Transilvania University of Braşov, Romania

Study program: Product Design Engineering (in English)

Faculty: Product Design and Environment
Study period: 4 years (bachelor)

1st Year (not available in the academic year 2019-2020)

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mathematical Analysis	ANM1	5	2	2		

Course description (Syllabus): Basic knowledge of Mathematical Analysis: Fundamental notions of Mathematical Analysis (sets, sequences, series; limits, continuity, differentiability and integrability of functions, properties of these), Practical abilities related to these concepts (finding the limit of a sequence, the sum of a series, the ability to decide if a given function is or not continuous, differentiable and/or integrable, and, if affirmative, to compute its derivative and/or its integral).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Linear Algebra, Analytical and Differential Geometry	ALG1	5	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. 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 3-dimensional Euclidean space: arclength, 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	seminar	laboratory	project
Technical Drawing and Computer Graphics I	DTI1	4	2		2	

Course description (Syllabus): This course is meant to develop skills in the reading, interpretation and production of Mechanical Engineering drawings. 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	seminar	laboratory	project
Computer Programming and Programming Languages I	PCL1	5	2		2	

Course description (Syllabus): Basics of how computers work, Physical and logical management of the data/files, Operating systems: functions, components, booting-up flow-chart, Hardware components: central unit (main board, microprocessor, internal and external memory, interfaces), peripheral devices (input and output devices), Computer networks: types and topologies, specific hardware and software components, Document editing, Tabular computing (spreadsheets), Web page programming: HTLM programming language.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Descriptive Geometry	GED1	4	2		1	

Course description (Syllabus): This course introduces fundamental principles in developing graphical solutions to engineering problems. It develops the ability to visualize spatial relationships; develop sequential thinking; set patterns of analysis; and spatial visualization through problem-solving. Basic Concepts of 3-Dimensional Descriptive Geometry. Points; Projection Planes; Orthographic Projection; Views; Auxiliary View. Lines in 3-Dimensional Geometry. Intersecting lines; Skewed lines; Parallel lines; Perpendicular lines; True Length of a line. Planes in 3-Dimensional Geometry. Representation; Points and lines on a plane; Dip of a plane. Spatial Relations of Lines and Planes. Examples - line parallel to plane; distances between lines, between planes; piercing point of line and plane; line of intersection; dihedral angle; visibility. The methods of the descriptive geometry. Method of replacing projection planes; method of revolution. Solids and Surfaces. Basic techniques for locating points, piercing points, and tangent planes for common solids - prisms, pyramid, cone, cylinder, sphere. Development of surfaces. Planar unfolding of common solids, and solids with warped surfaces. Intersection of geometric surfaces and solids.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Physics	FIZ1	4	2		2	

Course description (Syllabus): Kinematics and dynamics of the material point (basic concepts, conservation laws). Dynamics of rigid bodies; basic relations, the principal axes of inertia, calculation examples. The Gyroscope. The total kinetic energy of a rigid body. practical applications. the flywheel. Mechanical oscillations. Harmonic oscillations. General expressions, movement equations, the energy of an oscillator. Free damped and forced oscillations. The resonance phenomena. Composition of harmonic oscillations. Practical applications. Thermodynamics, thermodynamic processes, laws of thermodynamics, applications, thermal engines. Basic Aspects on Electric Phenomena. Electrostatics, laws, electric field and potential. Electrokinetics, electrical conduction, mechanism of conduction. Dielectrics, conductors, semiconductors. applications. Biot-Savart law, Ampere's circuital law. Substances in magnetic field. Technical applications. Laws of electromagnetic induction. Electromagnetic waves. Optics. Elements of photometry. Thermal radiation. Propagation of light. Reflection and refraction of light. Interference and diffraction of light. Technical applications. optical devices.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Materials Science and Engineering	SIM2	6	4		2	

