the subjects: Biology, (or) Ecology, Soil Science

Description:

European geobotanical school. Braun-Blanquette phytosociological methodology. The classification of vegetation in Poland. Systematic review of plant communities of Poland. Methods used for the research of vegetation. Forest site classification. Geobotanical regionalization of Poland. Natural and potential vegetation. Vegetation dynamics. Ecological processes (dynamic processes) in the communities. Anthropogenic changes of vegetation in Poland (synanthropisation of vegetation).

Skills: Recognition of the relationship between plant communities and a set of biotic and edaphic factors

Minimum number of students needed for a group class to convene: 4

Botany and plant physiology	**4**	**W**	
(prof.nzw. dr hab. Grażyna Łaska)	**FCEE-00148**		

Required knowledge: The students should have passed the subjects: Chemistry, physics, mathematics

Description:

The structure and function of the plant cell, the structure and function of tissues and plant organs including the anatomy of development of the root, the stem, the flower, the fruit and seeds, with the special regard of the anatomy of trees. Bases of the systematics of plants with the special regard of conifers and angiosperms used in the landscape architecture.

Basic living processes occurring on different levels of the plant organism, from molecular, by the level of organelles, cellular, tissue level, organs level, the whole plant and plant communities, determining the growth and the development of plants and having significance in the landscaping. Mechanisms of the regulation of living processes of plants.

The water relations, the mineral nutrition, respiration, photosynthesis, assimilate transport, growth and plant growth regulators, development and the influence of external factors on the plant functions. Present achievements of the physiology of plants applying in the modern landscape architecture with the special regard of the influence of stress factors of the environment such as frost, cold, high temperature, low and high hotosynthetically active radiation, drought, the shortage and the excess of mineral elements, heavy metals, soil and atmospherically pollution, salinity, diseases, pests etc. on plants and bases of the resistance of plants to stressors. Ecophysiological aspects of interactions between organisms of the same species and different plant species especially those grown under urban conditions.

Skills: Learning of bases of the cytology, anatomy, morphology and morphogenesis of plants, bases of processes on different levels of organization of the plant, the understanding of the dependence between the structure and functions of plants on different levels of their organization, interactions between plants and the environment and knowledge of reaction of plants on factors of environment

Minimum number of students needed for a group class to convene: 4

"Natura 2000" european ecological network	**4**		**S**
(prof.nzw. dr hab. Grażyna Łaska)	**FCEE-00073**		

Required knowledge:

Description:

1."Natura 2000" European Ecological Network in Europe, Poland and in Podlasie

2. The legal basis for the Natura 2000 network – Habitats Directive 92/43/EEC, Birds Directive 79/409/EEC, Art. 6 of the Habitats Directive 92/43/EEC

3. The review of Special Protection Areas for birds (SPAs, or bird sites), Special Areas of Conservation (SACs, or habitat sites) and Sites of Community Importance (SCIs) (based on the Act on the protection of nature) in Europe and Poland.

4. The review of conservation of natural habitats and of wild fauna and flora (Directive 92/43/EEC) and the wild birds (Directive 79/409/EEC)in Europe and Poland

5. "Natura 2000" ecological network in the aspect of sustainable development

6. Sustainable development and environmental impact assessment

Skills: Understanding of the rules of protection "Natura 2000" areas.

Minimum number of students needed for a group class to convene: 4

Ecology	**4**	**W**	
(prof.nzw. dr hab. Grażyna Łaska)	**FCEE-00031**		

Required knowledge: The students should have passed the subjects: Biology, Climatology, Soil Science

Description: The levels of biological organization: species, individual, population, biocoenosis, ecosystem. Life and the physical environment. Adaptation to aquatic and terrestrial environments. Habitat and ecological niche. Ecology tolerance of individuals. Population ecology. Population structures. Temporal and spatial dynamics of populations. Reproductiveness, mortality, migration of populations. Biocoenosis ecology. The structure and organization of biocoenosis. Interaction: competition, predation, parasitism, mutualism. Ecosystem: spatial and trophic structure. The food chains, food webs and food levels. Energy and matter in the ecosystem. Primary and secondary production. Pathways of elements in the ecosystem. Ecological succession.

