Transilvania University of Braşov, Romania
Study program: Industrial Environmental Engineering and Protection

Faculty: Product Design and Environment
Study period: 4 years (bachelor)
Academic year structure: 2 semesters (14 weeks per semester for semesters 1 – 7 and 10 weeks for the 8th semester)
Examination sessions (two): winter session (January/February)
summer session (June/July)

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Mathematical Analysis	DIAM01	5	2	3	-	-

Course description (Syllabus): Set. Figures. Relations. Sequences and series of figures. Functions. Limits. Continuity. Differentiation on R. Differentiation on R^n. Sequences and series of functions. Implicitly defined functions. Functional dependence. Extremum and conditioned extremum. Primitives of functions and Riemann integrals. Improper integrals. Parameter integrals. Euler Functions. Multiple integrals. Integrals formulae. Line integrals and surface integrals.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Chemistry I	DICH01	5	2	-	2	-

Course description (Syllabus): The chemistry laws. The modern view of atomic structure. Electronic structure of atoms. The periodic table of elements. Periodical properties of elements. Basic concepts of chmeical bonding: molecules and molecular compounds. Intermolecular forces. Ions and ionic compounds. Metallic bond. Aqueous solutions and general properties of the aqueous and nonaqueous solutions. Chemical equilibrium. Acid-base equilibria. Chemical energy conversion: Electrolysis and Galvanic Cells. Modern materials: Ceramic materials, Metals and alloys, Macromolecular compounds (chemical structure. physical and chemical main properties, applications).

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Computer Programming and Programming Languages	DIPC01	4	1	-	2	-

Course description (Syllabus): The discipline objective is to acquire the basic knowledge on: using a computer hardware, central unit (motherboard, microprocessor, internal memory, external memory) input & output units peripheral (keyboard, mouse, table digitizers, scanners, monitor, printer, plotter), the physical organization of data on disk (files and folders), logical organization of information systems (FAT, NTFS), management of the computer software (operating systems and graphical user interfaces), word processing, spreadsheet, programming of a web page.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Descriptive Geometry	DIGD01	4	2	-	1	-

Course description (Syllabus): History. Projectors and projection systems. Double and triple point representation in orthogonal projection. Line representation. Representation of the plan. Plan in particular positions to projection planes. Representation of lines in the plane. Line contained in the plan. The relative position of two planes. The relative position of a line to a plane. Methods of descriptive geometry. Polyhedron. Representing polyhedral bodies. Edges visibility. Planar sections through the prism and pyramid.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Technical Drawing and Infographics I	DIDT01	4	2	-	2	-

Course description (Syllabus): General standards of engineering drawing. Presentation methods. Multi-view orthographic projections and pictorial views (isometric projection). Sectioning standards and conventions. General dimensions - basic rules of dimensioning. Geometric and positional tolerance: finishes, basic tolerances, geometric tolerances. Drawing conventions of external and internal threads. Screw fasteners. Graphical representation of: shafts, keyways, splines and gears. Assembly drawings of machine parts and components.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Materials Science and Engineering	DISM01	5	3	-	2	-

Course description (Syllabus): Introductory notions. Electronic and Atomic Structure and Metallic Bonding. Crystal Structures, Miller Indices, Single crystals, Polycrystalline and Non-crystalline materials. Defects in Crystals, Diffusion, Thermal, Magnetic, Mechanical and Electrical Properties. Failure and Corrosion. Phase Diagrams, Phase Transformations. Heat treatments. Metals and alloys. Polymers. Ceramics. Composite materials. Industrial casting processes, Plasticity theory and friction, Forging, Rolling, Extrusion. Welding.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Pollution Sources, Processes and Products	DIPC02	2	1	1	-	-

Course description (Syllabus): The course presents, based on case studies, the overview of professional and horizontal knowledge and skills involved in defining, understanding and analysing environmental problems. Case studies follow the modification of specific area(s) as result of the anthropic activity; Area as natural (micro)environment. Anthropic activities in specific area(s), as pollution sources. Effects of pollution on the living and non-living systems in the area.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Technical Drawing and Infographics II	DIDT02	3	1	-	2	-

Course description (Syllabus): Introduction to AutoCAD. Editing objects in AutoCAD. Ordering information visualization commands. OSNAP ways, orders Circle, Arc, Ellipse, Polygon, Rectangle, Donut. View commands: Zoom, Redraw, Pan, Polar Traking. Working with layers, line types and colours. Applications. Other drawing commands: Solid, Sketch, xline, Ray, Mlini, etc., the selection means. Basic techniques of editing and modification. Editing commands. Modify commands. Applications. Advanced techniques work. Modify commands below. Advanced editing commands. Applications. Advanced drawing controls: draw polylines. Creating Hatch Patterns. Defining a new text style, types of writing, writing in AutoCAD with examples. Applications. Other useful commands: MSlide, VSLIDE, script, plot designs, Egen, Boundary. Preparing a design pattern. Isometric representation, etc. Word OLE Relations AutoCAD. Orders for insertion of images: Raster Image. Applications.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Mechanics	DIMC02	5	3	2	-	-