Course description (Syllabus): The course is a concise introduction to the *microstructures and processing of materials* (metals, ceramics, polymers and composites) and shows how these are related to the properties required in engineering field. Orientation and introduction. Electronic and Atomic Structure and Metallic Bonding. Crystal Structures, Miller Indice, Single crystals, Polycrystalline and Noncrystalline materials. Imperfections in Crystals, Diffusion, Thermal, Magnetic, Mechanical and Electrical Properties. Failure and Corrosion. Phase Diagrams, Phase Transformations. Heat treatments. Metals and alloys. Polymers. Ceramics. Composites materials. Industrial casting processes, Plasticity theory and friction, Forging, Rolling, Extrusion. Welding.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Special Mathematics	MSP2	5	2	2		

Course description (Syllabus): Differential Equations with constant coefficients. Fields theory. The theory of complex functions. Fourier series. Laplace Transform. Elements of mathematical statistics.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Technical Drawing and Computer Graphics II	DTI2	4	2		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 colors. Applications. Other drawing commands: Solid, Sketch, xline, Ray, Mline, 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	seminar	laboratory	project
Computer Programming and Programming Languages II	PCL2	4	2		2	

Course description (Syllabus): **1.** Basics of the object oriented programming (Objects; Classes; Delphi Integrated Development Environment (IDE); The Main Window; The Object Inspector; The Delphi Workspace; Component Palette) **2.** Applications development (Forms; Properties and Events; Label Component, Edit Component, Memo Component; Conversion Functions (The IntToStr, StrToInt, FloatToStr, StrToFloat Functions); MainMenu, Button, BitBtn Components Menu Designer; How to enable and disable Menu Items and Buttons; Modal Result Property used for Button Components; **3.** StringList and Memo components; String Formatting Routines (InputBox and Format Function); **4.** Providing Defaults Exception Handlers (Try Statement); Dialog Message Boxes (ShowMessage Procedure, MessageDlg Function); **5.** Visual Components and non-visual Components (OpenDialog, ColorDialog, SaveDialog, Timer, ImageList – non-visual Components); Execute Method **6.** Graphics in DELPHI (CANVAS Object; Properties and Methods; Image Component; ImageUsr Component) **7.** Setting the user window (Specific methods of the ImageUsr Component) **8.** Simulation by graphic animation **9.** Components for Multimedia Applications **10.** Methods for displaying a modeless Form (Show Method) and modally (ShowModal Method).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechanics	MCN2	6	3	2		

Course description (Syllabus): To know and work with the basic concepts and main theorems in Mechanics, the interdependencies between them and to be able to corectly orient their search when they require certain information. To create a basis for a general technical education, necessary in other studied 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 this way their knowledge and based on a solid ground.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Product Design in Engineering	DPI2	2	1		1	

Course description (Syllabus): 1. The profession of product design engineer: legislative framework, integration into the labor market. 2. Profession interdisciplinarity of the product design engineering - Case studies. 3. The role of fundamental courses in tackling the product design engineering problems - Case studies. 4. The role of domain courses in tackling the product design engineering problems - Case studies. 5. Horizontal competencies necessary in product design engineering.

2nd Year (not available in the academic year 2019-2020)

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Chemistry	CHM3	4	2		1	

Course description (Syllabus): Chemistry is a one semester course designed to provide a study of inorganic and physical chemistry. Topics studied in this course include atomic structure, covalent and ionic bonding, chemical reactions, chemical calculations, acid, base and solution chemistry, chemical kinetics, electrochemical conversion, pollution and environmental and chemistry of special materials. Quantitative reasoning skills are developed and used where appropriate to enhance the understanding of these concepts.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Tolerances and Dimensional Control	TCD3	5	2		2	

Course description (Syllabus): Mechanical instruments for measurement. 1.1 Direct length measurement with mechanical appliance. 1.2 The principles of comparative length measuremenmt. 1.3 High sensitivity indicators. Optical instruments for measurement. 2.1 Engineering microscopes. 2.2 Goniometric measuremenmts with the microscope. 2.3 Optical projectors. Limits and fits for cylindrical smooth parts. 3.1 International tolerance system for limits and fits (ISO 20286-1:1997). 3.2 General tolerances for dimensions. Surface texture measurements. 4.1 Surface roughness parameters. 4.2 Roughness and waviness. 4.3 Instruments for surface texture measurements. Geometric dimensioning and tolerancing. 5.1 Symbols for tolerances of position and form. 5.2 The concept of roundness. 5.3 Associated parameters. Tolerances and fits for part threads. 6.1 Tolerances and fits for general thread parts. Tolerances and fits for gear pairs. 7.1 Tolerances for gears and gears pairs. 7.2 Deviations and tolerances for gears and gear pairs. Angle measurements. 8.1 Angle measuring system and techniques. 8.2 Measurement of cone shaped technical parts. Pneumatic gaging. 9.1 Principal elements and operations of pneumatic gaging systems. 9.2 Pneumatic instruments for measurement. Measuring machines. 10.1 Definition and general evaluation. 10.2 Industrial measuring technology applications.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Strength of Materials I	REZ3	5	2	2	1	