Applied ecology.

Skills: Recognition of the relationship between life forms and a set of biotic, edaphic and climatic factors.

Minimum number of students needed for a group class to convene: 4

Landscape ecology	**4**	**W**	
(prof.nzw. dr hab. Grażyna Łaska)	**FCEE-00075**		

Required knowledge: The students should have passed the subjects: Ecology

Description: The mutual relationships of different components of the landscape. Influence of the spatial structure of the landscape on the functioning of plant and animal populations. The functioning of ecological corridors. Habitat islands and the concept of metapopulation. The functioning of the habitat patches of different size and shape. Boundaries and barriers in the landscape. Transformation and evolution of the landscape. Methods of the analysis of the spatial pattern of the landscape and biodiversity. Application of landscape ecology in nature protection and landscape planning.

Skills: Using of different methods of the analysis of the spatial pattern of the landscape and biodiversity in purpose of nature protection and landscape planning.

Minimum number of students needed for a group class to convene: 4

Soil science	**6**	**W**	**-**
(dr inż. Robert Czubaszek)	**FCEE-00032**		

Required knowledge: The students should have passed the subjects: Chemistry, Cartography

Description:

Lecture: Introduction to the soil science, basic definitions. Soil genesis, physical and chemical weathering. Soil-forming factors and processes. Soil morphology. Physical properties of the soil. Water in soil, its forms, movement and assimilability to the plants. Soil air and soil temperature. Soil colloids and their properties. Soil sorption complex. Chemical properties of the soil. Reaction, acidity and alkalinity of the soil. Buffering properties of the soil. Soil organic matter. Soil microorganisms and their role in functioning of the soil. Fertility and abundance of the soil. Systematic of the Polish soils. Geography of soils of the world.

Laboratory: Soil morphological properties. Soil material. Soil texture. Physical properties of the soil. Water properties of the soil. Soil filtration. Soil reaction. Soil sorption complex. Calcium carbonate in soil environment. Organic matter of soil. Total content of chemical elements in soil environment. Cartography of soils.

Skills: Students will get to know knowledge about basic properties of the soils, about their fertility and geography. Students will be preapred to determine basic physical and chemical properties of the soils.

Minimum number of students needed for a group class to convene: 4

Biogas and biomass	**4**	**W**	**-**
(dr inż. Robert Czubaszek, dr inż. Agnieszka Wysocka-Czubaszek)	**FCEE-00138**		

Required knowledge: Basic knowledge of chemistry.

Subject Description

Lectures: Air pollution. Climate warming. Greenhouse gases. GHG reduction policies and measures. Anaerobic digestion. Substrates for biogas production. Biochemical processes of anaerobic digestion. Kinetics of biogas production. Main parameters of biogas production. Biogas plants: types, operational parameters, technology, components. Utilization of biogas. Digestate use and management. Environmental impact of biogas production. Advantages of biogas technologies for society.

Laboratory: Chemical analyses of biogas substrates and digestate. Biomethane potential test as a method for measuring the methane specific yield.

Project: The determination of biogas potential in the selected region. Calculation of the efficiency of biogas production from different substrates. Determination of the potential and kinetics of biogas production from different substrates based on laboratory analyzes.

Skills: The ability to determine biogas potential in the selected region The ability to characterize the plant size for farm feedstock. The skills of chemical analyses of biogas substrates and digestate.

Minimum number of students needed for a group class to convene: 4

GIS in environmental engineering	**4**	**W**	
(dr inż. Andrzej Kamocki)	**FCEE-00034**		

Required knowledge: The students should have passed the subjects: Cartography, Land Surveying

Description:

Basic definition of maps and GIS. Difference between cartography and GIS. Theory of coordinate systems. Sources of spatial data (including paper maps and remote sensing data). Methods for modeling of environmental spatial data. Methods for visualizing and analyzing spatial data.

