Transilvania University of Braşov, Romania

Study program: Sustainable Product Design and Environment Protection

Faculty: Product Design and Environment
Study period: 2 years (master)

1st Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Energy and environment	D01.TC.01.1	3	1	1		

Course description (Syllabus): Energy-environment relationship. The concept of sustainable development. The energy considering the product's life cycle. Categories of environmental impacts. Energy production based on fossil fuels and its consumption along with the environmental impact. Photovoltaic systems; the life cycle of photovoltaic modules. Solar-thermal systems; coloured flat plate solar-thermal collectors with increased architectural acceptance. Energy sources based on biomass. Wind turbines; environmental problems associated with the production, location and decommissioning of wind turbines. National and local policies and strategies on climate change.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Advanced engineering design	D01.TC.01.2	5	3			2

Course description (Syllabus): Design and development of the technical products. Models in engineering design. The product considered as a technical system and its properties. Clarification and formulation of a technical problem. Abstracting and deviding a problem into sub-problems of various orders. Solving higher-order problems by aggregating solutions for lower-order problems. Evaluation and selection methods for the appropriate solutions. The phases of the product's life and the cycles related to it. The main modules of the advanced design for a technical product and the correlations between them. Algorithms and methods of the advanced design modules. Principles for the development of new and innovative solution(s); the TRIZ method and the CreaTRIZ software. Documentation of the product and typical aspects of the design for manufacture, sale, exploitation and disposal of the product. Prototyping and simulation in product design. Computer-aided prototyping and simulation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Eco-Design	D01.TC.01.3	3	1			1

Course description (Syllabus): Environmental protection, legal frame, product design, current design problems and "greening" design solutions. Production of materials. Efficient use of raw materials. Manufacturing the products. Clean production, clean technologies. Products' transport and distribution. Transport networks, different types of transport, their characteristics and impact on the environment, product's transport at different stages of the product life cycle. Use of products. The influence of the design on the material and energy consumption of the product during its lifetime. End-of-life options. Design strategies for end-of-life. Tools for assessing the environmental impact of products. Eco-indicators. Eco Web Design, the ecological footprint, the ecological backpack, the amount of energy stored, life cycle assessment, rethinking the designer's relationship with the environment. Product life cycle assesment. LCA limits, purpose and objectives, life cycle inventory analysis, data collection, results, interpretation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
RES Design	D01.TC.01.4	6	3	1		1

Course description (Syllabus): Renewable energy sources and systems: design, policies, strategies. Design requirements. Technical, economic and legal aspects. Feasibility study in the design of renewable energy systems. Solar energy conversion systems: solar thermal, photovoltaic (PV) and photovoltaic-thermal (PVT) systems. Wind energy conversion systems. Geothermal energy conversion systems. Micro-hydro systems. Hybrid systems based on renewable energy sources. Cogeneration systems based on renewable energy sources. Mixes of renewable energy systems. Sustainable communities.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Applied English language	D01.TC.01.5	3	1	1		

Course description (Syllabus): The verb in English, verbs commonly used in the sustainable development domain and in energy systems. The noun in English: countable / uncountable, the plural in English, the status of the noun in the scientific language. The adjective, the adverb, the conjunction, the preposition, the numeral, its use in science. Information resources: information search, texts available in electronic format, specialized language. Translation in the scientific area.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Academic ethics and integrity	D01.TC.01.6	3	1	1		

Course description (Syllabus): Attitude and ethical behaviour in the academic area. Principles of the research ethics. Academic writing. Documentation. Structure of the research paper. References. Plagiarism. Honesty. Loyalty. Environmental ethics.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Engineering modelling and simulation	D01.TC.02.7	6	2		2	1

Course description (Syllabus): Phases of the design process in the virtual environment. Modeling components and systems. Systems analysis (simulation). Parameterization of virtual models. Configuring the parameters for the optimal design. Investigation strategies for the analysis of the design sensitivities (parametric study, design of experiments). Optimizing systems with and without design constraints. Optimal design of mechatronic systems. Advanced software solutions for computer-aided engineering.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Advanced materials for design	D01.TC.02.8	4	2		1	

Course description (Syllabus): Advanced materials: materials with controlled properties, sustainable materials. The structure – properties correlation(s). Control of the material's properties: destructive and non-destructive techniques. Mechanical, optical, thermal, conductivity tests. Surface characterization. Metallic materials: corrosion control. Ceramic materials: ceramic block and ceramic nanostructures; control of the tribological, optical, opto-electronic properties. Polymeric materials: plastics and rubber; advanced polymers, conductive polymers. Composite materials: design of composite materials, 1D, 2D, 3D composites. Critical material. Possible solutions for the replacement of critical materials.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Industrial project management	D01.TC.02.9	4	1			1

Course description (Syllabus): The national strategy on innovation and technology transfer. Competitiveness. Profitability. Innovation. Technology transfer. Objects of intellectual property. Innovation, management of innovation.