Course description (Syllabus): Fundamental concepts. Mechanical properties of materials. Bodies mechanical interactions. External loads and supports. Bodies and loads schematic representation in Strength of Materials. Equilibrium equations. Internal Forces. General aspects. Internal forces concept. Differential relationships between external loads and internal forces. Internal forces diagrams. Geometrical Properties of Plane Areas. First moments and second moments of an area. 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. General aspects. Torsion of circular shafts. Torsion of Noncircular members. Statically indeterminate shafts. Design of transmission shafts. Elastic bending. General aspects. Prismatic members in pure bending. Navier's formula. Prismatic members in simple bending. Juravski's formula.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electrotechnics	ELEA	4	2		2	

Course description (Syllabus): 1. Introduction. 2.Direct - Current Circuits: Elements, symbols, electric diagrams, Ohm's Law, Kirchhoff's Laws, Work, Energy and Power in DC, series-parallel conections, Supperposition theorem. 3. Sinusoidal AC Circuits. 4. Three Phase Circuits. 5. Magnetic Circuits. 6. Transformers.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Applied Electronics	ELA3	4	2		2	

Course description (Syllabus): 1. Introduction2. Signals, Analog and Digital. Modulation and Demodulation. A/D, D/A Converters. 3. Semiconductors, Diodes and Power Supplies. Transistor Fundamentals. Introduction. FETs-MOSFET fundamentals. The logic gate. The common Source Amplifiers. BJT fundamentals. The NOT logic gate. The common Emitter Amplifiers. 4. Small signal amplifiers. Integrated circuits. 5. Power Electronics. Rectification. Single phase bridge inverter. 3 ph bridge inverters: PAM, PWM.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer Aided Design	PAC3	5	2		2	1

Course description (Syllabus): Introduction, 2D drawing (geometry, constraints, symbols and colors), 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, stiffener), 3D geometric modeling, dress-up features (edge fillet, chamfer, draft angle, shell, thickness, thread, pattern), Boolean operations (inserting new bodies, assemble bodies, intersect bodies, add bodies, removing bodies, trimming 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	seminar	laboratory	project
Strength of Materials II	REZ4	5	3	1	1	

Course description (Syllabus): 1. Resistance Theories. 2. Deflections of Beams under Transverse Loading. 2.1 General Aspects; 2.2 Equation of Elastic Curve; 2.3 Method of Superposition; 2.4 Statically Indeterminate Beams; 2.5 Application of Superposition to Statically Indeterminate Beams. 3. Stress under Compound Loads. 3.1 General Aspects; 3.2 Compound Loads with Normal Stresses (Axial Tension with Bending, Eccentric Compression of Low Height Members); 2.3 Compound Loads with Shear Stresses (Torsion with Shear, Cylindrical Springs Calculus); 3.4 Compound Loads with Normal and Shear Stresses (Circular Shafts, Rectangular Transverse Cross Section Members). 4. Curved Beams. 4.1 Stress Calculus; 4.2 Elastic Displacements Calculus. 5. Energy Methods for Linear-Elastic Displacements Calculus. 5.1 Work and Energy under a Single Load; 5.2 Work and Energy under Several Loads. General Expression of Strain Energy; 5.3 B.P.E. Clapeyron's Theorem; 5.4 A. Castigliano's Theorems; 5.5 Mohr-Maxwell's Method; 5.6 Veresceaghin's Method for Diagrams Multiply; 5.7 Forces Method; 5.8 Solutions to Statically Indeterminate Problems.. 6. Stability of Structures. 6.1 General Aspects; 6.2 Buckling of Prismatic Members (Euler's Formula, Euler's Formula Validity); 6.3 Design of Columns under Centric Load; 9.4 Design of Columns under Eccentric Load; 6.5 Laterally