Skills: Students will be able to draw numeric maps, to analyse spatial data and to visualize cartographic data.
Form of assessment: Project, oral exam.

Minimum number of students needed for a group class to convene: 4

Thematic Cartography	**4**		**S**
(dr inż. Andrzej Kamocki)	**FCEE-00149**		

Required knowledge: basic knowledge of information technology. The students should have passed the subjects: not applicable

Description:

Reading, use, preparing and editing of thematic maps, especially for environmental engineering and landscape planning purposes. Methods of mapping with categorical (qualitative) and quantitative data. The rules of elaboration of main elements of the map: contents of the map, cartographic projection and grid, scale, legend, symbols, diagrams and other marginalia information. Methods for gathering spatial data (including direct field mapping and remote sensing methods). Methods for presenting of the relief and altitude data.

Skills: Students will be able to read maps, to create thematic maps, using GIS applications.

Soil protection and land rehabilitation	**6**	**-**	**S**
(dr inż. Agnieszka Wysocka-Czubaszek)	**FCEE-00026**		

Required knowledge: Basic knowledge of chemistry, cartography and soil science

Description:

Short compendium of soil information. Forms of soil degradation such as salinization, desertification, acidification, organic depletion, compaction, nutrient depletion, chemical contamination, deterioration by mining. Land reclamation. Remediation. Water, gully, gravity and wind erosion. Methods of water, gully and wind erosion mapping. Mathematical modelling of erosion processes. Water erosion control. Wind erosion control.

Skills: The ability to identify the causes of soil degradation; to assess the degree of the soil transformation and degradation caused by natural and anthropogenic factors; to choose appropriate rehabilitation methods; to plan the rehabilitation techniques based on natural factors and management limits.

Minimum number of students needed for a group class to convene: 4

Computational and statistical methods	**4**		**S**
(dr inż. Sławomir Roj-Rojewski)	**FCEE-00052**		

Required knowledge: The students should have passed the subjects: Information Technology, Statistics and Modelling in Environmental Sciences

Description:

Discussion of the basic notions of the mathematical statistics. Empirical distribution. Random variable. Parameters of distribution. Elementary statistics. Initial data analysis. The use of the programme „Microsoft Excel" for computations and statistical analysis of data. Distribution fitting. Basic parametric and nonparametric tests. Regression. Correlation analysis. The statistical analysis using of the computer program „Jasp". Making the project concerning the statistical analysis of the environmental measurements using of the computer programs "Microsoft Excel" and "Jasp".

Skills: Skill of using statistical methods in analysis of environmental dates with the use of specialist computer software.

Minimum number of students needed for a group class to convene: 4

DEPARTMENT OF TECHNOLOGIES AND SYSTEMS IN ENVIRONMENTAL ENGINEERING

Air protection	**4**	**W**	**-**
(mgr inż. Ewa Szatyłowicz)	**FCEE-00025**		

Required knowledge: The students should have passed the subjects: Physics, Chemistry, Process Engineering

Description:

Definition of air pollution, basic classification of sources (natural, anthropogenic, stationary, mobile, dispersed). Major information about gaseous pollutants: carbon oxide, sulfur dioxides, nitrogen oxides, etc. and their effects on ambient air. Models of pollution dispersion in atmosphere. Identification and determination of the concentration of gas pollution in the context of permissible levels. Methods, technologies and equipment of pollutants removal. Technologies of emission control: carbon oxide, sulfur dioxides, and nitrogen oxides. Elaboration of an air protection project. Calculations of emission levels of selected gaseous pollutants, designing of equipment and technologies protecting the quality of ambient air.

Skills: Mastering the skills and competence of the understanding of phenomena and processes in the atmosphere, principles of operation, designing and use of equipment and technologies protecting the quality of ambient air.