Course description (Syllabus): To know and work with the basic concepts and main theorems in Mechanics and to be able to corectly guide the search when a certain information is requires. To create a basis for a general technical education, which is necessary in other subjects. To know how to approach practical challenges concerning the application of forces, their influence on equilibrium and motion, the possibilities of balancing a system, the different rigid motions within mechanisms (planetary, differential, worm-worm gear, etc.). To know and use correctly the new concepts, both in writing and discussing with the teaching staff, to be capable of working in a team but also to lead a

team during the laboratory or home assignments. To correctly create the connections with other subjects using the concepts in Mechanics, permanently enhancing the knowledge based on a solid ground.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Physics	DIFZ02	4	2	1	1	-

Course description (Syllabus): This is a course in General Physics that contains chapters of interest for students in engineering and environment protection. The main structure of the course consists in: Mechanics and acoustics, oscillations and waves; Thermodynamics and statistical physics; Electromagnetics - introduction in the electromagnetic field; Optics; Physics of atom; Solid state physics and semiconductors; Nuclear physics.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Linear Algebra, Analytical and Differential Geometry	DIAGAD	4	2	2	-	-

Course description (Syllabus): Euclidean vectors. Scalar (dot) product, vector (cross) product, triple mixed (box) product and their applications. Equations of planes and lines in space. Angles and distances. Coordinate transformations in plane and in space. Polar coordinates in plane. Cylindrical and spherical coordinates in space. Vector spaces and subspaces. Examples. Linear dependence and independence, basis and dimension of a vector space. Changes of bases. Linear transformations on finite-dimensional vector spaces. Conics. Center, axes, asymptotes. Reduction to the canonical form. Quadrics: sphere, canonical (reduced) equations of other quadrics. Generation of surfaces: cylinders, cones, conoidal surfaces, surfaces of revolution. Plane curves: arc length; contact of two curves at a common point; tangent and normal line at a regular point. Osculating circle, curvature and curvature radius of a plane curve. Curves in the 3D Euclidean space: arc length, Frenet-Serret frame, curvature and torsion. Differential geometry of surfaces: curves on a surface, tangent plane, first fundamental form and its applications.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Chemistry II	CHIMAN	5	3	-	2	-

Course description (Syllabus): The course follows the general characterization, the synthesis, the physical and chemical properties of elements and compounds relevant in environmental studies. The course focuses on: Hydrogen, Oxygen, Halogens, Sulfur, Nitrogen, Carbon and their compounds (oxides, acids, salts), and on representative elements and their main compounds, from the "s" "p" and "d" blocks.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Basics of Economy	DIDC02	2	1	1	-	-

Course description (Syllabus): Fundamental topics in the Economic Theory. Market and its competitive Structures. Production - between Economic Theory and Practice. Income Distribution. Macroeconomics and the Importance of the Macroeconomic Analysis. Aggregated Indicators. Monetary Market, Capital Market, Labour Market. Unemployment. Fluctuations in the Economic Activity. Anti-crisis Policies.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Foreign language (English/ French)	LS01	2	1	1	-	-
	LS02	2	1	1		

Course description (Syllabus): the verb, the noun, the adjective. Conditional sentences. Reported speech. Conditionals. Causation. Obligation and requirements. Cause and effect. Ability and inability. Scale of likelihood. Relative Clauses. Subordinate clauses of result and purpose. Countable and uncountable nouns. Comparison of adjectives. Adjectives and adverbs. Prepositions of time. Prepositions of place. Quantifiers. Contrasting ideas.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Practical Work I	PR04	2	-	30 hours		

Course description (Syllabus): Guided observation of the main environmental aspects related to a specific organization; The role of environmental engineer in organization.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Special Mathematics	DIMS03	4	2	2	-	-

Course description (Syllabus): The first order differential equations; n^{th} order differential equations with constant coefficients. Systems of linear differential equations. Symmetric systems. First order partial differential equations. Vector field theory. Complex functions: complex numbers; analytic functions; elementary functions; the derivative and its geometric interpretations; integrating functions of a complex variable; power series; residues and their applications. Fourier series. Second order partial differential equations. Operational calculus: Laplace transform.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Databases and Statistical Processing	DIBDPS	3	1	-	1	-