Buckling of Straight Members.. 7. Dynamic Stress. 7.1 General Aspects; 7.2 Dynamic Stress under Inertia Load; 7.3 Dynamic Stress under Impact Load. 8. Thin-Walled Pressure Vessels.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Fluid Mechanics	MFL4	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	seminar	laboratory	project
Machine Elements I	ORM4	4	2		1	1

Course description (Syllabus): Introduction (object; place in development of mechanical engineer; history of calculation and construction of machine elements; evaluation; references, general considerantion on design of machine elements). Joints (screw joints and screw transmissions; feather and key joints; spline joints; pins and bolts, safery rings; profiled joins; fit joints). Springs (elastic characteristics, helical cylindrical compression spring; helical cylindrical traction spring; helical cylindrical torsion spring; torsion bar spring; plane spiral spring, leaf springs, disc spring, rubber spring). Gears (materials; tooth failure; spur gear – contact and bending stress calculation; helical and gears – equivalent gear, contact and bending stress calculation; straight and curved bevel gears, – machining process, virtual gear, contact and bending stress calculation; worm gear; permissible stres; gear forces). Gear transmissions (gear ratios, torques and rotations for each transmission element, forces in speed reducers).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Numerical Methods	MNM4	4	2		2	

Course description (Syllabus): Errors in computing. (Absolute and relative errors, errors sources, errors classification, errors of the elementary operations). Numerical approximation of functions (interpolation: linear interpolation, Lagrange interpolation formula, spline functions of interpolation; regression: linear and polynomial regression). Nonlinear algebraic equations solving (one variable equations: bisection method, secant method, fixed point iteration method, Newton-Raphson method; nonlinear equations systems). Linear equations systems (Gauss method, Gauss-Jordan method, Jacobi method, Gauss-Seidel method). Numerical integration and differentiation (numerical differentiation formulas, Newton-Cotes integration formula, trapezoidal integration rule, Simpson integration rule). Ordinary differential equations (Taylor method, Euler method, Runge-Kutta methods). Design and optimization (optimization methods, case studies).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Basics of Product Design and Development	BPD4	3	2		1	

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 Product implementation: Manufacture of a product, Selling a product, Operation and maintenance, Recycling, reuse and disposal.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechanisms I	MEC4	5	3		1	2

Course description (Syllabus): 1. Introduction. Machine, Device, Mechanism. Mechanism Study. History. Examples. 2. Mechanism structure: elements, kinematic joints, kinematic Chain Main phases of structural modeling: 2.1 Structural modeling of the complex mechanism. 2.2.Structural optimization of the mechanism; Examples. 3. Modeling of linkage mechanism. Description. Example. 3.1. Structural modeling of linkage mechanism 3.2.Kinematic modeling of the linkage mechanism 3.3. Dynamic modeling of linkage mechanism. 4. Cam mechanisms. Description. Example. 4.1. Kinematic and dynamic analysis of cam mechanisms. 4.2. Kinematic and dynamic synthesis of cam mechanisms.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practical work 90 hours	PRA4	4				

Course description (Syllabus): The practical work proposes to familiarize the students with the real problematic from companies and to stimulate the appliance of the knowledge gained in faculty in the practical activity.

3rd Year (not available in the academic year 2019-2020)

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Machine Elements II	OMC5	4	2	1	1	
Machine Elements II - Project	OMP5	2				2

Course description (Syllabus): 1. Shafts (stresses and cycles; forces; calculations). 2. Couplings and clutches (clasification; permanent rigid couplings; mobile couplings; elastic couplings; clutches). 3. Tribology and sleeve bearings (friction; usage; lubricants; constructions – body, sleevesc; hidrodynamic bearings; bearings with limit friction). 4. Ball and roller bearings (kinds of bearings; failures; calculation; ball and roller bearing mountings) 5. Sealing devices. 6. Chain drives (constructive types; geometric calculation, kinematic elements; contact calculation; maintenance). 7. Belt drives (constructive types; geometric calculation, kinematic elements; forces and stresses; traction diagram, strength calculation, maintenance). 8. Friction drives. Variable speed drives (failures, calculation). 9. Consideration on the design of mechanical transmissions with variable load.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Thermodynamics and Heat Engines	TMT5	4	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	seminar	laboratory	project
Processing Technologies	TPR5	5	2		3	