Minimum number of students needed for a group class to convene: 4

Environmental impact assessment	**4**	**W**	**-**
(mgr inż. Ewa Szatyłowicz)	**FCEE-00101**		

Required knowledge: ecology

Description The course includes information about process used to predict the environmental consequences (positive or negative) of a plan, policy, program, or project prior the implementation decision, it proposes measures to adjust impacts to acceptable levels or to investigate new technological solution.

Minimum number of students needed for a group class to convene:

Noise pollution	**4**	**W**	**-**
(mgr inż. Ewa Szatyłowicz)	**FCEE-00062**		

Required knowledge: Basic knowledge of physics, chemistry, process engineering, air protection

Subject Description:

Basic knowledge on the effect of noise on the human body. Measurement and evaluation of noise in the environment. Noise reduction methods. Regulatory requirements. Basic terms: physical parameters, sound pressure, sound power, soundpropagation, noise mitigation ect.

Skills: Mastering the skills and competence of the understanding of phenomena and processes in the environment, principles of operation, designing and use of equipment and technologies protecting the quality of environment in aspect of noise pollution.

Minimum number of students needed for a group class to convene: 4

Facilities for water and wastewater treatment I	**6**	**W**	**-**
(dr inż. hab. Iwona Skoczko prof. PB)	**FCEE-00029**		
Required knowledge: The students should have passed the subjects: Chemistry, Ecology, Water Technology			
Description: General introduction into issues connected with designing water plant treatment, types of embrace of water, division and pattern of water treatment plant. The discussion of mechanical water purification devices: (gratings, sieves), to physical and mechanical water treatment (devices for the process of coagulation, dosage device, mixers, reaction tanks, versatile devices), iron removal and manganese removal from water devices. Appliance for disinfection, softening, demineralization and devices with application in membrane methods, ionit filter. A programme trip on technical objects of water treatment plant. **Skills**: Student can project water treatment plant for industry, city and farms			
Minimum number of students needed for a group class to convene: 4			
Water and wastewater technology I	**6**	**W**	**-**
(dr inż. hab. Iwona Skoczko prof. PB)	**FCEE-00041**		
Required knowledge: The students should have passed the subjects: Chemistry, Ecology			
Description: Removal of dissolved substances, colloidal and suspended in water. Methods, technological parameters and the effectiveness of the treatment of underground and surface water. Selection of technologies depending on the type of purified water, its quality, demand and use. **Skills**: understanding of the processes taking place in water purification			
Minimum number of students needed for a group class to convene: 4			
Facilities for water and wastewater treatment II	**6**	**W**	**-**
(dr inż. Joanna Struk-Sokołowska)	**FCEE-00040**		
Required knowledge: The students should have passed the subjects: Chemistry, Ecology, Wastewater Technology			
Description: General introduction into issues connected with designing wastewater treatment plant, types of embrace of wastewater, division and pattern of wastewater treatment plant. The discussion of mechanical wastewater purification devices: (sedimentation), to physical and biological wastewater treatment (devices for the process of coagulation, biofiltration, biological treatment on active sludge), industry pollutions removal from sewage devices. A programme trip on technical objects of water treatment plant. **Skills**: Student can project wastewater treatment plant for industry, city and farms			
Minimum number of students needed for a group class to convene: 4			
Water and wastewater technology II	**6**	**W**	-
(dr inż. Joanna Struk-Sokołowska)	**FCEE-00030**		
Required knowledge: The students should have passed the subjects: Chemistry, Ecology, Biology, Water Treatment Technology			
Description:			

Principles emerging waste management practices in water treatment. Characteristics of sewage. Water receivers. Unit processes for mechanical, chemical and biological sewage treatment plant. Removal of biogenic substances from wastewater. Integrated biological removal of carbon, phosphorus and nitrogen from wastewater. Sewage treatment plants under natural conditions.

