Faculty of Biology and Environmental Protection

course descriptions

"Applied Aquatic Ecology"

The course covers a range of advanced topics in applied aquatic ecology. Contains major questions, approaches, applications and tools for sustainable and integrated water resources management. The main objective of the course is educating in applying the ecological knowledge for protection, restoration and bioindication of aquatic ecosystems.

Prerequisits
Basic knowledge in biology, hydrology and ecology

Effects of Teaching
1. Student explains the functioning of the aquatic ecosystems (lotic and lentic) under natural conditions and in face of anthropogenic stress and disturbance. 2. Student recognizes and appraises various threats facing the quality and quantity of freshwater bodies (in local, regional and global scale) . 3. Student conducts the river quality assessment (from sampling to selected indices calculation methods with the use of PC software) in accordance with current environmental policy. 4. Student analysis the river quality assessment results, discusses the consequences of impact on aquatic ecosystems and presents the conclusions in the form of a report. 5. Student names and characterizes modern methods, techniques and technologies (ecohydrological biotechnologies) used in the river restoration. 6. Student justifies the need for self-restraint in managing water resources. 7. Student explains the need of the interdisciplinary and transdisciplinary knowledge required for process understanding and the integrated water resources management (IWRM) from the point of sustainable development. Realised learning outcomes for the field of study: 04OŚ2A_W02, 04OŚ2A_W03, 04OŚ2A_W05, 04OŚ2A_U05, 04OŚ2A_U07, 04OŚ2A_U10, 04OŚ2A_K02, 04OŚ2A_K05, 04OŚ2A_K06

Course Content
The theoretical part: 1. Major types of aquatic ecosystems (rivers, lakes, reservoirs) and description of their key features: distribution, genesis, typology and morphology; physico-chemical characteristics; community structure, interactions and seasonal dynamics; trophic relationships; food web structure; trophic cascade; biomanipulation, bottom-up and top-down processes. 2. Key concepts in freshwater ecology: nutrient cycling, river zonation, river continuum, flood pulse, land-water ecotones, intermediate complexity hypothesis, ecohydrology. 3. Human impact on river continuum, distribution of organisms and river productivity: water pollution, channel regulation, separation of oxbow lakes by levees, irrigation, damming, river fragmentation, flow regulation, changes in thermal regime, overfishing (including poaching), inappropriate stocking and introducing of non-native species, collapse of some commercial fisheries, reaction of steno- and eurytopic species to human pressure. 4. Biomonitoring and bioindicators in aquatic ecosystems: Phytoplankton and Fish based assessment methods - worldwide and European perspective. 5. River restoration with use of ecohydrological biotechnologies: concepts, stages, methodology, techniques, examples - worldwide and European perspective. The practical part: 1. Field trip,

laboratory work and computer class: Phythoplankton based assessment - sampling of phytoplankton and calculation of the Trophic Diatom Index (TDI). 2. Field trip, laboratory work and computer class: Fish based assessment - sampling of fish (electrofishing) and calculation of fish-based indices elaborated for Water Framework Directive EC EU purpose (e.g. European Fish Index EFI and EFI+, FiBS index). 3. Field trip: Example of the urban rivers restoration with use of ecohydrological biotechnologies on the basis of case-studies carried in Lodz City (SWITCH demo site – Sokołówka River; EH-REK – Bzura River in Arturówek, Łagiewniki Forest). 4. Tutorial: the review of the best practices in rural and urban rivers restoration (students PowerPoint presentations).

Method and Criteria of Assessment
25% (test) 25% (report - bioassessment) 50% essay (selected topic on application of ecological methods application)

Teaching Method
Lecture, movie, laboratory, computer class, tutorial, field trip.

"Applied Hydrology"

Students will obtain an understanding of hydrological processes. Students will learn about estimation of hydrological parameters important to water management and risk assessment. Students will practice hydrological measurement of surface and subsurface water in the field.

Prerequisits
– Good knowledge of physical geography on the level of undergraduate – Basic course of hydrology and meteorology

Effects of Teaching
Student: - classify and characterize fundamental phenomena and processes occurring in hydrosphere and related spheres - select and apply mathematical and statistical methods to description, interpretation and prediction of hydrological processes - describe hydrometrical equipment and apply modern technics of measuring of phenomena and objects in hydrosphere - appraise influence of quality and quantity of measuring data to research results and precision of hydrological models - predict natural and econiomic effects of hydrological extremes, characterize methods of their prevention - justify the need of constant specialist knowledge updating

Course Content
1. The hydrological cycle. Catchment as a 2- and 3- dimensional object and its importance to hydrological processes and water management. Watersheds and the drainage area structure. 2. Measuring and estimating main processes of the hydrological cycle: precipitation, interception, evaporation, infiltration, surface and subsurface flow, base flow. 3. Streamflow measuring and estimating. Characteristic values of flow and their importance to water management, environmental planning and protection. Runoff indices. 4. Hydrological extremes: floods and droughts - development dynamics, parameters estimation, prediction, ideas of prevention. 5. Water balance and water resources. 6. Hydrometry: selected methods and technics of surface and ground water measurement.

Method and Criteria of Assessment
Final written exam Practical test in the field

Teaching Method
Information lecture Problem lecture Seminar lecture Classical problem method Situational method Method of subject exercises Project method Case study method Experiment method Exhibiting method of demonstration.

“Ecohydrology”

The main objective of the course is to provide the knowledge and skills deal with the ecohydrology concept and ecohydrological biotechnologies, as modern, transdisciplinary tools to be implemented in sustainable use and management of ecosystem services, water and landscape resources with the special emphasis on enhancement resilience of ecosystem to climate unstability. Ecohydrology and ecohydrological biotechnologies are the key elements of development of "green infrastructure strategy", which has been defined by European Commission.

Prerequisits
Basic knowledge in ecology and hydrology Basic knowledge in freshwater ecology

Effects of Teaching
Student defines and explain the ecohydrology concept and ecohydrological approach to the water management strategy of water ecosystems in a basin scale in a context of enhancement of water resources, biodiversity, resilience and ecosystem services for society. Student applies the methodology and ecohydrological tools - ecohydrological biotechnologies, during practical field work on demonstration projects on ecohydrology. Student creates the ecohydrological strategies and implement ecohydrological biotechnologies in protection, sustainable management and restoration of water catchment in the context of Integrated Water Resources Management (IWRM), Water Framework Directive (WFD) and other related legislation. Realised learning outcomes for the field of study: 04OŚ2A_W02; 04OŚ2A_W03; 04OŚ2A_W05; 04OŚ2A_U03; 04OŚ2A_U05; 04OŚ2A_U06; 04OŚ2A_U07; 04OŚ2A_K02; 04OŚ2A_K07

Course Content
BASIC CONCEPTS AND DEFINITIONS in the field of Ecohydrology. ASSESSMENT - assessment & quantification of specific issues in watersheds: LANDSCAPES (defining critical areas in watersheds, urbanization and industries influence on water quality, assessment of landscape impacts on water quality, assessment of soil contamination); LAND-WATER INTERACTIONS (assessment of their effectiveness in maintaining and improvement of water quality and quantity, ground water influence on surface water quality, efficiency of ecotones in nutrient removal, estimation of the effects of flood zones on water quality and quantity); STREAMS & RIVERS (defining their quality & absorbing capacity); LAKES & RESERVOIRS (defining their ecosystem status, nitrogen processing in a water body, sedimentation, Cyanobacterial blooms’ impact on water quality and human health). MANAGEMENT - prevention of degradation & restoration of watersheds: LANDSCAPE MANAGEMENT (regulation of pollution exports & hydrological cycles, phytoremediation of soils, management of water cycles in watersheds, control of diffuse pollutant inputs to water bodies); LAND-WATER INTERACTIONS (reduction of contamination transport,

constructed wetlands - combining sewage treatment with phytotechnology, ecotones - diminishing nutrient transport from landscapes, floodplains and natural wetlands - reduction of N and P input into water ecosystems); STREAMS & RIVERS MANAGEMENT (enhancing absorbing capacity against human impacts, restoration of physical structure in a river, restoration of vegetation - increasing nutrient retention capacity and selfpurification ability); RESERVOIR & LAKE MANAGEMENT: improvement of water quality, ecohydrological methods of algal bloom control, management of biotic structure in a reservoir. General aspects of Integrated Water Resources Management (IWRM). Basic concepts in IWRM. Socio-economic aspects of ecohydrology & phytotechnology applications for IWRM. Global climate change effect on management outcomes. 04OŚ2A_W02 04OŚ2A_W03 04OŚ2A_W05 04OŚ2A_U03 04OŚ2A_U05 04OŚ2A_U06 04OŚ2A_U07 04OŚ2A_K02 04OŚ2A_K07

Method and Criteria of Assessment
Oral examination: 50 % Practice: 50%

Teaching Method
lectures, on-line lectures, movies, labs, field trips

"Ecotoxicology"

The main objective of the course is to provide the knowledge about ecotoxicology and its relations and connections with biological and environmental sciences, as well as introduction of terminology in the field of toxicology and ecology. The student will know about the environmental danger of chemical compounds including their sources, fates and health effect. The student will know how to conduct an environmental and health risk assessment in context of monitoring of toxic substances (also for WFD purposes).