The invention of service. The economic value of the patent. Technology licensing. The film of the operations for processing a landmark within an innovative product. Elements of cutting regimes, time rules required for mechanical processing. Location of the machines.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practice I 140 hours/sem.	D01.TC.01.10	6				
Practice I 140 hours/sem.	D01.TC.02.11	6				

Course description (Syllabus): Systematic methodologies for developing functional, constructive or improved solutions for an industrial product / process. Theoretical and experimental research based on carefull planning. The technical-economic evaluation of the solutions resulting from the analysis of the theoretical or experimental data. Synthesizing relevant conclusions and communicating the research results. Self-evaluation of the practical activity. Using the communication skills within a group and in relations with other specialists. Analysis and synthesis on the evaluation of the activity within an organization.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Advanced computer aided animation	D01.PD.02.12	5	2		1	1

Course description (Syllabus): Fundamentals of animation. Setting animation keys. Types of controllers. Editing controllers. Animation at the level of modification functions: PathDeform, SurfDeform, Morpher, Tesselate and Displace functions. Spatial deformations: Bomb, Wind, Gravity, Wave, Ripple, Conform functions. Position animation (Bézier Controllers, Position XYZ, Path, Position List, Noise Position). Rotation animation (TCB controllers, Euler XYZ, Look At). Animations using expressions. Audio Controller, Spring Controller, Waveform Controller, Color RGB Controller (Point3 XYZ Controller). Controlling Constraints: Attachment Constraint, Surface Constraint, Position Constraint. Link Constraint. Linking and reverse kinematics. Animations with HD IK Solver. Dynamic simulations. Dynamics Utility. Controller Reactor.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Graphic design	D01.PD.02.13	5	2		1	1

Course description (Syllabus): Perception. Dynamic balance in graphics. Gestalt theory applied in Graphic Design. Using fonts. Chromatic balance. Composition. The compositional balance. Sizes and proportions. Themes and visual rhythm. Use of illustration and photography in the graphic design. Design for advertising. Typography production. Tools and processes.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Renewable energy systems for thermal energy production I (geothermal and biomass systems)	D01.RE.02.12	5	2		1	1

Course description (Syllabus): Energy and the environment. The energy demand. The legal frame on the use of renewable energy sources. Geothermal energy. Global, European and national geothermal potential. Conversion systems of the geothermal energy into electrical or thermal energy. Heat pump systems for the geothermal energy conversion. Types of geothermal heat exchangers and of heat pumps. The operating principle of the heat pumps. Reversibility of the heat pumps. Evaluation of the energy performance of the heat pumps. The technical and economic feasibility of the geothermal energy conversion systems with heat pumps. Applications of the geothermal energy conversion systems with heat pumps. Systems with heat pumps with other heat sources (water, air, waste heat). Hybrid systems based on heat pumps. Implementing heat pumps systems in the built environment. Assessing the energy demand in the built environment. Evaluating the geothermal energy potential in a given location area. Sizing of the geothermal heat exchangers. Sizing the geothermal heat exchangers. Simulating the operation of the heat pump systems. Assesing the building's energy status following the implementation of the geothermal system. Energy

plants. Establishing the breeding ground, the growing conditions, the type of energy plant according to the type of soil, the technology for growing and processing the biomass, machines and equipment used. Case study - Green Energy Cluster - energy willow culture from Moacșa, Covasna County. Technologies for biomass conversion into thermal energy. Efficiency and costs of the installations. Types of biomass-based thermal power plants.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Renewable energy systems for electrical energy production I (wind and micro-hydro systems)	D01.RE .02.13	5	2	2		

Course description (Syllabus): Types of wind turbines (WT), components, construction, operation, assessing the wind potential; national and international standards for implementing WT. Design of a micro-wind system: the parameters, the feasibility study and the wind speed assessment. Methods for site evaluation: the geographical, weather and built environment study. Design of the electromechanical equipment (turbine, amplifier, generator). Types of micro-hydroelectric plants, components, construction, operation, estimation of the hydro potential. Design of a micro-hydroelectric plant: the feasibility study. Estimating the hydropower potential and the energy demand. Design of the transfer system and of the electromechanical equipment (turbine, speed increaser, electric generator). Control aspects. Environmental impact assessment, financial evaluation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Advanced materials and processes for water treatment	D01.ED. 02.12	5	2		1	1