Course description (Syllabus): Processing methods. Classification, structural features, kinematics characteristics. Techniques and mechanical cutting and microcutting methods: classification, processing principles. Machining techniques and methods (micro) plastic deformation. Machining techniques and methods (micro) injection. Machinability characteristics of materials.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Ecological Materials	MEC5	3	1		2	

Course description (Syllabus): 1. Overview of ecological/advanced materials and their applications in various fields. 2. Ecological metallic materials: structure, properties (physical, mechanical, chemical), applications. Corrosion and anticorrosion protective methods. 3. Ecological glasses and ceramic materials: definition, classification, obtaining, special uses. 4. Ecological polymeric materials: definition, classification, obtaining, properties, preparation technologies, special applications. 5.Ecological composite materials: definition, obtaining, properties, uses. Metallic, polymeric and ceramic composites - special applications.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Product Design Specifications	CPP5	4	2			2

Course description (Syllabus): Product design specifications: content and importance. IT revolution, globalization, personalized production, knowledge society, sustainable development. Design as a process. New products and patents.. Maslow necessities pyramid. Performance. The identification of customer needs. Customers identification and quantities quantification.. Market study of concurential products.. Costs, ergonomics, appearance, testing, quality and environment.. Standards, quality, safety, packing, storage, shipping, service. Establishing product attribute hierarchy using analysis of compensation method.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Finite Element Method	MEF5	4	2		2	

Course description (Syllabus): I. The general analysis problem with FEM, 2. Problems types solved with MEF, 3. General algorithm of MEF modeling and analysis, 4. Modeling methods with finite elements, 6. Material modeling, 7. Modeling constraints and loads, 8. Reference frames used in the FEM, 9. 1D geometrical modeling, 10. 2D geometrical rnodeling, 11. 3D geometrical modeling, 12. The rnodeling of the unknown physical parameters (displacemenets, forces, torques, temperatures), 13. Numerical model and FEM analysis of bar type mechanical structure, 14. Problem solving with MEF software.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechatronics	PRM5	4	2		1	

Course description (Syllabus): 1 Introduction. Mechatronic products evolution. Definition of mechatronics. The advantages of the field. 2 Mechatronic systems. Definition of mechatronic systems. The synthesis of a mechatronic system. The procedure of concurrent engineering applied to mechatronic systems. 3 Modelling of mechanical systems for mechatronic products. Examples of mechanical systems integrated in mechatronic products 4 Sensors for mechatronic products. Examples of sensors integrated in mechatronic products. 5 Motors and actuators used in mechatronic products. Classification of actuators for mechatronics. Biological, chemical, form memory, piezoelectric, magneto-strictive, thermal, optical, pneumatic actuators. DC motors – structure, dimensioning, functions. AC motors. Stepping motors – principles, characteristics, examples. Selection of a necessary motor. Examples of motors and actuators for representative mechatronic products. 6. Command and control. Classification of control mechanisms. Feed before control. Feedback control. Analysis and design of control mechanisms. Microprocessors and microcontrollers. Applications of microcontrollers. 7. Examples of representative mechatronic products.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechanisms II	MAS6	6	3		2	1

Course description (Syllabus): Modern design of products. Structural modelling of mechanical systems using the multibody method. Structural modelling of mechanical systems as multibody 3D model. Algorithm to define the MBS systems with minimum no of bodies. Spatial mechanical systems. Kinematical model of mechanical systems as MBS. Position, speed and acceleration functions of MBS. Dynamic model of mechanical systems as MBS. Examples of MBS in SolidWorks/ADAMS software.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Sustainable Development	BDD6	3	2		1	