Prerequisits
Basic knowledge of Biology and Chemistry.

Effects of Teaching
Subject learning outcomes Student: - Defines the basic concepts of toxicology and ecotoxicology - Lists the main groups of pollutants, - Describes the fate of pollutants in ecosystems, - Characterizes the impact of pollution on the organism populations and communities - Planning methods that can be used to monitor the quality of the environment, - Identifies the toxic effects for the studied plants and animals, - Adapts known methods of research into the ecosystems where it does, - Reports the results of research. Realized directional learning outcomes: 04OŚ2A_W02; 04OŚ2A_W03; 04OŚ2A_W09; 04OŚ2A_U04; 04OŚ2A_U07; 04OŚ2A_U08; 04OŚ2A_K01; 04OŚ2A_K04; 04OŚ2A_K05; 04OŚ2A_K09

Course Content
Lecture topics: The notion and classification of poisons. Mechanisms of the effect of poisons. Dose. Mutagenic, carcinogenic and teratogenic effects. Toxins in the environment, xenobiotics. Poisoning of the environment. Turnover, retention, bioaccumulation, biomagniphication and biotransformation of toxins in the environment. Toxikinetic and toxidynamic circles. Elimination of toxins from the environment. Detoxifications and

demutagenesis. Tests and the evaluation of the toxicity. Laboratory analysis of toxicants in the environment. Risk of contaminating the environment. Anthropogenic sources of toxins. Prevention of poisoning.

Method and Criteria of Assessment
1. Attendance. 2. Passing the exam at the end of the lectures - exam consists of multiple-choice test and the descriptive part to the question. 3. Reports on the implementation exercise.

Teaching Method
Lectures, seminars - introduction to the practical exercises, practical exercises.

"Environmental / Landscape Planning"

The main objective of the course is to provide the knowledge about the modern environmental / landscape planning as the tool of the implementation of the principles of the sustainable development and environmental protections. This course aims to achieve the key significance of dissemination and capacity-building of multi-hazard disaster mitigation for spatial planning under the legislative tools of EU and global institutions.

Prerequisits
Basic knowledge in biology, ecology, geography, environmental politics and economy

Effects of Teaching
1. Student identifies the types of the landscape. 2. Student undertakes certain degree of cooperation with planners. 3. Student analysis and interprets the planning documents. 4. Student assesses the environmental effects of the local development plans. 5. Student draws up the natural part of studies of the conditions and directions of spatial development of given area. 6. Student recognizes the range of natural hazards related to riverine systems with special emphasis to floods, their types and impacts. Realised learning outcomes for the field of study: 04OŚ2A_W01, 04OŚ2A_W05, 04OŚ2A_W06, 04OŚ2A_W07, 04OŚ2A_W10, 04OŚ2A_U03, 04OŚ2A_U06' 04OŚ2A_U09, 04OŚ2A_U10, 04OŚ2A_K04, 04OŚ2A_K05, 04OŚ2A_K06

Course Content
Spatial environmental units. The evaluation and the valorization of the landscape. Structure of managing and using the space. Principles of shaping ecotones. Managing the space in different types of the landscape – spatial politics, planning. System of the landscape planning in Poland and its organization. System of the landscape planning in the World (case studies). Planning documentation. Procedures of using the space (analysis of the study of the conditions and directions of spatial development of the commune, local plans of developing, regional development strategy, conception of spatial planning of the country). The landscape planning as the tool of the implementation of the principles of the sustainable development and environmental protections. Consequences in law of development plans. Limitations in using the space. Areas of the special-purpose. Spatial conflicts. Water & Forests in landscape planning 1. Hydrological cycle in forest ecosystems: soil-plant-atmosfere continuum (SPAC), ewapotranspiration, age-related changes in forest composition and structure and changes in transpiration and water storage; role of flow regime in forests along river corridors and ecologically acceptable flow regime (EAFR) 2. Wetland ecosystems and consequences of

deforestation, reforestation and afforestation – sustainable development and forest policy; nature protection versus (?) local policy 3. Drainage of forested area, riverbed regulation, landscape desertisation and "small retention" 4. Ecological and biological diversity of riparian and boggy forest communities in Poland. Restoration and creation of wetland environments 1. Degradation of wetlands ecosystems 2. Environmental and biological site evaluation. 3. The major goals of planning . 4. Typical stages in the design, implementation and assessment of ecological restoration/creation projects . 5. Restoration project planning guidelines according to Committee on the Restoration of Aquatic Ecosystems (1992) Land use changes - afforestattion of agricultural lands 1. Afforestation porgrammes in European countries 2. Finnacial and technical support 3. The economical, ecological and social drivers of afforestation

Method and Criteria of Assessment
Written examination: 25% test , 50% essay Project: 25%

Teaching Method
Lecture, practice, computer class, movie, field trip, workshop, presentation

"Environmental Modelling and Statistics"

The aim of the module is familiarization with methods of data management and data analysis; testing statistical hypotheses; methods of proper test selection depending on the type of data; basic statistical tests (chi-squared test, t-test, ANOVA, post-hoc tests, selected non-parametric tests); graphs and other methods of data presentation and their proper use.

Prerequisits
Secondary school maths competence level

Effects of Teaching
Student: - know and is able to use statistical methods in data handling and environmental analyses within the Ist ecohydrological principle framework; - apply Ist and IInd principle of Ecohydrology in solving environmental problems using modelling methodology and innovative GIS approach; - assess model base research on environmental processes in two-dimensions (temporal and spatial) in a catchment and administrative units scale; - efficiently use modeling methodology for identification and quantification of processes and phenomena in environment; - are able to built and conduct an environmental risk assessment analysis at a basic skill level; - know the assumptions and procedures of environmental modelling for purposes of identification of threats and ecosystems opportunities; - explains differences between scales of measurement; - describes application of selected parametric and non-parametric tests; - gives examples of basic statistical tests; - describes basic functions selected spreadsheets and statistical packages; - defines significance, degrees of freedom, confidence interval, statistical errors; - is able to take notes and correctly reproduces provided information; - discusses a selected problem in a spreadsheet or a statistical package; - identifies type of measurement scale; - draws conclusions based on graphically presented data; - feels motivated to update the knowledge in the field of computer science and statistics; - is creative in solving problems in the field of computer science and statistics; - accepts responsibility for the used equipment; - show respect for own and other people's work. Effects of field teaching: 04Bt1A_W01, 04Bt1A_W04, 04Bt1A_U06, 04Bt1A_K02, 04Bt1A_K03, 04Bt1A_K07, 04Bt1A_K08

Course Content
Methods of statistical data analysis and data interpretation; scale, precision, rounding, data transformation; testing statistical hypotheses; data characteristics and test choice; basic test: chi-squared test, t-tests, ANOVA; post-hoc tests, selected non-parametric tests; methods of data presentation: graphs and tables; selected statistical software packages and their practical application. Introduction to mathematical modelling - the origins contexts, categories and type of mathematical models (focus to environmental models). Deterministic and probabilistic models of beloveds of processes occurring in nature. Environmental modelling as an innovative tool for environmental sciences - the linkage network of EH approach with modelling methodology. Environmental modeling and introduction to GIS. Vector and raster data. Spatial and geostatistical methods and tools of ArcGIS, GoogleEarth, QuantumGIS software. Geoinformation database - structure and accomplishment of EH research requirements. Models requirements and data structure of abiotic and biotic subsystems. Concepts and functionality of models of environmental processes occurring in a catchment scale. Quantification and identification of abiotic and biotic processes within both the spatial and temporal dimensions. Site selection and hot-spots modelling analysis. Application of selected modelling software including scenario analysis.

Method and Criteria of Assessment
Lecture: practical exam (100%) Labs: each lab exercise marked separately (100%)

Teaching Method
Lecture, interactive talk, workshop

"Environmental Protection Politics"

The main objective of the course is to provide the knowledge about the environmental protection politics. Intention is to provide an overview of international environmental politics and law in a global contects, however, in some cases, with a special attention on the European regulations and some particular chosen countries.

Prerequisits
As prescribed for the Ecohydrology studies in general

Effects of Teaching
Student : -lists and describes changes in the environmental policy; political and legal-economic conditioning in the environmental protection; principles of the ecological politics. [Realised educational effects in a field: Student specifies the environmental linkages with other scientific disciplines, including interdisciplinary methods for environmental protection research - 04OŚ2A_W05; characterises the social role of specialist in the field of environmental protection - 04OŚ2A_K07] -relates and designs the knowledge in the scope of environmental issues in the education and shaping the ecological awareness of the society and shaping the social basis for sustainable development [Realised educational effects in a field: Student discuses the complexity of the human impact on the structure and functioning of natural systems and problems with its estimate - 04OŚ2A_U01; formulates judgments on important social issues - 04OŚ2A_K03; specifies the possible use of the achievements of the natural sciences for sustainable socio-economic development - 04OŚ2A_W07] -integrates the information obtained during the course into creating programs of the environmental protection on the split level of treated issues and decision making (verification by practical questions and

issues to consider) [Realised educational effects in a field: Student characterises strategic environmental protection problems as a basis for defining the national environmental policy - 04OŚ2A_W06; uses specialized terms in Polish or English in the development of documentation on environmental protection - 04OŚ2A_U10; describes the effects of opinions, decisions or actions of a specialist in the field of environmental protection - 04OŚ2A_K06] Realised educational effects: 04OŚ2A_W05, 04OŚ2A_K07, 04OŚ2A_U01, 04OŚ2A_W07, 04OŚ2A_K03, 04OŚ2A_W06, 04OŚ2A_U10, 04OŚ2A_K06.

Course Content
Strategic problems of the environmental protection in the world. Reasons to protect environment, "raison d'être" of environmental protection politics, main actors involved, subject of protection in global, regional and local vision. Ecological politics of the state. Regional and local strategies and programs of the environmental protection. Principles and methods of forecasting in the environmental protection. Administrative and market instruments. Participation of the society in the achievement of the goals of the of the goals of the environmental politics. Conditions of effective environmental protection, barriers and limits to effective environmental protection in different countries and parts of the world. Conflict between ecology and economy, opposition between environmental protection and humans' needs and activities. Transnational character of environmental problems and of environmental protection law and politics. Concept and role of international law in environmental protection, international negotiations in the field of environment, history of environmental protection law and politics. Different international agreements, their role in environmental protection, character and answering different environmental questions. United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro (Earth Summit), Earth Summit's documents in general, Rio Declaration on Environment and Development, Agenda 21. Principles of environmental law (detailed presentation of the principles of: prevention, precaution, polluter-pays), concept of sustainable development (idea, history, different spheres concerned, different meanings, realization in practice, problems, etc.). Atmosphere and climate protection: United Nations Framework Convention On Climate Change and Kyoto Protocol (negotiations, parties, principles, objectives, instruments, rules, economic instruments used, different mechanisms, etc.). Climate protection in UE (system of emission allowances, subjects involved, main ideas and rules: allocation, auctioning, introduction of aviation into the system etc.). Climate protection in chosen countries. Other aspects of air and climate protection : Geneva Convention on Long-range Transboundary Air Pollution and related protocols.). Biosphere protection: reasons of protection of biodiversity, specific problems in this field development of biosphere protection policy, Cites (Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora), Rio Convention on Biological Diversity and Cartagena Protocol. Protection of the Marine Environment and Watercourses in general way. Other issues in environmental protection politics: international ecological safety, use of economic instruments for the environment protection, access to environmental information, etc.

Method and Criteria of Assessment
Oral exam + activity during lectures + possible students' presentations.

Teaching Method
PowerPoint Presentation (slides) - principal part Work in groups (small panels in class) Discussions Possible students' presentations

“Estuarine and Coastal Ecohydrology”

The main objective of the course is to propose the Ecohydrology as a new tool for sustainable management of estuaries and coastal waters.

Prerequisits
Basics in biology, ecology and ecohydrology

Effects of Teaching
1. Student explains the need of the interdisciplinary and transdisciplinary knowledge required for process understanding and the integrated management of estuarine and coastal seas. 2. Student identifies human activity and climate change as factors impacting the estuaries and coastal ecosystems. 3. Student applies a range of ecohydrological methods for ecosystem mitigation and remediation. 4. Student analyses the numerical models deal with estuarine and coastal ecosystems - their benefits and limitations. Realised learning outcomes for the field of study: 04OŚ2A_W05; 04OŚ2A_W02; 04OŚ2A_W03; 04OŚ2A_U04; 04OŚ2A_U05; 04OŚ2A_U10; 04OŚ2A_K02

“Phytotechnologies & Phytoremediation”

The main objective of the course is to provide knowledge of modern methods and techniques of repair, with special emphasis on phytoremediation and fitotechnologie. This course provides a scientific basis for the use of a variety of physical, chemical and biological remediation methods in order to solve the problems of pollution in groundwater, surface water and soils. The course provides knowledge and develops skills in the selection and evaluation of remedial actions; informed about the possibilities of monitoring programs to fit the specific environmental pollution. The student will develop the skills to choose the most effective corrective actions to properly estimate the severity of contamination and propose the use of available, optimal methods phytotechnologies and remediation.

Prerequisits
Knowledge basic of plant biology and ecology, hydrology and soil science

Effects of Teaching
Subject learning outcomes: Student: - Assess some aspects of human impact on ecosystems, surface water, ground water and soil, - Explains the processes of transport and dispersion in different centers, - Explains the role of vegetation in the neutralization, distribution and absorption of pollutants for the protection of aquatic and terrestrial ecosystems, - Distinguish between different methods and techniques of repair for sites contaminated by persistent organic pollutants, inorganic pollutants and heavy metals, - Evaluate the positive and negative aspects of using plants as biofuel for the production of bio-energy, - Presents examples of selected methods of remediation and the use of plants for the production of biofuels, which are used in Poland and around the world. Directional learning outcomes: 04OŚ2A_W02; 04OŚ2A_W03; 04OŚ2A_U01; 04OŚ2A_U06; 04OŚ2A_U07; 04OŚ2A_U08; 04OŚ2A_U10; 04OŚ2A_K01; 04OŚ2A_K08

Course Content
Lecture topics: Ecohydrology & Phytotechnology; Fundamental Processes - Remediation Technologies; Physical Treatment Technologies; Chemical Treatment Technologies and Chemical Reactive Barriers; Biodegradation and Bioremediation with Bacteria and Enzymes and Fungi; Phytoremediation of Persistent Organic Contaminants; Phytoremediation of Metals and Inorganic Pollutants; Mechanisms: 1) Occurring outside plant system (Phytosequestration, Rhisodegradation, 2) Occurring inside plant system (Phytoextraction, Phytodegradation); Applications of Phytotechnologies and Phytoremediation: 1) Containment Strategies, 2) Treatment Strategies

Method and Criteria of Assessment
For the issue of the assessment of the subject will be taken into account: 1) Attendance, 2) Evaluation of activity in the classroom, 3) Rating for the preparation and multimedia presentation from a given scientific theme - at the rights of the exam. The method of the course assessment will rely on assigned the weight for particular assessments (exam grade - 75%, the evaluation of the exercises - 25%).

Teaching Method
Lectures, working in groups

“Urban Ecohydrology”

Urban Ecohydrology covers issues related to the challenges, opportunities, methods and examples of ecohydrology and ecosystem biotechnology application in urban areas. It introduces their role in creating a sustainable, environmentally friendly, healthy cities of the future; and the benefits of system solutions and transdisciplinary knowledge in understanding and management of the complex links among ecological, technical, economic, social and institutional structures of the city. Theory and practice of innovative methods of organisation and facilitation of work in multi-institutional stakeholder platforms includes building a vision, scenarios and strategies for urban systems.

Prerequisits
Fundamentals of ecology; The basics of the protection of the environment; The basics of ekohydrologii; Knowledge of English is an asset;

Effects of Teaching
Explains the mechanisms, effects and methods of mitigating the impacts of urbanization on the natural environment; Discuss the complexity of processes and transdisciplinary character of environmental management in urban areas; Develops scientific research as the basis for designing innovative solutions for rehabilitation of freshwater ecosystems in the urban area; Formulate and verifies research hypotheses by integrating knowledge from various fields of science; Uses statistical methods and computer techniques to carry out research tasks; Communicates with stakeholders in the course of the performance of the tasks of the research; Uses a specialized terms in English and Polish; Critically evaluates the results of conducted observation, information from the scientific literature and media relating to socio-ecological aspects in the city; Effectively apply modern methods of communication and moderation; (04OŚ2A_W03; 04OŚ2A_W05; 04OŚ2A_U01; 04OŚ2A_U02; 04OŚ2A_U03; 04OŚ2A_U05; 04OŚ2A_U09; 04OŚ2A_U10; 04OŚ2A_K02; 04OŚ2A_K07; 04OŚ2A_K08)

Course Content
Lectures: 1. challenges generated by urban development, its impact on water resources and their management in the face of global change; 2. the effect of antropopressure on water ecosystems as the basis for decision-making in management and rehabilitation measures; 3. IUWRM, BMPs, LID, SUDS in the regeneration and management of the water cycle in the city; 4. regeneration of biogeochemical cycles and water pollution control in cities; 5. system solutions: integrating water management, urban infrastructure and social, economic and cultural systems; the methodology; 6. ecosystem services in cities; 7. green infrastructure in urban planning; The importance of sustainable development and planning of cities for public health; The Concept of Blue-Green Network; 8. the management of water in cities in the EU directives and international acts; 9. the theory and practice of cooperation in stakeholder platforms including stakeholder maps and institutional building; 10. the methodology of building the vision, scenarios and strategic plans, communication and facilitation in stakeholder platforms; Technical classes: 1. system solutions on the Sokolowka River - River City rehabilitation for improving retention and quality of stormwater the quality of life of the inhabitants; 2. Sequential Sedymentary-Biofiltration System for stormwater purification; 3. energy plantations at Lodz Waste Water treatment Plant - system solutions for the nutrient regeneration and production of clean energy; 4. stormwater systems Modeling; 5. Methodology of building the vision, scenarios and strategic plans, communication and facilitation in stakeholder platforms;

Method and Criteria of Assessment
1. Results of the workshop exercises on the basis of complexity and reliability of the developed opinions and solutions (15%); 2. Essay 35%; 3. Multimedia presentation 15%; 4. Final Test 35%;

Teaching Method
1. Multimedia Lectures; 2. Movies; 3. Workshops using modern methods of facylitation and communication (e.g., Cafe World; Open Space); 4. Preparation of presentation; 5. Reports; 6. Self-study.

“Wetlands & Land-Water Ecotones”

The main objective of the course is to provide knowledge about wetland ecosystems (natural and constructed by man) and the water-land ecotone zones, as well as the role they play in the functioning of freshwater ecosystems. The aim is to present the characteristics of the wetland and ecotone ecosystems and their ecological, natural, social and cultural meaning. Get to know the role of these ecosystems in terms of biodiversity conservation, self-cleaning, maintaining long-term viability of aquatic environments, as well as a systematic approach to sustainable functioning and management wetlands. Presentation of the Declaration on Sustainable Floodplain Management.

Prerequisits
Knowledge of basic issues of hydrology, biology and ecology.

Effects of Teaching
Subject learning outcomes: Student: - Distinguish between basic types of wetland ecosystems and the types of ecotones - Explains the role of wetland ecosystems (natural and man-made) and ecotones to biodiversity, the circulation of biogenic elements, purifying water and surface

water ecosystems, - Describes the process flow of energy through an ecosystem and circulation of matter in the ecosystem at different stages of its development, - Quantify water balances of different types of wetland ecosystems, - Assesses the environmental, natural, social and cultural importance of wetland ecosystems and ecotones - identifies the selected plant and animal species associated with the wetland ecosystems, - plans simple experiments or research related to the functioning of wetland ecosystems, - presents the results obtained in the researches, - elaborates the experimental results in the form of reports. Directional learning outcomes: 04OŚ2A_W02; 04OŚ2A_W03; 04OŚ2A_U01; 04OŚ2A_U06; 04OŚ2A_U07; 04OŚ2A_U08; 04OŚ2A_U10; 04OŚ2A_K01; 04OŚ2A_K08

Course Content
Lecture topics: Wetlands and land-water ecotones and human history; Distribution of wetlands - the largest and most valuable wetland areas in the world; Wetland hydrology and land-water ecotones - wetland water budget, retention time, the influence of the dynamics of the hydrological on functioning of ecosystems and biodiversity condition; Wetlands biogeochemistry and land-water ecotones - the nitrogen, sulfur, carbon and phosphorus cycle, biogeochemical budget, the ability of organisms to adaptation to wetland conditions; Human impact on the development of wetland ecosystems and ecotones and their sustainable management; Climate change and wetlands. Assessment of the value of natural, ecological, social, wetlands and ecotones; Floodplain wetlands and ecotons on the Pilica River valley - impact on flood sediment retention and accumulation of nutrients, introduction to the international document on wetlands and floodplain terrace - "Declaration on Sustainable Floodplain Management".

Method and Criteria of Assessment
For the issue of the assessment of the subject will be taken into account: 1) Attendance, 2) Evaluation of activity in the classroom, 3) Rating for the preparation and multimedia presentation from a given scientific theme - at the rights of the exam. The method of the course assessment will rely on assigned the weight for particular assessments (exam grade - 75%, the evaluation of the exercises - 25%).

Teaching Method
Lectures, working in groups.

“Aging of cells and organisms”

Getting the students acquainted with the biological basis of the process of aging. Learning the abilitity of critical evaluation of the available information concerning this process and possibilities of its modification.

Prerequisits
Basic requirements: knowledge of biology at the high school level. Desired (but not obligatory): knowledge of basis biochemistry and physiology at the University level

Effects of Teaching
Student who has completed the course: EK-1: Identifies main changes occurring in the human body with aging, EK-2: Describes the process of aging at the cellular level, EK-3: Explains evolutionary hypotheses of the orihgin of aging, EK-4: Presents main hypotheses of the

mechanisms of aging at the cellular and molecular levels, EK-5: Accounts of studies aimed at identification of genes affecting life span, EK-6: Cricically analyzes assumptiosn of the :anti-aging medicine", EK-7: Understands biological and social problems of the elderly.

“Cell cycle, apoptosis and cancer”

The main aim of this course is to present mutual connections between the cel cycle, apoptosis and neoplastic transfromation. Apart from these connection, basic information on the cell cycle regulation, basic apoptotic pathways and molecular mechanism of cancer trasformation will be presented.

Prerequisits
Basic cytology and molecular genetics course. Basic molecular biology terminology in English. English language intermediate skills.

Effects of Teaching
A student: - describes a mutual relationship between the cell cycle, apoptosis and cancer - describes the cell cycle and apoptosis as essential elements of eukaryotic cells - explains apoptosis as cellular response to a stress factor and alterantive for cancer transformation - describes cancer as a disease of genes - explains genomic instability as a prerequisite to cancer transformation - appreciates the role of viruses in cancer transformation - distinguishes stages of cancer transformation: initiation, promotion and progression - appreciates the importance of oncogenes, tumor suppressor genes and mutator genes in cancer transformation

Course Content
THE CELL CYCLE Overview of the cell cycle 1. The Eucaryotic cell cycle is divided into four phases 2. Cell-cycle control 3. Cell-cycle control study The cell cycle control system 1. Major events of the cell cycle are triggered by the cell-cycle control system 2. Cyclicaly activated cyclin-dependent protein kinases (Cdks) 3. Inhibitory phosphorylation and Cdk inhibitory proteins (CKIs) 4. Cyclical proteolysis 5. Network of biochemical switches formed by the cell cycle control S phase 1. S-Cdk 2. Chromosome duplication requires duplication of chromatin structure 3. Cohesins Mitosis 1. M-Cdk drives entry into mitosis 2. Condensins 3. The mitotic spindle 4. The APC/C triggers sister-chromatid exchange and completion of mitosis 5. Meiosis Cytokines 1. Actin and myosin II 2. RhoA Control of cell growth and cell division 1. Mitogens stimulate cell division 2. Cell can delay division by entering a specialized nondividing state 3. DNA damage blocks cell division. The DNA damage response 4. Abnormal proliferation signals cause cell-cycle arrest or apoptosis except in cancer cells APOPTOSIS 1. Programmed cell death eliminates unwanted cells 2. Apoptotic cells are biochemically recognizable 3. Apoptosis depends on an intracellular proteolytic cascade that is mediated by caspases 4. The intrinsic and extrinsic pathways of apoptosis 5. Cell-surface death receptors 6. Bcl-2 and IAPs CANCER Cancer as a microevolutionary process 1. Cancer cells reproduce without restraint and colonize other tissues 2. Most cancers derive from a single abnormal cell 3. Cancer cell contains somatic mutations 4. Cancer cells are usually altered in their response to DNA damage and other forms of stress 5. How do

cancer stem cells arise? 6. Epigenetic changes contribute to cancer transformation The preventable causes of cancer 1. Many cancer-causing agents damage DNA 2. Tumor initiators damage DNA, tumor promoters do not 3. Viruses and other infections contribute to a significant proportion of human cancers Finding the cancer-critical genes 1. Oncogenes, tumor suppressors and mutators 2. The Ras oncogene 3. The steps in tumor progression can often be correlated with specific mutations Cancer treatment: present and future 1. Traditional therapy exploits the genetic instability and loss of cell-cycle checkpoints response in cancer cells 2. New drugs can exploit the specific cause of a tumor's genetic instability 3. Small molecules can be designated to inhibit specific oncogenic proteins

Method and Criteria of Assessment
Credit in the form of conversation during the last lecture

Teaching Method
Lecture - lecturing, giving spoken explanations of the subjects illustrated with static and dynamic pictures.

"Dental Anthropology"

The acquaintance with dental anatomy (deciduous and permanent teeth). The acquaintance with dental variation in historic and recent human populations. The acquaintance with sequence and timing of dental growth. The acquaintance with histology of dental tissues, tooth wear and tooth diseases.

Prerequisits
background in biology

Effects of Teaching
Student: - describes dental morphology - properly describes odontological complexes (Sino-, Sundadonts) - describes regulatory mechanisms of dental development describes histology of dental tissues (specially enamel) - describes variability of dental wear - describes selected tooth diseases - search and presents scientific informations - adhere to ethical standards while examining human skeletal remains and processing the biological information obtained as a result thereof.

Course Content
Dental morphology and its variation in historic and recent human populations. Establishing method and theory for using tooth morphology in new vision of human evolution. Tooth morphology and population history (Sinodonty, Sundadonty; cranometric and genetic data in light of the dental evidence for human population relationships). Geographic variation in tooth crown and root morphology. Dental morphology: ontogeny, asymmetry, sex dimorphism, intertrait association. Characterization of dental variation in modern and historic Polish population (biological distances between Polish and other Europeans).

Method and Criteria of Assessment
positive written evaluation

Teaching Method
lecture, interactive talk, work with print.

"DNA damage and repair"

Presentation of the main sources and types of DNA damage and cellular reaction to DNA damage in the category of DNA repair and regulation of the cell cycle.

Prerequisits
Basic knowledge on molecular genetics: structure of DNA and RNA, replication, transcription translation and recombination as well as basic information on gene manipulation: vectors cell-based and cell-free DNA cloning, transgenic animals. English language intermediate skills.

Effects of Teaching
A student distinguishes DNA damage, mutation and polymorphism appreciates the significance of DNA double strand breaks and interstrand cross-links distinguishes physiological changes in DNA structure from changes induced by DNA damage is aware of a key role of signal transduction in cellular DNA damage response interprets the pathways of DNA repair distinguishes cellular deaths discusses mutual association between DNA damage and aging finds current information on cellular DNA damage response in the Internet – extends his/her knowledge actively and independently.

Course Content
1. Basic DNA damage 2. DNA damage and mutation 3. Endogenous DNA damage 4. Environmental DNA damage 5. Errors of DNA polymerase 6. Tautomeric forms of the DNA bases 7. Deamination of the DNA bases 8. Lack of the DNA bases 9. FaPy 10. DNA damage and aging and cancer 11. DNA damage induced by ionizing radiation 12. DNA strand breaks induced by ionizing radiation 13. DNA damage induced by UV radiation – pyrimidine dimers and (6-4) photoproducts 14. DNA alkylation 15. Metabolic activation to electrophiles 16. Nucleosomal organization of DNA 17. Detection of DNA damage 18. Mutations, mutagenesis and supresors 19. Ames test 20. Mutagenicity of DNA replication 21. Reversion of DNA damage 22. Photoreactivation 23. DNA photolyase 24. Base excision repair 25. DNA glycosylases 26. Nucleotide excision repair 27. Mismatch repair 28. DNA double strand breaks and their repair 29. Homologous recombination repair 30. Non-homologous end joining 31. Single strand annealing 32. Error-prone DNA polymerases

Method and Criteria of Assessment
Credit in the form of conversation during the last lecture

Teaching Method
Lecture - lecturing, giving spoken explanations of the subjects illustrated with static and dynamic pictures.

“Ecology of Parasitism”

The lecture considers basic aspects of the parasites in the ecosystem. It is divided to the main topics: Host-parasite evolution, types of parasites, types of hosts, costs of being the host, factors influencing parasite population, influence of parasite on host population, mediation of the host behavior by the parasite, food web patterns and the parasite’s perspective, parasitism and environmental disturbances

Prerequisits
1. Explains basic phenomena and biological processes on different levels of biological organizantion. 2. Uses biological specialist terms in Polish and English languages. 3. Chooses and operates scientific literature in Polish and English languages. 4. Synthesizes scientific data from different sources in Polish and English languages.

Effects of Teaching
1. Explains complex phenomena and biological processes. 2. Criticizes and synthesises scientific data from different sources in Polish and English languages. 3. Criticizes effect of the parasite on its host. 4. Evaluates parasite influence on the host and the whole community in the ecosystem.

“Fluorescence and fluorescence probes in biological research”

Prerequisits
- basic knowledge of physics, especially atomic physics and optics - basic knowledge of organic chemistry - basic knowledge of cell biology - basic knowledge of metabolic pathways - basic knowledge of nucleic acid biochemistry - basic knowledge of protein chemistry

Effects of Teaching
Student: - describes the interactions between electromagnetic radiation and matter - defines the fluorescence phenomenon - explains the Jablonski's diagram - calculates the Stokes' shift magnitude - describes the interactions between an excited molecule and its surroundings - analyses the Stern-Volmer plot - differentiates between static and dynamic quenching - explains the radiative and non-radiative energy transfer phenomena - formulates FRET conditions - describes fluorescence polarisation and anisotropy - prepares a model of the fluorescence anisotropy measurement system - gives the examples of fluorescence anisotropy use in biology - defines a fluorophor - creates a scheme depicting GFP synthesis and action - gives the examples of fluorescenct proteins use in biology - points out the features of a good fluorescent marker - gives the examples of fluorescent markers use in biology - gives the examples of DNA-binding fluorescence dyes use in biology - explains the ratiometric ion concentration measurement basis - differentiates FRAP, FLIP and FLAP - points out and explains the function of fluorescent microscope building elements - points out and explains

the function of flow cytometer building elements - presents the differences between an analyser and a sorter - analyses 2D dot plot - uses the histogram to find the MFI value and to determine the antigen expression level vs control.

“Freshwater ecology”

Main aims: to introduce the fundamental knowledge about biology and ecology of freshwaters in Europe, and discuss the main requirements of the European Union in the field of freshwater conservation, sustainable management and restoration.

Prerequisits
Fundamental knowlegde of hydrobiology, hydrology, zoology and botany

Effects of Teaching
Concluding student activities: - student defines the main types of freshwater ecosystems and wetlands and identifies global freshwater resources; - student compares different habitat conditions in the major types of freshwater ecosystems in Europe, with emphasis on the role of key environmental factors that determine the occurrence of the aquatic organisms (fitobenthos, macrophytes, macrobenthos, fish); - student defines the main types of aquatic organisms and their importance in the water quality control of the aquatic environment; - student explains the mechanisms of response of aquatic organisms to various types of environmental disturbance (natural fluctuations and anthropogenic strresors); - student characterises an ecological status assessment of freshwater ecosystems, under the WFD; - student justifies the need for implementation of innovative methods for monitoring and protection of freshwater ecosystems; - student characterises the results of the ecological status assessment of freshwater ecosystems by specialists, in the field of control and protection of freshwater ecosystems, according to the WFD. Implemented directional learning outcomes: 04OŚ2A_W01, 04OŚ2A_W02, 04OŚ2A_W03, 04OŚ2A_W06, 04OŚ2A_W07, 04OŚ2A_U01, 04OŚ2A_U04, 04OŚ2A_U05, 04OŚ2A_U07, 04OŚ2A_K01, 04OŚ2A_K02, 04OŚ2A_K04, 04OŚ2A_K05.

Course Content
1. Freshwater resources: distribution, origins and forms; global water balance; freshwater typology. 2. The running water habitats: patterns in drainage basins (stream size, stream order; morphometry; longitudinal patterns; runoff and flow patterns); Types of lotic habitats (e.g. springs; low- to mid-order temperate streams; lake and reservoir outlets; large and floodplain rivers); Regional/biogeographical similarities and differences. 3. The running waters habitat templet: physical properties (e.g. oxygen, temperature, light, mineral substrate, riparian vegetation – influence on the biota;); water chemistry (geology/soil; land use: nutrients and pollution; organic matter and suspended solids; variation in water chemistry in space and in time); flow and hydraulics (discharge and current, shear stress, biological interactions); food resources and energy flow; nutrients. 4. Biology of freshwaters: types of aquatic organisms; Adaptations to life in running waters; Phenology and life history -

responses to environmental conditions. 5. The ecological integrity assessment of freshwaters: ecological status assessment under the European Water Framework Directive; biological quality components (periphyton, larger plants, benthic macroinvertebrate communities, fish communities). 6. Intercalibration of the assessment methods in UE; classification of water bodies under the WFD.

Method and Criteria of Assessment
Lecture(form of assessment): an essay

Teaching Method
Lecture with the use of multimedia.

"Genetics engineering"

Introducing of basic terms concerning genetic engineering/gene manipulation

Prerequisits
Basic knowledge on molecular genetics: structure of DNA and RNA, replication, transcription translation and recombination. English language intermediate skills.

Effects of Teaching
A student − appreciates the importance of gene manipulation in the light of legislature − distinguishes DNA cloning, cellular cloning and cloning of organisms – describes basic stages of cellular cloning − distinguishes categories of vectors used in cellular cloning − describes basic stages of PCR – interprets basic mechanisms of mammals cloning – describes the production of transgenic animals – discusses social and ethic aspects of human cloning − finds current information on gene manipulation in the Internet – extends his/her knowledge actively and independently

Course Content
1. Gene manipulation 2. Cutting and joining of DNA molecule 3. Plasmid vectors 4. Bacteriophage vectors 5. Complex vectors 6. Cloning strategies, gene libraries and cDNA cloning 7. Recombinant selection and screening 8. Expression in E. coli of cloned DNA molecules 9. Polymerase chain reaction 10. Genome maping 11. Genome sequencing 12. Importance of genomic sequences 13. Site-directed mutagenesis 14. Cloning in Saccharomyces cerevisiae and other microbial organisms

Method and Criteria of Assessment
Credit in the form of conversation during the last lecture

Teaching Method
Lecture - lecturing, giving spoken explanations of the subjects illustrated with static and dynamic pictures

“Human genetics”

Providing information on the significance of processes determined by the structure and function of the human genome, both in health and disease.

Prerequisits
Basic knowledge on molecular genetics: structure of DNA and RNA, replication, transcription translation and recombination as well as basic information on the structure and function of the human genome. English language intermediate skills.

Effects of Teaching
A student identifies time and tissue specificity of the expression of human genes is aware of a key role of RNA interference in regulation of human genes expression interprets the mechanisms underlying the gene-disease pathway explains familial susceptibility to some categories of diseases is aware of the role of repeating sequences in human pathology finds current information on human genetic diseases in the Internet – extends his/her knowledge actively and independently

Course Content
HUMAN GENE EXPRESSION 1. Spatial and temporal restriction of gene expression in mammalian cells 2. Transcriptional and post-transcriptional regulation of human gene expression 3. Epigenetic regulation of human gene expression 4. Histone modifications 5. Chromatin remodelling 6. Transcription by RNA polymerase I, II and III 7. Cis-acting regulatory sequences in the regulation of human gene expression 8. Long range control of gene expression 9. Imprinting and inactivation of the X chromosome 10. Unique organization and expression of Ig and TCR genes GENETIC MAPPING OF MENDELIAN CHARACTERS 11. Recombinants and nonrecombinants 12. Genetic markers 13. Informative and uninformative meioses 14. Multipoint mapping IDENTIFYING HUMAN DISEASE GENES 15. Position-independent strategies for identifying disease genes 16. Positional cloning 17. Computer assisting 18. Transcript mapping 19. Use of chromosomal aberrations 20. Functional complementation in transgenic mice MOLECULAR PATHOLOGY 21. Nomenclature of mutations 22. Loss- and gain of function mutations 23. Molecular pathology – from gene to disease 24. Expansion of unstable DNA repeats 25. Molecular pathology of chromosomal disorders 26. DNA repeats as a disease source

Method and Criteria of Assessment
Credit in the form of conversation during the last lecture

Teaching Method
Lecture - lecturing, giving spoken explanations of the subjects illustrated with static and dynamic pictures

“Insect diversity and adaptations”

The aim of the lecture is to present insect diversity and adaptations to different types of habitats. The following issues will be discussed: - world's hot-spots of insect biodiversity, their localization and history, - evolutionary history of insects as a main factor of actual species richness withing this group of arthropods (colonization of land, evolution of wings

and flight, holometabolism, evolution of mouthparts), - insect adaptations to feeding on plant and animal tissues (including parasites and parasitoids) - insect adaptations to extreme environments (hot springs, deserts, mountain icebergs and winter active fauna, open oceanic waters, caves), - coevolution of insects and flowering plants, - evolution and structure of insects societes. Assessment method: written test

Prerequisits
Basic knowledge in morphology, classification and ecology of insects.

Effects of Teaching
Student is able: - to characterise insect species diversity over the world, - to explain relationships among geological as well as climatic history of Earth and evolution of the insect fauna, - to point main adaptations of insects to life in different types of habitats, - to apply terminology proper for entomological studies. Realised learning outcomes for the field of study: 04B-2A_W01, 04B-2A_W02, 04B-2A_W03, 04B-2A_W04, 04B-2A_W05, 04B-2A_W07, 04B-2A_W08, 04B-2A_U01, 04B-2A_U02, 04B-2A_U05, 04B-2A_U07, 04B-2A_U08, 04B-2A_K02

“Microbes and their hosts”

Course title: Microbes and their hosts (faculty lecture) Speciality: all Year (semester): I/II (1) System of studies: stationary, II° (master degree), III° PhD students Lecturer: The academic workers of the Institute for Microbiology, Biotechnology and Immunology University of Łódź (prof. dr hab. M. Mikołajczyk-Chmiela, prof. nadzw. B. Sadowska, dr M. Kowalewicz-Kulbat, dr. M. Fol. Dr J. Gatkowska, mgr K. Rudnicka) Course form: lecture 13h (interdisciplinary lecture) Language: English Assessment method: presentation of selected topic by student’s own concept, coordination of scientific discussion. Aim: The aim of the course is to familiarize students with scientific vocabulary in English, in the field of microbiology, epidemiology, immunology and other related disciplines, as well as improving the understanding and use of English in speech and writing, in the context of the use of the specialized scientific literature.

Prerequisits
Preliminary requirements: assessment of bacteriology, immunology and genetics courses.

Effects of Teaching
Theoretical knowledge Student -explains in English the physiological and pathological processes in the human body, associated with the infectious agents: 04M2A_W02; P2A_W01, P2A_W02, P2A_W03, P2A_W04, P2A_W05, P2P_W01, P2P_W02, P2P_W03, P2P_W05. -characterizes in English components, phenomena and processes in the field of microbiology, epidemiology, immunology, genetics, and other related disciplines:04M2A_W01; P2A_W01, P2A_W03, P2A_W04, P2A_W05, P2P_W01, P2P_W03, P2P_W05. Practical knowledge Student -uses specialized scientific literature in English, in the field of microbiology,

epidemiology, immunology, genetics and other related disciplines, respecting the copyright: 04M2A_U07; P2A_U02, P2P_U02. Social competence Student -presents arguments for continuing education, update knowledge in the field of microbiology, epidemiology, immunology, genetics and related disciplines as well as improvement of professional competence: 04M2A_K01; P2A_K01, P2A_K05, P2A_K07, P2P_K01, P2P_K05, P2P_K07.

Course Content
Contents of teaching: Diversity of microorganisms. The hosp-parasite relationship. The evolution of parasitism. The natural microflora and its role in the host organism. Bacterial biofilms. Inflammation as a weapon in the fight against infectious agents. Natural resistance in action - TB and phagocytosis. Adaptive mechanisms of anaerobic bacteria. House dust as a cause of health problems. Toxoplasmosis zoonotic infection.

Method and Criteria of Assessment
Criteria and methods of assessment: student writes abstract on the selected topic in English.

Teaching Method
Forms of work: problem lecture, seminar discussion, student,s own work.

"Molecular genetics"

Providing basic information on the structure and function of nucleic acids in the context of organism physiology and pathology.

Prerequisits
Basic knowledge on molecular biology: structure of macromolecules and cellular metabolism. English language intermediate skills.

Effects of Teaching
− describes the structure of and differences between DNA and RNA − distinguishes pro- and eukaryotic DNA − interprets the nucleosomal organization of eukaryotic DNA − explains the processes granting the maintenance of the genome and its metabolism: DNA replication, recombination and metabolism – explains the mechanisms of the expression of the genome: transcription, translation and RNA splicing – finds current information on molecular genetics in the Internet – extends his/her knowledge actively and independently

Course Content
The Structures of DNA and RNA. Chromosomes, Chromatin, and the Nucleosome. The Replication of DNA. The Mutability and Repair of DNA. Homologous Recombination at the Molecular Level. Site-Specific Recombination and Transposition of DNA. Mechanisms of Transcription. RNA Splicing. Translation. The Genetic Code.

Method and Criteria of Assessment
Credit in the form of conversation during the last lecture.

Teaching Method
Lecture - lecturing, giving spoken explanations of the subjects illustrated with static and dynamic pictures.

"Molecular genetics II"

Providing basic information on the regulation of gene expression.

Prerequisits
Basic knowledge on molecular genetics. English language intermediate skills.

Effects of Teaching
describes the regulation of gene expression at transcriptional level − distinguishes basic mechanisms of gene expression in Pro- and Eukaryots − interprets the fundamental role of regulatory RNAs in regulation of gene expression − explains the mechanism of gene expression in development and evolution – describes genome analysis – finds current information on molecular genetics in the Internet – extends his/her knowledge actively and independently

Course Content
Principles of transcriptional regulation. Regulation of transcription initiation: examples from prokaryotes. The cased of bacteriophage lambda: layers of regulation. Conserved mechanisms of transcriptional regulation from yeast to mammals. Recruitment of protein complexes to genes by eukaryotic activators. Signal integration and combinatorial control. Transcriptional repressors. Gene silencing by modification of histones and DNA. Epigenetic gene regulation. Regulation by RNAs in bacteria. RNA interference is a major regulatory mechanism in Eukaryotes. Synthesis and functions of miRNA molecules. The evolution and exploitation of RNAi. Regulatory RNAs and X-inactivation. Three strategies by which cells are instructed to express specific sets of genes during development. The molecular biology of Drosophila embryogenesis. Homeotic genes: an important class of developmental regulators. Genomic overview. Systems biology.

Method and Criteria of Assessment
Credit in the form of conversation during the last lecture

Teaching Method
Lecture - lecturing, giving spoken explanations of the subjects illustrated with static and dynamic pictures

"Paradise not yet lost- enormous biodiversity in waters"

Objectives: Defining physical, chemical, geological and biological factors shaping marine and freshwater environments; Understanding complexity of relationships among abiotic factors and organisms in marine and freshwater ecosystems; Knowledge of basic hypotheses explaining biodiversity in marine and freshwater ecosystems; Ability to describe and explain

the adaptations of organisms to life in aquatic ecosystems; Awareness of anthropogenic factors influencing aquatic environments and ability to critical assessment of this influence.

Prerequisits
Basic knowledge and abilities in zoology, botany, ecology and hydrobiology obtained during the 1st level studies (biology or nature protection).

Effects of Teaching
After completing the course, student identifies physical, chemical, geological and biotic factors typical for marine and freshwater ecosystems; lists and defines biocenoses associated to various habitats in aquatic environments; explains influence of abiotic factors on aquatic organisms and selects examples of adaptations of organisms to life in various types of marine and fresh waters; qualifies anthropogenic factors influencing hydrosphere; appraises the need for protection and sustainable management and explitation of hydrosphere resources. 04B-2A_W05; 04B-2A_W06; 04B-2A_U02; 04B-2A_U05; 04B-2A_U06; 04B-2A_U08; 04B-2A_U11; 04B-2A_K06; 04B-2A_U08.

Course Content
1. Characteristic of water environment. 2. Adaptations for living in water 3. Ocean environment and adaptations of organisms for living in different oceanic domains 4. Community structure of shallow water and deep sea habitats. 5. Oceanic oases: tropical coral reefs, cold coral reefs. 6. Underwater mountains, chemoautotrophic ecosystems, 7. History of biological research in the Arctic and in the Antarctic. 8. Evolution of Arctic and Antarctic marine fauna. 9. Diversity of Antarctic benthos. 10. Environmental protection of polar ecosystems. 11. Life underground: karst, caves, interstitial waters, from springs to the sea Springs, river continuum, deltaic systems and lagoons. 12. Lakes: lake types, ancient lakes and their biodiversity, temporary waters and other unusual aquatic habitats: temporary rivers and lakes, sulphur ponds, hot springs etc., 13. threats to aquatic ecosystems and conservation issues. 14. Biodiversity of water ecosystems: databases.

Method and Criteria of Assessment
written test

Teaching Method
lecture

Bibliography
3. Literatura: Allan J.D., Castillo M.M. 2007. Stream ecology - structure and function of running waters. Springer. Brönmark C., Hansson L-A. 2005. The Biology of Lakes and Ponds. Oxford University Press. Giller P.S., Malmqvist B. 2004. The Biology of Streams and Rivers. Oxford University Press. Clarke, A., Johnston, N.M., 2003. Antarctic marine benthic diversity. Oceanography and Marine Biology: An Annual Review 41, 47-114. Shirihai, H. (2002) A complete guide to Antarctic wildlife: the birds and marine mammals of the Antarctic continent and the Southern Ocean. Princeton University Press. Herring P. 2002. The biology of the deep ocean. Oxford University Press Gage J.D., Tyler P.A. 1991. Deep-sea biology. A

natural history of organisms at the deep-sea floor. Cambridge University Press, Cambridge Van Dover C.L. 2000. The ecology of deep-sea hydrothermal vents. Princeton University Press

“Physiology of Animals/Principles of Neural Sciences”

The aim: review of selected problems concerning the structure and function of the central nervous system of animals (including human) for foreign students

Prerequisits
1. The knowledge of basic terms in the animal physiology 2. The knowledge of basis of biochemistry and biophysics 3. The knowledge of neuroanatomy 4. The knowledge of advanced English

Effects of Teaching
1. Definse in English main neurobiological therms 2. Describes mechanisms of orgin of resting qnd action potentials 3. Explains principal phenomenons concerning theynaptic transmition 4. Explains principle of function of reflex arch 5. Clasiffies types of reflexes 6. Describes mechanisms of orgin of wake and sleep. 7. Explains the risk of non hygienic style of life. Realized lerning effects: - 04B-1A_W05; 04B-1A_W06; - 04B-1A_U02; 04B-1A_U05; 04B-1A_U06; 04B-1A_U08; 04B-1A_U11; - 04B-1A_K05; 04B-1A_K07.

Course Content
1. The morphology of neuronal cell including cell membrane and insets 2. Process of generation of resting and action potential 3. The synapse structure and the synaptic transsmition (chemical and electrical synapse) 4. Sensory receptors (receptor potential and generator potential), sensory organs 5. Principles in neuroanatomy 6. Reflex arch: structure and function 7. Central regulation of selected functions 8. Sleep and wake

Method and Criteria of Assessment
attendance of lecture, oral exam-2 questions

Teaching Method
Lecture

“Plant in vitro culture: theory and practice”

The aim if this course is to provide basic theoretical concepts in the area of plant in vitro cultures and their applications in modern plant biotechnology.

Prerequisits
Biology and chemistry on secondary school levels

Effects of Teaching
Student: E1 - defines the main types of plant in vitro cultures E2 - describes the methods of micropropagation and plant transformation E3 - recognizes the applications of plant in vitro cultures in biotechnology

"Stem cells"

Introducing of basic terms concerning stem cells

Prerequisits
Basic knowledge on molecular genetics: structure of DNA and RNA, replication, transcription translation and recombination as well as basic terms of genetic engineering. English language intermediate skills.

Effects of Teaching
A student appreciates the importance of research on stem cells in the light of leislature and social demands distinguishes totipotent, pluripotent, multipotent and monopotent stem cells – describes reprogramming of somatic cells to a pluripotence stage explains the perspective of clinical use of stem cells describes embryonic and cancer stem cells – discusses social and ethic aspects of the use of human stem cells finds current information on stem cells in the Internet – extends his/her knowledge actively and independently

Course Content
Why stem cells research? A new path: induced stem cells. "Stemness": definitions, criteria and standards. Pluripotent stem cells from vertebrate embryos. Embryonic stem cells in perspective. Molecular bases of stem cell self-renewal. Epigenetic mechanisms of cellular memory during development. Cord blood hematopoietic stem and progenitor cells. Stem cells and the regenerating heart. Adult liver stem cells. Stem cells in the gastrointestinal tract. Induced pluripotent stem cells derivation. Characteristic and characterization of human pluripotent stem cells.

Method and Criteria of Assessment
Credit in the form of conversation during the last lecture

Teaching Method
Lecture - lecturing, giving spoken explanations of the subjects illustrated with static and dynamic pictures

"Sustainable development- the challenge of XXI century"

The aim of the course is to introduce the theoretical and practical aspects of sustainable development. SD rules are discussed on the basis of various economic sectors: energy, transport, agriculture. Issues related to the problem of excessive consumption, environmental awareness and practical methods to reduce the negative impact on the natural environment are addressed.

Prerequisits
Proficiency in modern spoken and written English, ability to cause-effect thinking and to analysis and synthesis, knowledge of computer skills.

Effects of Teaching
Student: • explains the economic and social causes of degradation of the environment • characterizes climate change problems as a basis for defining an environmental policy, • identifies opportunities for the use of the modern sciences achievements in favor of sustainable development, • uses specialized terms in English in the development of presentations in the field of environmental protection, • formulates judgments on important social and environmental issues, • outlines the implications of action taken by environmental protection specialists. Directional learning outcomes: 04OŚ2A_W03, 04OŚ2A_W06, 04OŚ2A_W07, 04OŚ2A_U10, 04OŚ2A_K03, 04OŚ2A_K06

Course Content
1. Fundamentals of Sustainable Development (SD) 2. The effects of climate change and the possibility of their reduction 3. Sustainable transport - utopia or reality? 4. Industrial agriculture and organic farming, 5. Do we stop the loss of biodiversity? 6. Evaluation of the SD implementation in Poland and the European Union 7. Environmental awareness as the basis for SD

Method and Criteria of Assessment
activity, the assessment of a group presentation

Teaching Method
multimedia presentation, discussion, group work

“The human genome”

Presentation of the aim and methodology of genome sequencing as well as current information on the genome structure-organism phenotype relationship. Presentation of basic techniques employed in genome sequencing.

Prerequisits
Basic knowledge on molecular genetics: structure of DNA and RNA, replication, transcription translation and recombination as well as basic information on gene manipulation: vectors, cell-based and cell-free cloning, DNA sequencing. English language intermediate skills.

Effects of Teaching
A student identifies Human Genome Projects and its goals critically interprets press news on successes of the Project explains the mechanism underlying the genotype-phenotype pathway distinguishes between "genome sequencing" and "genome project" finds current information on human genome in the Internet prepares for advanced techniques used in genome research

Course Content
THE HUMAN GENOME PROJECT 1. Goals of the Human Genome Project 2. The tools used in the study of the genome 3. Cloning and sequencing of chromosome fragments 4. Questions and doubts associated with the Human Genome Project 5. „Junk DNA" HUMAN GENOME MAPING AND SEQUENCING 6. Medial aspects of the Human Genome Project 7. Research strategy in the Human Genome Project 8. Genome mapping 9. Hybrid cells in the Human Genome Project 10. Radiation hybrid cells mapping 11. Shotgun strategy 12. Genes identification 13. In silico genome analysis ORGANIZATION OF THE HUMAN GENOME 14. Nuclear and mitochondrial genomes 15. Mitochondrial genes 16. The genetic code in the mitochondrium 17. Functional diversity of human genes 18. Human genes with uninterrupted coding sequences 19. Genes-within-genes 20. Functionally similar genes 21. Gene families 22. Retrogenes and pseudogenes 23. Human proteome 24. DNA repeats INSTABILITY OF THE HUMAN GENOME 25. DNA damage and mutation 26. Distribution and frequency of mutation in the human genome 27. Pathogenic potential of DNA repeats 28. Unequal crossover, unequal sister chromatid exchange and gene conversion 29. Splicing mutations 30. Short tandem repeats as a hot spot of mutations 31. DNA repair PRACTICUM ON BASIC METHODS EMPLOYED IN HUMAN GENOME RESEARCH 1. Restriction enzymes 2. Plasmid, phage, cosmid and YAC vectors 3. Cell-based cloning 4. PCR 5. In silico DNA analysis

Method and Criteria of Assessment
Credit on the basis of conversation during the last lecture

Teaching Method
Lecturing, giving spoken explanations of the subjects illustrated with static and dynamic pictures

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"Human molecular genetics 3" Tom Strachan, Andrew P. Read, Garland Science, New York, 2004; „The human genome" Julia E. Richards, R. Scott Hawley, Elsevier Academic Press, 2005; "Genomy" T.A. Brown, Wydawnictwo Naukowe PWN, Warszawa, 2009

"Urban Ecohydrology"

Urban Ecohydrology covers issues related to the challenges, opportunities, methods and examples of ecohydrology and ecosystem biotechnology application in urban areas. It introduces their role in creating a sustainable, environmentally friendly, healthy cities of the future; and the benefits of system solutions and transdisciplinary knowledge in understanding and management of the complex links among ecological, technical, economic, social and institutional structures of the city. Theory and practice of innovative methods of organisation and facilitation of work in multi-institutional stakeholder platforms includes building a vision, scenarios and strategies for urban systems.

Prerequisits
Fundamentals of ecology; The basics of the protection of the environment; The basics of ekohydrologii; Knowledge of English is an asset;

Effects of Teaching
Explains the mechanisms, effects and methods of mitigating the impacts of urbanization on the natural environment; Discuss the complexity of processes and transdisciplinary character of environmental management in urban areas; Develops scientific research as the basis for designing innovative solutions for rehabilitation of freshwater ecosystems in the urban area; Formulate and verifies research hypotheses by integrating knowledge from various fields of science; Uses statistical methods and computer techniques to carry out research tasks; Communicates with stakeholders in the course of the performance of the tasks of the research; Uses a specialized terms in English and Polish; Critically evaluates the results of conducted observation, information from the scientific literature and media relating to socio-ecological aspects in the city; Effectively apply modern methods of communication and moderation; (04OŚ2A_W03; 04OŚ2A_W05; 04OŚ2A_U01; 04OŚ2A_U02; 04OŚ2A_U03; 04OŚ2A_U05; 04OŚ2A_U09; 04OŚ2A_U10; 04OŚ2A_K02; 04OŚ2A_K07; 04OŚ2A_K08)

Course Content
Lectures: 1. challenges generated by urban development, its impact on water resources and their management in the face of global change; 2. the effect of antropopressure on water ecosystems as the basis for decision-making in management and rehabilitation measures; 3. IUWRM, BMPs, LID, SUDS in the regeneration and management of the water cycle in the city; 4. regeneration of biogeochemical cycles and water pollution control in cities; 5. system solutions: integrating water management, urban infrastructure and social, economic and cultural systems; the methodology; 6. ecosystem services in cities; 7. green infrastructure in urban planning; The importance of sustainable development and planning of cities for public health; The Concept of Blue-Green Network; 8. the management of water in cities in the EU directives and international acts; 9. the theory and practice of cooperation in stakeholder platforms including stakeholder maps and institutional building; 10. the methodology of building the vision, scenarios and strategic plans, communication and facilitation in stakeholder platforms; Technical classes: 1. system solutions on the Sokolowka River - River City rehabilitation for improving retention and quality of stormwater the quality of life of the inhabitants; 2. Sequential Sedymentary-Biofiltration System for stormwater purification; 3. energy plantations at Lodz Waste Water treatment Plant - system solutions for the nutrient regeneration and production of clean energy; 4. stormwater systems Modeling; 5. Methodology of building the vision, scenarios and strategic plans, communication and facilitation in stakeholder platforms;

Method and Criteria of Assessment
1. Results of the workshop exercises on the basis of complexity and reliability of the developed opinions and solutions (15%); 2. Essay 35%; 3. Multimedia presentation 15%; 4. Final Test 35%;

Teaching Method

1. Multimedia Lectures; 2. Movies; 3. Workshops using modern methods of facylitation and communication (e.g., Cafe World; Open Space); 4. Preparation of presentation; 5. Reports; 6. Self-study.