Course description (Syllabus): Introduction to environmental data acquisition and management; Data models and databases for environmental engineering; Querying and reporting environmental data; Descriptive and inferential statistics applied to environmental data; Advanced analytics and IoT systems for environmental monitoring; GIS for environmental data; Integrated reporting and indicators for sustainable development.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Strength of Materials	DIRM03	5	3	1	1	-

Course description (Syllabus): Fundamental concepts. Internal Forces. Geometrical Properties of Plane Areas. Strength of Materials Basic Assumptions. Displacements, stresses and strains. Axial loading. Stresses and strains. Stress-strain diagram. Transverse contraction. Factor of safety. Statically indeterminate problems. Conventional Shear Calculus. General aspects. Stresses and strains. Riveted joints. Welded joints. Fundamental Concepts of the Theory of Elasticity. General aspects. Axial stress. Plane state of stress. General state of stress. Generalized Hooke's Law. Strain energy. Torsion. Elastic bending. Deflections of Beams under Transverse Loading. Stress under Compound Loads.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Chemistry III	SMCO03	5	3	-	3	-

Course description (Syllabus): Structure of organic compounds. Bonding in organic compounds. Isomerization. Chemical reactivity. Classification of organic compounds. Hydrocarbons: (a) Alkanes and cycloalkanes (structure, synthesis, properties); (b) Alkenes and polyenes (structure, synthesis, properties); (c) Alkynes (structure, synthesis, properties). (d) Aromatic compounds (structure, synthesis, properties). Structure, synthesis, properties of hydrocarbons derivatives: (a) organic halogens compounds; (b) alcohols and phenols; (c) aldehydes and ketones; (d) amines; (e) nitroderivatives; (f) carboxylic acids and their derivatives (acyl halides, acid anhydrides, esters, amides, nitriles).

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Thermodynamics	SMCF03	5	2	-	2	-

Course description (Syllabus): Terminology and definitions used in the thermodynamic characterization of physical and chemical systems and processes; Thermodynamic principles applied on physical and chemical processes (focus on

environmental pollution and protection); Phase diagrams of mono-component and binary systems; Significance and interpretation; Application in environmental pollution and protection; Ideal solutions laws; Significance, interpretation and calculations; Application in environmental protection; Thermodynamics of chemical processes: spontaneity, reaction heat and free enthalpy, chemical equilibrium in homogeneous and heterogeneous processes (definition, factors of influence, calculation of the equilibrium constant and composition, selection of the most likely reaction in simultaneous processes).

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Applied informatics	DIM3D	2	1	-	1	-

Course description (Syllabus): Introduction. 2D drawing (geometry, constraints, symbols and colours). 2D geometric modeling techniques (elementary shapes drawing, geometrical constraints). Relimitation features (corner, chamfer, trim, break, complement). Multiplication features (symmetry, translate, rotate, scale). 3D geometric modeling, basic features (pad, pocket, hole, groove, shaft, rib, slot and stiffener). 3D geometric modeling, dress-up features (edge fillet, chamfer, draft angle, shell, thickness, thread and pattern). Boolean operations (inserting new bodies, assemble bodies, intersect bodies, add bodies, remove bodies, trimm bodies). Assembly design (bodies assembly, coincidence constraint, contact constraint, angle constraint). Technical documentation (ensemble drawing, sections, detail drawing).

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Sustainable Development	DIDD04	3	2	-	1	-

Course description (Syllabus): The concept of sustainable development. Major events and strategies at the international level; Millennium Development Goals and Sustainable Development Goals: 2000-2015 and 2015-2030; Major problems of humanity. Greenhouse gases; Integrated development of economy-environment-society; Models of sustainable development; Rational use of resources for energy production; Technological resources; Food resources; Sustainable energy. Renewable energy sources; Sustainable economy: Industry – Transport – Agriculture; Sustainable communities

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Transfer Phenomena and Unit Operations I	DITMT	3	2	-	1	-

Course description (Syllabus): Thermodynamics. Fundamental measures. First principle of thermodynamics. Ideal gas. Mixture of ideal gases. Ideal gas state transformations. Second principle of thermodynamics. Thermodynamic cycles. Entropy. Fuel combustion. Internal combustion engines. Reciprocating compressors. Gas turbine installations. Heat transfer. Conduction, convection, radiation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Elements of Electrochemistry and Corrosion	ECHC04	5	3	1	2	-

Course description (Syllabus): Electrochemistry thermodynamics: electrode potential, electrochemical cells, electrolysis. Electrochemistry kinetics. Corrosion: factors affecting the metal surface; corrosion types; corrosion rate; corrosion in the environment (influence of air humidity and temperature). Anti-corrosion measures and protection.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Mechanical engineering	DIOM04	5	3	-	2	-