Course description (Syllabus): Sustainable development: history, concept, national and international support legislation. Chapters of sustainable development: sustainable industry, sustainable agriculture, sustainable transportation. Energy – the key problem of sustainable development. Sustainable energy: energy efficiency, energy saving and renewable energy systems. Overview of the renewable energy sources and systems (solar energy conversion systems, wind systems, small hydro systems, biomass systems, systems for geothermal conversion). Education and training for sustainable development. Sustainable communities.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Shape Design and Modelling	CMF6	4	2		2	

Course description (Syllabus): 1. Industrial object - definitions, properties, creation. Definition of product shape; product life cycle; product properties: structure, shape, material, size, surface; stages of product creation. 2. Methods used in the shape design. Existing limits; structure variance method; shape variation method. 3. Shape factors in product design. Origin of shape requirements; interdependence of the product basic properties; design factors: designer, company, society; production factors: manufacturing process, feasibility, economic factors involved in the process choice, operator, detail design, assembly; factors related to sales and distribution; factors concerning the use of the product; destructive factors; evaluation of the recommendations related to product shape. 4. Visual (appearance) dimension in the design of new product. The idea of appearance: aesthetics, unity and order; shape elements; application of basic design principles relating to visual balance, rhythm, scale; combination of shape elements - lines and planes, joints; industrial product and artistic expression; flexibility characteristics / lightness / ease, weight and stability, movement. 5. Case Study: shape concept of an innovative 3D surround headphone.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Conceptual Design	DCO6	2	2			
Conceptual Design - Project	DCP6	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 of 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, Principle 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	seminar	laboratory	project
Recycling technologies	TRC6	4	2		2	

Course description (Syllabus): 1. Introduction. Technological processes. Technical and economic characteristics. National waste management strategy. 2. The importance of waste recycling in product life cycle. Waste. Classification and ways of waste identification. 3. Waste recycling methods and technologies. Primary recycling - reuse. Secondary recycling - mechanical. Tertiary recycling - chemical. Quaternary recycling - thermal. 4. Operations and processes,

equipments and machineries used in recycling technologies. 5. Recycling technologies of the main categories of solid waste (paper, glass, wood, metal, plastics, rubber, electrical equipment and appliances).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Management	MNG6	2	1	2		

Course description (Syllabus): Management appearance and evolution; Companies in Romania; Company, company environment, company functions; Management attributes and functions; Incomes and outcomes budget; Company patrimony and resources; Company accounting; About staff selection and payment; About VAT, added value and surplus value, duties and taxes, fiscal documents; About planning; Production planning and organization; Stock organization, planning and management; Inventory and administration issues.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practical Work 90 hours	PRA6	3				

Course description (Syllabus): The practical work proposes to familiarize the students with the real problematic from companies and to stimulate the appliance of the knowledge gained in faculty in the practical activity. The students have to compile a project regarding the development of a concept of innovative product from the company field of activity.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Tribology	TRB6	3	1		2	

Course description (Syllabus): 1. Introduction (definition of friction, lubrication and wear). 2. Lubricants (kinematic viscosity and dynamic viscosity-temperature dependence, viscosity, pressure, measurement, classification, types of lubricants - mineral and synthetic oils, greases, additives). 3. Dry friction (solid surface topology model of tact, friction and wear). 4. Friction limit (the phenomenon of adsorption / chemosorb ie, mechanism of lubrication). 5. Hydrodynamic lubrication (Reynolds equations, applications in bearings, pressure distribution, load capacity, friction power loss). 6. Abrasive wear, corrosion and cavitation, wear and fatigue.

4th Year (not available in the academic year 2019-2020)

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Aesthetics and Ergonomics	ESE7	4	2		2	