Skills: Understanding of the processes taking place in wastewater purification

Minimum number of students needed for a group class to convene: 4

Environmental chemistry	**4**	**-**	**S**
(dr Joanna Szczykowska)	**FCEE-00068**		

Required knowledge: The Students should have passed the subjects: Chemistry

Subject description:

The definition and classification of pollution. Basic issues and concepts of toxicology. Toxic and harmfull substances in environment and formed as a results between chlorine and organic precursors in drinking water. Characteristic of organic and inorganic components and pollutants of water and wastewater. Physico-chemical and biochemical reactions and transformations taking place in water and wastewater. Nitrogen, phosphorus and carbon cycle, acid rain, water quality indicators. Predicting results of presence of harmful and toxic substances in water environment. Rules of taking samples and sample stabilization for chemical analysis. Preparing chemical reagents necessary in full and shorten analysis of water and sewage. Physico-chemical analysis of natural components and water pollutions. Predicting results of presence of harmful and toxic substances in environment. Physico-chemical and biochemical transformations taking place in water and wastewater. Influence of those elements on the environment. Chemical aspects of soil. Environmental problems related to soil. Pathways of elements and compounds in the environment.

Skills: Students can control and evaluate quality of water and wastes, can work out and interpret correctly research results. They can give definition and explanation of chemical processes in water environment, prepare correctly chemical reagents and carry out laboratory analyses.

Minimum number of students needed for a group class to convene: 2

Water management and water protection	**4**	**W**	**-**
(dr Joanna Szczykowska)	**FCEE-00134**		

Required knowledge: The students should have passed the subjects: Chemistry

Description:

Description:Understanding hydrological phenomena and processes. Extended informations about resources and classification of water, sources of pollution and protection of waters against pollution. Learning about the importance of the problem of rational use of water resources. Presentation of the scale and impact of human activities on the aquatic environment and how to minimize them. Presentation of the basics of legal protection of waters in Poland and instruments of water management (water permit, water cadastre). Learning about water classification, methods of evaluating the purity of rivers, lakes and reservoirs, as well as the development of documentation on the obtained engineering tasks. Preparation of the results of the projects in the form of a multimedia presentation. Rules and skills of when and how to use measuring apparatus. Learning about the water physico - chemical characteristics by basic laboratory testing. Individual work on select tasks, and the ability to work in a team. Preparation of results, discussion, interpretation, and to comparisson with the literature.

Minimum number of students needed for a group class to convene: 4

Municipal and industrial wastewater treatment	**6**	**-**	**S**
(dr hab. inż. Wojciech Dąbrowski)	**FCEE-00039**		

Required knowledge: The students should have passed the subjects: Chemistry, Ecology, Wastewater Technology

Description:

Designing and dimensioning of municipal and industrial wastewater treatment plant. Physic and chemical characteristic of municipal and industrial wastewater. Legislature of wastewater treatment and municipal sewage sludge disposal. Division of municipal and industrial wastewater treatment systems- technology and facilities. Review of high efficiency methods of carbon, nitrogen and phosphorus removing. Application of biological filters, rotary biological contactors and fluid beds in municipal wastewater treatment. Selection of facilities for mechanical, biological and chemical treatment in municipal wastewater treatment plant. Rules of proper wastewater and sewage sludge management. Examples of real scale municipal wastewater treatment plants, operation and basic monitoring.

Skills: Skill in designing and operation of municipal and industrial wastewater treatment plant.

Minimum number of students needed for a group class to convene: 4

Environmental Monitoring	**4**	**W**	**-**
(dr Adam Łukowski)	**FCEE-00106**		

Requirements: basic information about environmental chemistry; **Basic knowledge**: basic skills for working in a laboratory

Description:

Work safety regulations. Water and soil sampling. Characterisation of water samples (pH, chemical oxygen demand, phosphates, nitrates, electrolytic conductivity, calcium and magnesium). Characterisation of soil samples (pH, available phosphorus andmagnesium, determination of Zn and Ni). Interpretation of study results with regard to current domestic regulations.

Classes outline:

During the first class students will learn about safety regulations in the laboratory and class content. They will be informed about grading criteria, writing a laboratory report and its content. Instructor will clarify all reasonable questions students might have relative to the course objectives. During next classes students will learn about selected physicochemical properties of water and soil. The study results must be compared to current domestic regulations in the final report.