Course description (Syllabus): Basics of mechanisms structure; Geometry and kinematics of involute gears; Structural, kinematic and dynamic aspects of gear with fixed axes; Structural, kinematic and dynamic aspects of linkages. Joints (screw joints and screw transmissions; feather and key joints; spline joints; pins and bolts); Springs (elastic characteristics, helical cylindrical compression spring); Couplings (permanent rigid couplings; mobile couplings; elastic couplings); Gears (materials; tooth failure; spur gear - contact and bending stress calculation, permissible stress; gear forces); Ball bearings (kinds of bearings; failures; calculation; ball bearing mountings); Chain and belt drives - geometric calculation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Fluid Mechanics	DIMF04	3	2	-	1	-

Course description (Syllabus): Introduction. Physical properties of fluids; Basics on static of fluids; Kinematics, basic definitions; Basic equations of fluid Dynamics. Dynamics of inviscid fluids: Euler equation, Bernoulli law, law of momentum; Dynamics of viscous fluids: laminar regime and turbulent regime; Some topics in the dynamics of inviscid compressible fluids: water hammer; Measurement of various parameters of flowing fluids: velocity and flow rate; Hydraulic machines: introduction, classification, working parameters; Turbomachines: characteristic curves, efficiency definitions, similarity laws and factors for turbomachines, the ensemble pump-network, operating point, suction head of a pump, cavitation, pump regulation; Volume machines. Hydrostatic pumps and motors. Hydraulic and pneumatic drives. The operating principle. Characteristics of pneumatic drives.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Practical Work II	PR04	4	-	60 hours		

Course description (Syllabus): Presentation of the topics and of the practical activities laboratory; Modern management of chemical substances in an environment laboratory; Chemical substances use - safe and health at work; Classification, packaging and labeling of chemical substances in laboratory; Safety Data Sheets - for chemical substances and chemical preparation operations in laboratory; Develop written instructions (procedures) on how to work with chemical substances and on various preparation operations in laboratory.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Electrotechnics	DIEA03	5	2	-	2	-

Course description (Syllabus): Basic concepts: charge, voltage, current, power and energy, electric and magnetic field, Kirchoff's laws, circuit elements; Electrostatics & Electrodynamics: mains principles and relations, phenomena; Main laws and theorems on the functioning of the electrical installations, devices and electric machines; Simple DC and AC circuits. Three phase circuits with star connection; General elements about electrical installations, electrical equipment and electrical motors.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Electronics	DIEA03	5	2	-	2	-

Course description (Syllabus): By following this course, the students acquire and develop knowledge in the field of electronics from the perspective of their use in the design and management of systems in the field of environmental engineering. Introduction to circuit analysis; alternating currents; circuit elements. Fundamentals of network analysis. Network analysis; Maxwell circular currents; Superposition theorem; Thevenin and Norton theorems. Principles of amplifiers. Voltage coupling; low and high frequency couplings. Solid-state devices. Semiconductors; Conductivity; p-n junction; Junction bias; Capacitance – varicap diodes. Amplifiers with bipolar transistors. Bipolarization, static operating point. Voltage amplifier. with stabilized operating point. Saturation regime. Multijunction devices. Negative feedback. General principles; Frequency response and negative feedback; Stability; Distortions and their measurement; Instability and reactance. Impedance matching. Input impedance and output impedance; Impedance

measurement; Impedance matching; Impedance matching assemblies. Emitter repeater; Input and output impedances; Common-base arrangements. H-bridge circuits. Power amplification; Classes A,B,AB.
Characteristics of semiconductor devices. Input and transfer characteristics of bipolar transistors and FETs; Load line. DC amplifiers. Amplifiers with operational amplifiers; Differential and instrumentation amplifiers. Power supplies. Rectifiers and stabilizers. Introduction to digital electronics. Implementation of logic functions with bipolar and unipolar transistors

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Ecotoxicology	SMCA04	3	2	-	1	-

Course description (Syllabus): Ecotoxicology. Introduction. General aspects; Toxic substances - classification and properties. The effect of toxic substances on living bodies; Radioactive waste. Toxicology and radiologic protection; Bioaccumulation, bio-concentration and bio-magnification; Pollutants toxicity evaluation, the biochemical effect of pollutants; Toxic substances in food and drugs; Toxic and hazardous waste.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Natural Resources	SMCA04	3	2	-	1	-