Course description (Syllabus): Water - source and resource. Properties of pure water. The interaction of water with matter. Natural water, wastewater. Sources of water pollution. Product development and water pollution. Adapting the project of the water treatment plant to the type of water. Advanced treatment / conventional treatment processes: oxidation, photodegradation, osmosis, adsorption, disinfection. Water treatment for residential consumption and for industrial uses. Specific removal processes for pollutants / toxics. Desalination of salty water for consumption.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Advanced environmental chemistry	D01.ED.0 2.13	5	2	1	1	

Course description (Syllabus): Water chemistry. The use of water. Water pollutants: heavy metals, inorganic species, organic pollutants. The atmosphere chemistry. Chemical reactions in the troposphere and stratosphere. Atmospheric pollutants and atmospheric pollution events: particulate matter, gaseous inorganic pollutants, organic pollutants. Acidifying the atmosphere. Smog. Decreased ozone layer. Indoor air pollution. Soil chemistry. Soil pollutants from agricultural activities: nutrients, pesticides. Waste. Effects of waste on the environment. Circular economy.

2nd Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practice for research I 112 hours/sem.	D01.TC.03.1	6				
Practice for research II 196 hours/sem.	D01.TC.04.4	15				

Course description (Syllabus): Comparative analysis and synthesis of the development level in the research field. Identifying the main research lines and trends in the field. Identify possible applications to be addressed in the dissertation work. Comparative analysis of the identified solutions. Synthesis of the innovative solutions and their optimization. Experimental validation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Valorisation of the research results	D01.TC.04.2	5	2			2

Course description (Syllabus): Research and the inovative/new research results. Types of research results and their valorising paths. The role of communication of the research results. Publishing the research results. Selecting the type and the scope of the journal/publication. The general structure of a scientific paper. Selecting the data to be published. Selecting the journal where the paper is intended to be published. Developing a research paper: the structure of the Introduction, describing the experimental part, describing and discussing the results, formulating the conclusions, citing the references. The legal frame on patenting: the invention subject of pattenting; rights and obligations; protecting the intellectual property rights; recording, publishig and checking the pattent proposal, pattent submission. Pattent databases. Searching and selecting the state of the art patents. Identifying the similarities and the limitations of the already pattented solutions existent in the research literature. Developing the pattenting documentation. Describing the invention. Claims. Technical drawings. Abstract of the invention subject of pattenting.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practice for elaboration of dissertation thesis 140 hours/sem.	D01.TC.04.4	10				

Course description (Syllabus): Systematic methodology for the development of the constructive / functional model / industrial process solutions. Theoretical or experimental research based on planning. Technical-economic evaluation of the identified solutions and processing the theoretical or experimental data. Synthesize relevant conclusions and communicate the results.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Advanced mechanical engineering design	D01.PD.03.5	3	2			1

Course description (Syllabus): Energy sizing of a machine. Calculation of loads. Calculation of cylindrical gears. Calculation of bevel gears. Calculation of worm gears. Calculation of chain transmissions. Calculation of belt transmissions. Shaft calculation. Bearing calculation. Dedicated software applications. Using the software applications.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Control engineering	D01.PD.03.6	3	2			1

Course description (Syllabus): Applications of computer science in engineering. The graphic programming environment. Programming elements. Data types and structures. Programming structures. Elements for graphic representations. Objects included in the front panel. File operations. Application planning.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Integrated product design	D01.PD.03.7	4	2			1

Course description (Syllabus): Introduction to integrated product design and development. Matrix of product development: structure, line elements: general solution algorithms, column elements: life cycle modules of the product. Modelling matrix elements. Analysis and conceptual synthesis in the development of a technical product. Algorithms and methods of advanced prototyping modules. Solutions for representative functions in the development of technical products. Integrated product development. Phases and influence factors in the integrated development process. The cycle of the development process and the product cycle. Organizational forms in integrated product development: simultaneous engineering and concurrent engineering. Short-term product development. The role of marketing and technological innovation in the integrated development of a product.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Advanced aesthetics and ergonomics	D01.PD.03.8	4	2			1