Course description (Syllabus): 1. Introduction. Industrial aesthetics. Object. Domains. Historical bench marks. Industrial aesthetics laws. Industrial aesthetics functions. Everyday aesthetics. Aesthetics of information. The position and importance of aesthetics in the industrial design. Notions, categories and aesthetics principles. 2. The aesthetics of forms. Form, shape, image. Methods and means for shaping the objects. Psychological effects of shapes. The relationship between form and function, material, technology. 3. Colour. Colour sources. Colour perception and psychological effects of colours. Colour mixtures. Using contrasts and colour combination. Colour and light. Colour and shape. 4. Visual perception. Elements about rhythm, visual balance, visual weight and visual dynamics. The contrast. The space. The wrong perception: optical illusions. The Gestalt principles in visual perception. 5. Textures. Materials, as texture producers. Products appearance and forms finishing. 6. Proportion and proportionality. Proportion laws. Methods for obtaining proportionality. Triangulation. Recurrence. Modulation. 7. Aesthetics in product design. Industrial products design. Industrial products aesthetics. The aesthetics in conceptual design and constructive design. Form and colour of industrial products. Product appearance. Product emphasis. Product shape expressing its functionality. 8. Ergonomics. Domains connected to ergonomics. Conceptual ergonomics and correctional ergonomics.

9. The working conditions. Posture. Active space. Manual and foot commands. Working place safety. Physical environment factors: lighting, chromatics, pollution factors, vibrations and noise. Psychological environment factors. The working place design. The human-product system. Anthropometric measures. Human-product -environment relationship. Ergonomic product design.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Embodiment and Detail Design I	PCD7	4	2			2

Course description (Syllabus): Welded assemblies; Riveting assemblies; Actuators; Special bearings; Embodiment design 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); Product development assessment.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Automatics	AUT7	7	3		2	2

Course description (Syllabus): Electric drives, DC machine, Step-by-step motors, Synchronous machine, Pneumatic drives and hydraulic systems, Sensors and sensory systems, Elements of systems theory, Signal conditioning circuits, Continuous linear behavior of control systems, Discrete-time linear systems, Control system structure.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Renewable Energy Systems	SER7	6	4		3	

Course description (Syllabus): 1. Fundamentals of RES. Energy sources. Renewable energy. Energy managment 2. Solar energy. Solar radiation. Instruments for measuring solar radiation. 3. Solar thermal energy conversion. Solar-thermal systems. Solar collectors. 4. Photovoltaic conversion. Principles. PV modules. Systems. 5. Wind power systems. 6. Micro hydros (SMH). 7. Biomass. 8. Geothermal energy.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Clean technologies	THC7	4	2			1

Course description (Syllabus): Mass industrial processes in metalurgy, machine building, domestic goods, chemical processes. Analysis of the pollution degree and energy consumption. Non-polluting processes as alternatives in mass production industries Low-energy consumption alternatives in the idnustrial processes. Cost-benefit analysis for process re-design. Imapct on the final product. Wastes recycling; wastes from manufacturing and end-of-life wastes. Clean technologies: analysis. Case studies: renewable energy systems; energy efficienct systems-intelligent systems. Implementing clean technologies: the rope of the product designer. Conception and manufacturing.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Eco-design	ECD7	4	2			1

Course description (Syllabus): Why ecodesign? (industrial design and ecodesign motivation, ecodesign. some definitions); Environment in product life cycle (the environmental impact of human activities, the environmental impact of a product); Eco – alternatives in product life cycle (energy resources, raw materials, manufacturing, clean technologies, transport, product use, product end of life options); Designing eco-products (design to minimize material usage, design for disassembly, design for remanufacture, design for waste minimisation, design to minimize hazardous materials, design for energy efficiency); Eco-product management (legislation supporting eco-products, managing eco – product development, eco-labeling); Ecodesign perspectives.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Quality Management (10 weeks)	MCP8	3	2		1	

Course description (Syllabus): Introduction. Importance of quality as a factor in the competitiveness of organizations. Evolution of the quality approach, quality management. Terminology. 1. Defining the concept "quality". Terms and concepts. Development concept of"quality" (inspection, quality control, quality assurance, quality management. Total quality management). 2. Family of standards EN ISO 9000. History, principles of quality management, concept of process and process-based approach. 3. Experimental data processing and statistical quality control. Methods of data analysis, statistical quality control. 4. Methods for quality products analysis. Checklists: role, types, variables, attributes. 5. Quality planninc tools. Strategic planning tool, SWOT analysis applied to quality, portfolio quality, operative planning methods, function QFD (Quality Function Deployment). 6. Quality costs. Costs of achieving quality, quality cost models. 7. Classic and modern tools and techniques used In quality management. Cause-effect diagram, Pareto diagram, the correlation diagram, relations diagram, matrix diagram, affinities diagram. PERT chart.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Virtual Prototyping (10 weeks)	PRV8	4	2		1	2

Course description (Syllabus): General aspects and applications in engineering of the virtual prototyping technique; Basic principles of the virtual prototyping process; Critical success and limiting factors; virtual prototyping enablers; Modeling the systems in the virtual prototyping concept; Software platform for virtual prototyping: software components, communications between components; Virtual prototyping phases; Parameterization and optimization in virtual environment; Virtual prototyping of the mechatronical systems in the concurrent engineering concept; Operating characteristics of the virtual prototyping software solutions.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Project Management (10 weeks)	MPR8	2	1	1		

Course description (Syllabus): Introduction; What is Project Management? (Everyday life projects, management matters, role on a project); Tools and keys to project success. (Tools: planning and communicating, organizing work over time, getting work done, solving problems as a team. Keys: managing communication and team work, defining the project clearly, creating a detailed work plan, ensuring high quality); Project stages, from beginning to end. (Concept stage, analysis stage, design stage, development stage, transition to production, project close); Managing the team; Managing risk as change; Managing project quality.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Embodiment and Detail Design II (10 weeks)	PCD8	4	2			2

Course description (Syllabus): Technical documentation. Information extracting from the virtual model. Checking the technical documentation. Establishing the detail drawings shape (number of views, sections, details); Quotation rules (rules, conventions, quotations types, functional quotation); Dimensional exceptions (tolerances fields, adjustments types); Shape and position exceptions. Component assembling; Product use and maintenance; Dimensional control; Product end of life and dismantling; Recycling; Environment protection.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Products Prototyping and optimisation (10 weeks)	POP8	2				3

Project description (Syllabus): Conceptual design. product design (proposed variants, variant chosen); Virtual prototyping and product optimisation. Designing parts (calculation mechanical systems, electrical, hydraulic. command and control, etc. Drawings, computer statement, results ofthe use of software. Design parts / product (aesthetics, ergonomics, color, shape, style, etc.).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practical work for diploma project (4 weeks x 24 hours)	PPD8	4				

Course description (Syllabus): The students have to accomplish the design of the product developed within the diploma project, covering aspects related to conceptual design, embodiment design, aesthetics, detail design, ergonomy etc.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Law and Intellectual Property (10 weeks)	LPI8	2	1	1		

Course description (Syllabus): Copyright. The notion of copyright and its legal nature. Ownership of copyright. Subject to copyright. Transmission of succession to copyright. Protecting the copyright.
Contracts of the exploitation of copyright. Industrial property law. Inventions. Patenting inventions. Subjects of the legal protection of inventions. Protection of inventions. Rights and obligations regarding inventions. Innovations. Utility models & industrial designs.Brand, trademark and service.
Protection of trademarks. The subject oftrademark law. Entitlement to the branding. Transmission rights ta the brand. Forfeiting the brands entitlement. Trade names, indications of source and appellations of origin. Technology transfer contracts. Unfair competition.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Product Maintenance (10 weeks)	MTP8	2	1		1	

Course description (Syllabus): Introduction. Reliability and maintainability. Place of reliability and maintainability in engineering. Elements of probability theory – Application to reliability and maintainability of systems. Classical laws of distribution used in reliability and maintainability. Reliability. The mathematical model of reliability. Maintainability and maintenance of products and systems. Corrective maintenance. Preventive maintenance. Criteria for assessing the efficiency of maintenance. Maintainability models of analysis. Maintenance management. Factors influencing the maintenance activities. Maintainability indicators. Determining the availability of preventive maintainability operating conditions.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Production and Sustainable Consumption (10 weeks)	PCD8	3	2	1		

Course description (Syllabus): The concept of sustainable production and consumption. Principles, directions and components of sustainable development. Dmensions of the sustainable consumption development. Energy systems in the context of sustainable consumption. Natural resources. Renewable energy resources. Sustainable production and consumption indicators. Green technologies. Development strategies in sustainable production and consumption. Legislative aspects for sustainable production and consumption.