Course description (Syllabus): Natural resources - general information. Exploitation and use of natural resources in the context of sustainable development. Types of natural resources - Definitions, classifications: Mineral resources - ferrous and non-ferrous resources. Coal. Oil and natural gas. Renewable energy resources. Solar energy, wind energy, hydraulic energy, tidal energy and geothermal energy. Biomass: alcohol and biogas. Biofuels. Resources for nuclear energy. Sustainable management of natural resources. Ecological Footprint.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Ecological Design of Products I	BPP05	4	2	-	-	2

Course description (Syllabus): Introduction to design engineering. Product design process. Design modules: conceptual design, embodiment design, detailed design. Prototyping and simulation in product design. Product design specifications and the changes in the design stages.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Environmental Chemistry	SMCM5	4	2	-	2	-

Course description (Syllabus): The course describes the fundamental principles of chemistry to provide an understanding of the source, fate and reactivity of compounds in the natural and polluted (micro)environment. Basics of chemistry of the atmosphere, hydrosphere, lithosphere. Urban atmosphere pollution. Climate change. Ozone layer depletion. Indoor pollution. Water pollution. Nutrients, Pesticides, Heavy Metals in surface water. Plastics and microplastics in the environment.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Soil Science and Soil Depollution Processes	SSPDS06	4	2	-	2	-

Course description (Syllabus): Soil: environmental factor. Soil sampling and soil analysis. Standard soil depollution process. Bioremediation. Pesticides - pollution prevention and alternative remediation techniques.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Information Technology	DIMEF5	4	2	-	2	-

Course description (Syllabus): The course presents the main topics related to modelling with the finite element's method: the general analysis problem; the general analysis algorithm; modeling methodology; finite element typology; materials modeling; modeling of loads and constraints; reference frames in FEM; geometrical modeling of 1D, 2D, and 3D domains; modeling of the unknown physical parameters; the numerical model of the axial loaded bars; software based on FEM. The laboratories are referring on applications in the field of static (with loads as forces, moments, pressures, temperatures) and free frequencies analysis considering, 1D, 2D AND 3D domains.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Instrumental Analysis	SMAI05	5	2	-	3	-

Course description (Syllabus): Principles of the instrumental analysis methods. Types of instruments used in chemical analysis Spectroscopy (SEA, SAA, UV-VIS, IR, RES, RMN, X rays): Principles, Instruments, Qualitative and quantitative interpretation of spectra; Refractometry: Principles, Instruments, Qualitative and quantitative interpretation of results; Polarimetry: Principles, Instruments, Qualitative and quantitative interpretation of results; Conductometry: Principles, Instruments, Qualitative and quantitative interpretation of results; Potentiometry: Principles, Instruments, Qualitative and quantitative interpretation of results; Polarography: Principles, Instruments, Qualitative and quantitative interpretation of results; Thermal analysis (thermogravimetry, DSC).

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Methods for the separation and Analysis of the Pollutants	SMSEP05	3	1	-	1	-

Course description (Syllabus): Separation - esential step in environmental analysis. Classification of the separation techniques. Chromatography. Chromatographic analytical techniques. Electrophoresis. Electrophoretical techniques. Hyphenated techniques.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Communication. Ethics and Academic Integrity	DIDC05	3	1	1	-	-

Course description (Syllabus): Definitions, models and theories of communication; Communication for personal presentation – CV, interview. Oral and written scientific communication: report, scientific paper. Documentation for scientific communication. Principles of ethics in academic environment. Violation of academic conduct roles.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Meteorology and Climatology	MET05	3	1	-	2	-

Course description (Syllabus): Introduction. General concepts in meteorology and climatology; Atmosphere: structure, chemical composition, physicochemical properties (temperature, pressure, density); Radiant energy: source and solar spectrum properties. Energy flows. Energy balance and net radiation; Heat processes in the underlying surface, in the active layer and in the atmosphere; Air movements. Horizontal and vertical movements. Local winds. The general circulation in the atmosphere; Water in atmosphere. Evaporation and evapotranspiration. Atmospheric humidity. Condensation. The clouds - The International system of clouds classification. Precipitations; Synoptic meteorology - basic concepts. Cyclone and anticyclone. Climatology - basic concepts. Climatic changes and their consequences.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Chemometry	SMCH05	2	1	1	-	-

Course description (Syllabus): Error classification. Student distribution. Chemometric methods. Validation criteria.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Transfer Phenomena and Unit Operations II	SMFT05	4	2	1	-	1

Course description (Syllabus): Unit operations - introduction, types. Mass balance, energy balance. Mechanical separation of solids/polydisperse solids. Sedimentation - fundamentals. Clarification. Decanters - types, operating principles. Filtration - fundamentals; filters- type, operating principles, design. Centrifugation - fundamentals. Centrifugal sedimentation processes. Centrifuges-types, operating principles. Diffusion - fundamentals. Diffusion installation - operating principles. Distillation and rectification: fundamentals. Distillation installations - calculations and operating principles. Gas-liquid absorption: absorption equilibrium. Absorption columns - operating principles. Solid - liquid adsorption isotherms. Adsorption columns (absorbers) operating principles. Liquid – liquid extraction - principles of extraction. Extraction equipment.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Ecology	ECOIPMI	2	1	-	1	-

Course description (Syllabus): Introduction: definition and object of the Ecology. Divisions in Ecology. Organization of the living environment. Characteristics of the biological systems. Levels of organization in the living environment. Populations in ecology. Ecological niche and habitat. Laws of Ecology. Biocenosis. Trophic levels of the biocenosis. Biotope. Ecosystem: structure, functions, dynamics, limits. Circuits in ecosystems. Production and fluxes of organic matter. Transfers between biocenosis and the abiotic environment. Dynamics in ecosystems. Changes in biocenosis. Biodiversity - types and assessment. Biodiversity management.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Ecological Design of Products II	DIDC06	2	2	-	-	-

Course description (Syllabus): Basic notions used in the Product Conceptual Design (Overall function of a product, Product structure and structure of the overall function. Solving principles and solving structures. Conceptual synthesis of a compound function). Modelling the technical products design process (Modelling of the technical product life cycle, Design modelling of technical products). Conceptual Design modelling of technical products (Requirements list, Conceptual design modelling algorithms, Principal solution establishment by solving structures evaluation). Conceptual design examples. Solving examples for functions with usual technical use.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Project - Ecological Design of Products II	DIDCP06	2	-	-	-	1

Course description (Syllabus): Applying the basic notions of Conceptual design in developing the project of a specific device at the level of structural scheme.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Technological Processes: Analysis and Synthesis	ASPT	5	2	-	3	-

Course description (Syllabus): Overview on technological processes analysis and synthesis: basic concepts, technological apparatus symbols, materials and energy balances in industrial processes. Basic operations in technological processes: mechanical, aero-dynamical, thermal and mass transfer operations. Mineral raw materials: classification, mechanical preparation using manual, electrostatic, magnetic and gravitational methods. Energy in technological processes. Solid (coal), liquid (petrol and diesel) and gaseous (natural gas and artificial) fuels. Drinking water and industrial water. Natural water quality parameters. Treatment processes: natural water purification, purified

water quality correction and wastewater treatment. Analysis and synthesis processes of sodium and chlorine based products manufacturing: manufacturing soda ash and caustic soda. Analysis and synthesis processes for the manufacture of chemical fertilizers with nitrogen (ammonia, ammonium nitrate and urea) and phosphorus (simple and concentrated superphosphates). Analysis and synthesis of polymeric materials manufacturing processes: definition, classification, manufacturing technology of macromolecular compounds, polymer materials processing technologies (compression, transfer, injection, extrusion and calendering).

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Technologies and Equipments for Water and Wastewater Treatment I	TRATAP	4	2	-	2	-

Course description (Syllabus): This course focuses on the mechanical and chemical processes and equipment required to obtain drinking water, or water to be used in water boilers and power plants. Drinking water systems. Water collection systems (network) and water supply. Water treatment: removing the suspensions, coagulation, water clarification, water filtration, water disinfection, ion exchange for water softening and to get deionized water. Other treatment applied to water.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Practical Work III (90 Hours)	PR06	4		90		

Course description (Syllabus): Practical activity on specific aspects of environmental engineering in institutions/ companies. Solving specific problems related to environmental engineering.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Air Purification Technologies and Equipments	PEPA06	3	2	1	-	-

Course description (Syllabus): Air pollutants. Types of sources. Dispersion of pollutants in the atmosphere. Technological and environmental balances of materials and energy of pollutant industrial processes. Air pollutants monitoring (sampling and analysis). Principles and characteristics of the main depollution processes and equipment. Equipment based on detent, impact, inertia and sock. Equipment based on centrifugal principle. Equipment based on filtration principles. Equipment based on electrostatic separation. Wet separators. Acoustic systems of separation. Bio-filtration.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Chemistry of Colloids and Surfaces	SMSP6	3	2	-	2	-