Course description (Syllabus): Sensorial perception. Rhythm, visual balance, visual weight, visual dynamic. The perception explained using the principles of the Gestalt psychology. Subliminal perception. Optical illusions. Shape: ways to reach the object's shape and the form – function - material - technology correlations. Colour: colour sources, colour perception and psychological effects, colour mixtures, colour contrasts and combinations, colour-form and colour-light relationship. Materials and textures: surface quality of the products, materials as texture sources, products' appearance and surfaces finishing. Proportion and proportionality: proportionality laws, methods for obtaining proportionality. Semiotics. Human communication through signs. Semantics, syntactics, pragmatism. Relationship between sign, its object and its significance. The aesthetics principles applied in product design. Aesthetics in conceptual and embodiment design. Industrial products' shape and colour. The product visual aspect. Product emphasis. The product shape reflecting the form-function relationship. The aesthetics of product presentation. The package. Package functions and characteristics. The aesthetic of package design. The aesthetics of product promotion. The advertising aesthetics: poster, advertisement, flyer, folded ad, advertising clip, leaflet. The aesthetic function of: the firm, the brand, the label, the product catalogue. Exhibition facilities: stand, show window, exhibition stand. The impact of the aesthetic principles in advertising. Elements of corporate identity. The economic and social effect of the aesthetic product design. Modern concepts in industrial design: modular solutions, standardization, flexible flows, serial production, mechanical aesthetics. The aesthetic design of industrial products using CAD methods. The sketch, geometric modelling, assisted simulation. The industrial aesthetics in CAD. Elements of advanced ergonomics. Conceptual and correction ergonomics. Cognitive ergonomics. Working conditions. Physical environmental factors. Psychological environmental factors. Product ergonomics. Anthropometrics. The human-product-environment relationship. Designing ergonomic products. Ergonomic principles and safety norms in product design.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Design of renewable energy systems (RES)-based products	D01.PD. 03.9	5	2			2

Course description (Syllabus): RES based products. Methods for developing the virtual prototype of RES-based products. Identify the possibilities to define the forces / moments necessary for the launch of the products based on RES. The choice based on the identified forces / moments of the electromechanical systems required for the movement of the products based on RES. Choosing the RES components able to provide the energy required for the products. Implementing the electromechanical, lighting and RES components in the product. Optimizing the virtual prototype. Transposition from virtual to real environment of RES based products. Testing RES-based products, identifying weaknesses and possible improvements.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Products testing	D01.PD.03.10	5	2		2	

Course description (Syllabus): Classification of tests. Performance test. Establishing the significant product parameters for testing. Setting the limit values of the parameters and the allowed error percentage. Recording, analysis and interpretation of the experimental data. Testing results. Test of resistance. Establishing the testing parameters. Recording, analysis and interpretation of the experimental data. The test of sustainability. Product testing facilities. Operating principles. Installations with open energy circuit. Closed circuit energy installations. Equipment required for the products testing. Driving equipment. Measurement equipment. Equipment for recording and processing the experimental results.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Tracking systems for solar energy convertors	D01.RE.03.5	4	2			1

Course description (Syllabus): Types of solar energy conversion. Characteristic functions of solar energy conversion systems. Specific requirements and functions of the conversion process of solar energy into electric / thermal energy. Types of mechatronic systems used to increase the efficiency of solar energy conversion. Modelling the solar radiation and the solar angles. Mechatronic tracking systems for increasing the efficiency of the solar energy conversion into electric / thermal energy. Analysis, modelling and optimization of solar tracking programs according to the local climatic factors. Analysis and modelling of the main types of mechatronic solar tracking systems. Design, implementation and maintenance of mechatronic tracking systems for solar energy converters.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Renewables for electrical energy production II (photovoltaic and hybrid systems)	D01.RE.03.6	6	3		1	1

Course description (Syllabus): Solar radiation, wind and precipitation as input data in the design of hybrid systems. Variability and predictability of the solar energy. Characteristics of hybrid electric systems (standard properties, functional properties). Optimizing the electrical response of hybrid systems (materials selection, selection of the operating conditions, orientation of the photovoltaic modules). Optimal design of hybrid electric systems; capitalizing on local renewable resources; particular aspects in the built environment. Feasibility of hybrid electric systems; functional and economic aspects, implementation area. Sustainability of hybrid renewable electricity systems; LCA analysis, recycling of photovoltaic modules.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Renewables for thermal energy production II (solar thermal and hybrid systems)	D01.RE.03.7	6	3		1	1

Course description (Syllabus): Energy, solar energy, conversion of the solar energy into thermal energy. Solar thermal systems. Optimizing the solar thermal energy conversion systems. Hybrid thermal energy conversion systems based on renewable energy sources. Optimizing the hybrid thermal energy conversion systems based on renewable energy sources.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Renewable energy systems in the built environment	D01.RE.03.8	3	2			1