Methods of assessing learning outcomes: evaluating the student's report

Minimum number of students needed for a group class to convene: 2

Systems of Sewage Disposal	**4**	**-**	**S**
(dr inż. Dariusz Andraka)	**FCEE-00028**		

Required knowledge: The students should have passed the subjects: Fluid Mechanics

Description:

Lectures: General information on sewage disposal systems. Computation of sewage flows. Design principles of separated and combined sewage systems. Operation and design principles of pressure and vacuum sewage systems. Hydraulic calculations of sewers. Pipe materials and sewerage appurtenances. Design: Engineering design of separate sewage system for a small community.

Skills: students will learn engineering principles and design methods for sewage disposal systems; especially they will be able to estimate sewage budget from a community, design layout of gravity sewage disposal system and calculate hydraulic conditions in the sewers.

Minimum number of students needed for a group class to convene: 4

Systems of Water Supply	**6**	**W**	**-**
(dr inż. Dariusz Andraka)	**FCEE-00038**		

Required knowledge: The students should have passed the subjects: Fluid Mechanics

Description:

Lectures: General characteristics of water supply systems. Evaluation of water demand - required capacity of water distribution system. Surface water and groundwater intakes. Water storage reservoirs. Hydraulic design of water distribution systems – branching and closed conduit systems. Pipe materials and water systems appurtenances. Design: Water distribution pipe network design.

Skills: students will learn engineering principles and design methods for water supply systems; especially they will be able to estimate water demand for a community, design layout of water supply system and choose appropriate pipe diameters for water distribution system

Minimum number of students needed for a group class to convene: 4

Waste Management	**4**	**-**	**S**
(dr hab. inż. Izabela Tałałaj)	**FCEE-00037**		

Required knowledge: The students should have passed the subjects: Chemistry, Systems of Wastewater Treatment

Description:

Lectures: Legislation and regulation in field of waste management. Characteristics of waste quantity and quality. Waste analyses methods. Waste disposal methods. Principles of landfiling, composting and thermal utylisation. Monitoring of waste management system Design: municipal landfill design.

Skills: Practical skills of choosing right waste disposal system, knowledge of possibility of its practical use, skills of assessment threats and prevention for each disposal system, competence in decision making in field of waste disposal. Practical outcome is engineering design of landfill/composting plant for chosen administrative unit.

Minimum number of students needed for a group class to convene: 4

Material science	**4**	**W**	**-**
(dr inż. Dariusz Wawrentowicz)	**FCEE-00104**		

Required knowledge: field broadly based in chemistry, physics, and the engineering sciences

Description Materials science is a field broadly based in chemistry, physics, and the engineering sciences. The field is concerned with the design, manufacture, and use of all classes of materials (including metals, ceramics, semiconductors, polymers, and biomaterials), and with energy, environmental, health, economic, and manufacturing issues relating to materials. Materials science is a field critical to our future economic and environmental well-being.

Minimum number of students needed for a group class to convene: 4

Computer modeling of water supply and sewage systems	**4**	**W**	**-**
(dr inż. Wojciech Kruszyński)	**FCEE-00133**		

Basic knowledge of water supply and wastewater systems, Basic knowledge of desktop geographic information system (GIS) - not obligatory.

LEARNING OUTCOMES 1 - Has general knowledge of the application of numerical models to the design and operation of wastewater and water supply systems. 2 - Ability to create and implementation of GIS model of wastewater and water supply system along with their basic elements. 3 - Ability to identify and properly assume the most important parameters of the object models, and interpret the simulation results. 1. Introduction to software (EPANET, SWMM, QGIS, WaterCAD, Civil Storm) 2. Water quality and hydraulic modeling of water supply systems 3. Storm water and wastewater flows modeling. Rainfall data aqustion and analysis. 4. GIS Aplicattions for water, wastewater and stormwatersystems.