Course description (Syllabus): Colloidal systems: basics, types of systems, preparation, purification; applications; Stability of the colloidal systems: the electrical double layer, Zeta potential, stabilization mechanisms, DLVO theory. Applications; Surface tension and contact angle (Young equation, wetting and spreading, applications); Adsorption from solutions and monolayer formation, Surfactants, Thermodynamic of the superficial layer, Gibbs equation; Colloidal structures and surfactant solutions, Association colloids (micelles, vesicles, membranes). Thermodynamics of micelles formation, critical micelle concentration, catalysis by micelles; Emulsions: preparations, applications; Foams: preparations, applications; Adsorption phenomena - basics, G/S, L/S adsorption (adsorption isotherms, mechanisms of adsorption, specific surface), adsorbents.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Chemistry of Colloids and Surfaces	SMSP6	3	2	-	2	-

Course description (Syllabus): Interfaces - definition, importance of interface processes; Free energy of surfaces; Thermodynamics of dispersed systems; Modification of surface energy. Study of adhesion, cohesion, wetting phenomena; Study of liquid/solid interfaces: adsorption, sedimentation, flocculation; Gas/solid interfaces: surface contamination, superficial soil pollution; Liquid/liquid interfaces: liquid films, emulsions; water pollution with petroleum products; Stabilization and destabilization of interfaces. DLVO theory. Dispersions, foams

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Ecological Design of Products III	DP07	4	2	-	-	2

Course description (Syllabus): Product development steps, interactions. Basic rules of embodiment design (clarity, simplicity, safety). Principles of embodiment design. Elements of embodiment design (Designing to allow for expansion, Designing to allow for creep and relaxation, Designing against corrosion damage, Designing to standards). Project: Starting from the product design specification (PDS) and a structural scheme (result of the conceptual design phase), the embodiment design of part of a mechanical device will be developed. There will be evaluated elements of the embodiment design process (basic rules, principles, guidelines). Assemble and part drawings will be developed. The model will be created using CATIA package.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Biomass Based Energy Systems	BIO07	4	2	-	2	-

Course description (Syllabus): Biomass structure: (a) carbohydrates from biomass (structure, physical and chemical properties). (b) Lipids from biomass (structure, physical and chemical properties). (c) Proteins structure and properties. Correlations between the chemical structure and the energy potential of biomass. Evaluation methodology of the energy potential of biomass. Biomass based energy systems: (a) synthesis of biogas from biomass/biomass waste; (b) synthesis of bioethanol from biomass/biomass waste; (c) synthesis of biodiesel from biomass/biomass waste; (d) synthesis of alcohols from biomass (e) synthesis of TBME and TBEE from biomass; (f) thermochemical processes for obtaining energy from biomass.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Technologies and Equipments for Water and Wastewater Treatment II	APE07	5	2	-	2	-

Course description (Syllabus): The course is focused on describing the basics in the field of wastewater treatment. The main topics are: the wastewater pollutants; the physical, chemical and biological indicators of wastewater; basics of wastewater treatment; primary, secondary and tertiary processes; industrial wastewater treatment (targeting re-use); wastewater treatment plants.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Environmental quality: Data Acquisition, Monitoring and Diagnosis	MONIT07	5	2	-	2	-

Course description (Syllabus): Pollutants and their imapct on human health - toxicological approach; Romanian strategy for environment protection; Integrated monitoring system in Romania; Environmental indicators; Enviornmnetal Monitoring programs: Aims and objectives; Sampling; Analysis; Data interpretation; Reports; Dissemination; Case studies: environmnetal monitoring programs reports (local/national/intrenational level).

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Waste Treatment and Recovery Technologies	COM07	4	2	-	2	-

Course description (Syllabus): Fundamental concepts: waste, National Waste Management Plan. Types of waste, classification. Organic and inorganic waste; Waste recovery through primary recycling, secondary recycling; Waste recovery through tertiary recycling, quaternary recycling; Operations and processes; equipment and machinery used in recycling technologies; Waste treatment and recovery technologies: extrusion, injection, compression, thermoforming, coating, blowing; Waste recycling technologies for material recovery: Material recycling. Chemical waste treatment. Biological waste treatment. Waste compaction and its use in construction. Waste neutralization and destruction technologies

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Engineering of Pollution Control Processes	DEPOL07	3	2	1	-	-

Course description (Syllabus): Fundamentals of the environmental processes engineering. Mass and energy balance. Process design: continuous processes, main flow, secondary flows. Process design optimization: energy saving in industrial processes. Discontinuous processes: mass and energy balance. Economic analysis of the processes. Technical-economic analysis of the processes: the costs of the depollution.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Project - Engineering of Pollution Control Processes	DEPOL07	2	-	-	-	2

Course description (Syllabus): the steps of the environmental depollution process. The flow chart of the process: main flow, secondary flows. The equipment chart for the process. The sketch of the process installation. Design the key equipment in the sketch.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Environment and Society	MSOC07	3	1	2	-	-

Course description (Syllabus): Quantitative assessment of the environmental quality; Indicators for sustainable development; Hierarchies in environment and in the social system; Interactions at different levels of the hierarchies - constrains and opportunities; Environmental attitude and environmental behavior; Approach to participation for the environment; Core principles of social learning; Case studies on projects aiming to reduce the environmental damage.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Integrated Waste Management	MCM08	4	2	2	-	-

Course description (Syllabus): 1. Waste management. Fundamentals. The national plan of waste management. Basic principles of waste management at international and national levels. 2. Legal and regulatory framework waste management. The EU directives on waste management. Impact of waste on the environment and on human health. The main stages of the waste management: The municipal solid waste. Salubrity. Waste collection and transport. Sorting and separation methods of solid waste. Methods of recovery and recycling solid waste. Heat treatment. Incineration. Co-incineration. Pyrolysis. Gasification. Drying process of the wastewater treatment sludge. Reducing solid waste by chemical and biochemical methods. Composting. Disposal methods of solid waste. The landfill.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Impact Assessment	IMP08	5	2	2	-	-

Course description (Syllabus): Environmental impact assessment in the sustainable development context. Defining a problem and deciding on a direction. Regulatory frameworks. Socio-economical implication in environmental impact assessment. Global pollution index. Public implication in decisions making.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Environmental Policies and Regulations	LEG08	4	1	1	-	-

Course description (Syllabus): International environmental policies: Treaties and conventions; National environmental policies; General environmental policies at EU level – PAM 1-7; Specific environmental policies: energy; Specific environmental policies: water, air, climate; Specific environmental policies: waste and biodiversity

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Development of the diploma project	LIC08	4	-	-	4	-

Course description (Syllabus): Analysis of the environmental aspects related to the selected subject of diploma project. BAT assessment. Design of a process/environmental monitoring system. Laboratory study/ modelling on the studied subject. Design of the key equipment in the process. Technical - economical assessment.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Ecological Management	EPE08	4	2	-	2	-

Course description (Syllabus): The concept of ecological management; Natural and anthropogenic phenomena that lead to the degradation of natural ecosystems; Ecological management system; Basic principles of ecological management; Legal framework of ecological management: International agreements on environmental protection; International standards for ecological management; Ecological management tools: Life Cycle Assessment of the product (LCA); Environmental Management System (EMS); Environmental management standards; Monitoring and reporting of ecological performance: Environmental performance indicators (KPI); Methods for monitoring ecological impact; Sustainability reports and ecological audit. Emerging trends and future technologies in ecological management

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Implementation of Renewable Energy Systems	EPE08	4	2	-	2	-

Course description (Syllabus): Thermo-hygro-energy design of buildings in context of the use of renewable energy systems. The methodology for calculating the energy performance of buildings. Behaviour of building materials to water vapour diffusion. Thermal stability of construction materials. Constructive solutions to design improved thermo-hydro-energy buildings. Mounting systems for renewable energy equipment.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Climate Change Mitigation	PRO08	4	2	2	-	-

Course description (Syllabus): The concepts of global change and climate change; Estimation of global threats to nature and the environment; National strategic and legislative documents proposed for adaptation to climate change; European Union legislation on climate change; European Union actions to combat climate change; Climate change mitigation strategies in Romania.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Environmental Projects Development and Management	PRO08	4	2	2	-	1

Course description (Syllabus): Project. Definition. Concepts (time, budget, quality, participants, expectations); Project structure; Planning (structure and stages of the project, SWOT analysis, PEST analysis, feasibility study, impact report, team selection, DWP - detailed working program, GANTT chart; Project implementation (about changing). Lewin diagram; Project quality. Cause - effect diagram; Pareto diagram; Control and evaluation; Authority (team building,

motivation, conflicts, communication, stress management, time management). Fundamentals in building and implementing an environmental management system. Fundamentals in environmental audit.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Environmental Risk Management	PRO08	4	2	-	-	2

Course description (Syllabus): National legislation in the field of risk management; Environmental risk assessment; Environmental risk management; Environmental risk prevention; Environmental risk control and monitoring.

Course title	Code	No. of credits	Number of hours per week			
			course	seminary	laboratory	project
Health and Safety Management in Industry	PRO08	4	2	-	-	2

Course description (Syllabus): Terminology, dimensions of EHS management, National legislative context in the field of occupational safety and health; ISO 45001 Standard; Organization of prevention activities in EHS: Stakeholders, Roles Signaling of occupational safety and health; Occupational accident and occupational disease: Causes of occupational accidents and their prevention; Characteristics of an occupational safety and health plan; Ergonomics and industrial hygiene.