Course description (Syllabus): The thermo-hygro-energetic configuration of the buildings in the context of the use of renewable energy systems. Evolution and structure of the energy demand in buildings. Assessing the energy demand in buildings. The concepts of "Passive House", "Low Energy Building", "Nearly Zero Energy Building", "Zero Energy Building" and "Plus Energy Building". The legal basis for thermo-hygro-energy configuration of the buildings. Methodology for calculating the energy performance of the buildings. Improved constructive solutions in the thermo-hygro-energy design of buildings. Optimizing the thermal protection level of the buildings when using renewable energy systems. Types of solutions. Composition rules. Assessment of the building energy performance following the implementation of the improved solutions. Implementing renewable energy systems in the built environment. The potential of renewable energy sources specific to the building location. Selecting, sizing and implementing renewable energy systems. Assessing the building energy status after implementing renewable energy systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
RES implementation, operation and maintenance	D01.RE.03.9	5	2		2	

Course description (Syllabus): Implementation, operation and maintenance of solar thermal systems. Implementation, operation and maintenance of heat pump systems. Implementation, operation and maintenance of

solar thermal and heat pump hybrid systems. Implementation, operation and maintenance of photovoltaic systems. Implementation, operation and maintenance of wind energy systems. Implementation, operation and maintenance of hybrid electric systems composed of photovoltaic modules and wind turbines.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Environmental monitoring and impact assessment	D01.ED. 03.5	5	2			2

Course description (Syllabus): National and European institutions involved in environmental monitoring and environemntal impact assessment. Romanian and European Union regulations on environmental quality (air, water and soil) and environmental impact assessment. Evaluating the toxic compounds in air, water and soil. Standard methods for sampling and analysing environmantal samples. Accredited laboratories for environmental analysis. Integrated environmental impact assessment.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Advanced processes for wastewater treatment	D01.ED. 03.6	5	2			2

Course description (Syllabus): Wastewater treatment for recycling and reuse. Conventional *vs.* advanced wastewater treatment processes. Materials and processes for concentrating the pollutants: adsorption, control of the adsorption process; membrane processes, ultrafiltration and dialysis. Processes for destroying the polutants: electrochemical processes, control of the electrochemical processes. Advanced materials and processes for the pollutants decomposition: catalytic oxidation, catalytic photo-oxidation in homogeneous and heterogeneous systems. Combined materials and processes for advanced wastewater treatment: photocatalysis and adsorption, selectivity and process control. Sustainable wastewater treatment plants, targeting water re-use.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Wastes recycling	D01.ED.03.7	3	2			1

Course description (Syllabus): Wastes recycling and the National Waste Management Plan. Basic principles in wastes management and audit. Legal and normative framework for wastes management and recycling. Recycling wastes by category. Recycling the plastic wastes. Technological processes. Phases in the technological processes of plastics recycling. Plastics recycling codes. Waste management and audit. Recycling the polyethylene terephthalate (PET) waste. High-density polyethylene (HDPE) wastes recycling. Waste polyvinyl chloride recycling. Low-density polyethylene (LDPE) waste recycling. Recycling the polypropylene (PP) waste. Recycling the polystyrene waste. Recycling the rubber waste. Steps in the rubber recycling processes: preparation of rubber mixtures, preforming, vulcanization.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Biomass conversion	D01.ED.03.8	3	2		1	

Course description (Syllabus): Physical, chemical and biochemical properties of biomass. Structure, properties of different types of biomass (generation I, II, III, IV). Case Study - Molasses Power Plant Plantation, Covasna County. Correlations between the physico-chemical structure and the physical, energy, chemical, biological potential of the biochemical components of biomass. Biomass conversion technologies into thermal energy (combustion, pyrolysis, gasification). Process earnings, costs, and managing installations. Analysis of various types of biomass-based thermal power plants. Case Study – the thermal power plants in the Green Energy Cluster.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Atmospheric pollution and treatment	D01.ED.03.9	3	1		1	

Course description (Syllabus): Local micro-inventaries of the pollutants in the atmosphere. Software for transforming the geographical coordinates in the X-Y plan. Software for calculating the pollutants dispersion in the atmosphere. ISO documents for the atmospheric pollutants analysis.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Emergent pollutants: sources, advanced treatment processes	D01.ED.03.10	5	2		2	

Course description (Syllabus): Emergent pollutants. Sources of emergent pollutants. Properties of the emergent pollutants. Monitoring the emergent pollutants and ecological risk assessment. Impact of emergent pollutants on human health and on the environment. Advanced processes for emergent pollutants removal.