Minimum number of students needed for a group class to convene: 2

Inne Katedry DEPARTMENT OF SPATIAL ECONOMY AND ENERGY-EFFICIENT CONSTRUCTION			
Environmental Management System	**6**	**W**	**-**
(dr hab. inż. Elżbieta Broniewicz)	**FCEE-00121**		
Required knowledge:			
Description: The aim is to gain by students the theoretical and practical knowledge of environmental management system according to PN-EN ISO 14001. Characteristics of modern management systems according to international standards ISO. Elements of an environmental management system in accordance with the requirements of ISO 14001. Identification of environmental aspects as a basic element of the planning of the environmental management system. Rules for the implementation of the environmental management system in organizations. Procedures for environmental management system audit according to ISO 19011. System documentation. Costs and benefits related to the implementation and operation of the environmental management system. The procedure for certification of the environmental management system. Methods and indicators to assess the environmental performance ofinvestment and operational activities. **Skills:** gaining knowledge about the environmental management system ISO 14001 and acquire the skills to elaborate an environmental management system documentation, mainly - environmental management programme. References: 1. PN-EN ISO 14001:20105 Environmental management systems - General guidelines on principles, systems and support techniques 2. PN-ISO 14004:2015 Environmental management systems - Requirements with guidance for use 3. PN-EN ISO 19011:2012 Guidelines on Quality and/or Environmental Management Systems Auditing			
Minimum number of students needed for a group class to convene: 4			
Geodesy and photogrammetry	**4**		**S**
(dr inż. Waldemar Łupiński)	**FCEE-00142**		
Required knowledge: The basics of mathematics and geography at the secondary school level			
Subject Description: Geodesy as a science. Systems of reference geodetic measurements. Coordinate systems used in geodesy. Elements of coordinates. The role and the division of geodetic networks. Methods and equipment for measuring angular and linear. Measurement methods situational. Methods and equipment for measuring altitude. Situational-height maps and their use for environmental engineering. Calculation methods associated with situational-elevation maps. Maps for design purposes. Methods staking situational and height. Geodetic measurements related to the implementation and operation of utilities. Geodetic records of public utilities - design principles and main tasks. Photogrametry: methods, equipment, possibility of use in environmental engineering. Measurements of displacements and deformations and constructions. General principles of GPS measurements			
Minimum number of students needed for a group class to convene: 3			

Diploma orientation seminar	**8**		**S**
	FCEE-00102		
Required knowledge:			
Subject Description:			

Familirizing with the technics of preparation of the final project. Basic rules of preparation technicall presentation in relation to the engineering problem. Acquiring the knowledge in the range of modern applications in road engineering and ability of their applications. Preparation and execution of laboratory tasks in range of analyzing task.

Skills: Fundamental knowledge related to final project preparation. Practical ability of planning and executing of technical engineering problem.

Minimum number of students needed for a group class to convene:

Final project for bachelor degree	**15**		**S**
	FCEE-00103		

Required knowledge:

Subject Description: .

Student is obliged to study in Bialystok University of Technology the whole academic year. Students should have basic knowledge in the field of mathematics, basics of building, concrete technology, concrete and bridge structures, basics of mechanics of building structures, road engineering, building exploitation, fundamentals of computer science.

Skills:

Familirizing student with the methodology of solving engineer problems. Developing skills of appropriate choice and use of literature references and use of scientic and technical data bases. Training the ability of analyzing the literature to identify the possible solutions of the problem stated in the engineer project. Achieving skills of preparing plan and schedule of the process of the given task realization. Improving skills of analyzing the solving problem and formulating final conclusions.

Minimum number of students needed for a group class to convene: 2

Final project for master thesis	**20**	**W**	
	FCEE-		

Required knowledge:

Subject Description:

Students should have basic knowledge in the field of mathematics, basics of building, concrete technology, concrete and bridge structures, basics of mechanics of building structures, road engineering, building exploitation, fundamentals of computer science. Realization of master thesis research depends on the field of study.

Minimum number of students needed for a group class to convene: