Transilvania University of Braşov, Romania
Study program: Industrial Design (in English)
Syllabus for ERASMUS + students

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

1st Year

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Mathematical Analysis	MAT1	English	4	2	2		

Course description (Syllabus): To acquire the basic knowledge of Mathematical Analysis. To learn the fundamental notions of Mathematical Analysis (sets, sequences, series; limits, continuity, differentiability and integrability of functions, properties of these); To acquire the 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	language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Chemistry	CHIM	English	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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Technical Drawing and Computer Graphics I	DTIF	English	4	2		2	

Course description (Syllabus): This course is meant to develop skills in the reading, interpretation and production of Mechanical Engineering drawings. Topics include: 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Computer Programming and Programming Languages I	IDPC1	English	4	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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Descriptive Geometry	GEOD	English	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. Topics include: 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; 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Physics	FIZ1	English	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; Electro-kinetics, electrical conduction, mechanism of conduction; Dielectrics, conductors, semiconductors; applications; Ampere's circuital law. 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Industrial Design Fundamentals I	IDDI	English	3	1	1		

Course description (Syllabus): Design understanding. Design. Industrial design. Engineering design. The role of the designer in a design team. Position of designer and engineer in present and future companies. Simultaneous engineering. Human need - the main motivation of design. Sustainable design. Understand the context of product use. Product categories. The quality of products. Instruments of a designer. Hand drawing, technical drawing, computer assisted design, assisted modeling, CAD. Software tools used in engineering design. Activities in the design studio. From idea to product. Steps in the design process. Product design and development. Materials and manufacturing technologies. Working model, scale model, prototype. The Design Workshop. Innovation in design.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Materials Science and Engineering I	STMA	English	5	3		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. The main subjects are: Orientation and Introduction. Electronic and Atomic Structure and Metallic Bonding. Crystal Structures, Miller Index, Single crystals, Polycrystalline and Non-crystalline 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Linear Algebra, Analytical and Differential Geometry	MAT2	English	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 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Technical Drawing and Computer Graphics II	DTI2	English	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, 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Computer Programming and Programming Languages II	IDPC2	English	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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Mechanics	MEC1	English	5	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 correctly orient their search when they require certain information.

To create a basis for a general technical education that is 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Artistic Drawing	IDDS	English	3			2	

Course description (Syllabus): Drawing Techniques – The sketch; Drawing Techniques – Constructive drawing (Drawing the static nature, still life); Anatomic Drawing; Perspective; Composition; Representation techniques – charcoal, pencil, pen; Representation techniques - aquatint, monotyping, logography, markers, combined techniques.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Practical work I 30 hours	IDPrI	English	4				

Course description (Syllabus): The practical work aims 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.

2nd Year

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Special Mathematics	MASP	English	4	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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Measurement Techniques and Systems	TOCD	English	4	2		2	

Course description (Syllabus): 1. Mechanical instruments for measurement. 2. Optical instruments for measurement. 3. Limits and fits for cylindrical smooth parts. 4. Surface texture measurements. 5. Geometric dimensioning and tolerancing. 6. Tolerances and fits for part threads. 7. Tolerances and fits for gear pairs. 8. Angle measurements. 9. Pneumatic gaging. 10. Measuring machines.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Strength of Materials I	REZ1	English	5	2	2	1	

Course description (Syllabus): 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Electrical Machines and Actuation	IDMAE03	English	5	2		2	

Course description (Syllabus): Electric transformer - Construction, operation of the single-phase transformer empty, in load. Determination of transformer parameters by tests, characteristics. Three-phase transformer; Synchronous machine. Equation and voltage diagrams of the synchronous generator. Synchronous generator features. Electromagnetic torque and electromagnetic power. Synchronous machine with permanent magnets; Asynchronous machine - Basic construction elements. Operation of the asynchronous machine as an electric motor. Electromagnetic torque and regimes asynchronous machine operation. Asynchronous machine operation as generator; DC machine - Basic construction elements. The principle of operation. Induced reaction. Electromagnetic torque. Features DC generators. DC machine with magnets permanent; Elements of electric drives - Fundamentals. Electric motor regimes and services. Choosing the power of electric motors.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Industrial Design Fundamentals II	BDP	English	3	1		1	

Course description (Syllabus): Design process; Ways to achieve unity; Emphasis and focal point Scale and proportion; Balance and rhythm; Design elements; Line and shape/volume; Pattern and texture; Illusion of space and illusion of motion; Value; Color.

Course title	Code	language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Technical Drawing and Computer Graphics III	IDMODE	English	4	2		2	

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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Communication skills-Ethics	IDCOM	English	2	1	1		

Course description (Syllabus): 1. Definitions, models and theories of communication. The components of the communication process. Forms of communication. Communication barriers; Forms of interpersonal communication; CV; Tactics used in conflict - negotiation and mediation; **Communication** within the group. Group processes. Roles within the group. Leadership and communication; **Oral** and written scientific communication; report; scientific article.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Strength of Materials II	REZ2	English	4	3	1	1	

Course description (Syllabus): 1. Resistance Theories; 2. Deflections of Beams under Transverse Loading. 3. Stress under Compound Loads. 4. Curved Beams. 5. Energy Methods for Linear-Elastic Displacements Calculus. 6. Stability of Structures. 7. Dynamic Stress. 8. Thin-Walled Pressure Vessels.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Fluid Mechanics	MEFM	English	3	2		2	

Course description (Syllabus): 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Machine Elements I	IDORM1	English	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 consideration on design of machine elements). Joints (screw joints and screw transmissions; feather and key joints; spline joints; pins and bolts, safety 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 stress; gear forces). Gear transmissions (gear ratios, torques and rotations for each transmission element, forces in speed reducers).

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Numerical Methods	IDMNI	English	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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Quality Management	IDMC	English	3	1	1		

Course description (Syllabus): Quality. Quality management. Quality management system; Standards. Fundamental principles; Total quality management; Quality audit; Quality management tools; Various quality assurance methods; Quality control and cost; Quality certification.

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

Course description (Syllabus): Introduction. Machine, Device, Mechanism. Mechanism Study. History. Examples. Mechanism structure: elements, kinematic joints, kinematic chain. Main phases of structural modeling: Structural modeling of the complex mechanism. Structural optimization of the mechanism; Examples. Modeling of linkage

mechanism. Description. Example. Structural modeling of linkage mechanism Kinematic modeling of the linkage mechanism**.** Dynamic modeling of linkage mechanism Cam mechanisms. Description. Example. Kinematic and dynamic analysis of cam mechanisms. Kinematic and dynamic synthesis of cam mechanisms.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Practical work 90 hours	IDPr04	English	4				

Course description (Syllabus): The practical work aims 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

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Manufacturing Technologies and Cutting Tools	IDTASA	English	3	2		1	

Course description (Syllabus): Materials. Manufacturing processes classification. Single-point cut. Turning. Shaping. Boring. Planning. Multi-point cut: Drilling, Reaming, Spot-facing, Broaching, Milling. Abrasive cut: Grinding, Honing, Super finishing, Lapping. Sheet metal processes: Bending, Shearing, Spinning, Deep drawing, Stretch, Punching. Non-mechanical material removal: Mechanical processes, Ultrasonic, Water-jet, Water-jet abrasive, Electrochemical processes, Thermal processes, Electrical discharge machining, Wire EDM, Electron-jet, Laser profiling, Plasma-jet, Chemical processes. Rapid prototyping: Liquid base processes, Stereo-litography, Strato-conception manufacturing system, Model Maker manufacturing system, Solid base processes, Laminated object manufacturing, Fused deposition modeling, Powder base processes, Selective laser sintering, Three dimensional printing

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Machine Elements II	IDORM2	English	6	2	1	1	3

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

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Heat Engineering and Thermal Machines	TERM	English	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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Materials Science and Engineering II (Special Materials)	IDMS05	English	3	1		2	

Course description (Syllabus): Overview of special/advanced materials and their applications in various fields; Metallic materials: structure, properties (physical, mechanical, chemical), applications. Corrosion and anticorrosion protective methods; Glasses and ceramic materials: definition, classification, obtaining, special uses; Polymeric materials:

definition, classification, obtaining, properties, preparation technologies, special applications; Composite materials: definition, obtaining, properties, uses. Metallic, polymeric and ceramic composites - special applications.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Conceptual Design I	IDSPD5	English	5	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 competitive 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Finite Element Analysis	IDMEF5	English	5	2		2	

Course description (Syllabus): The course presents the main issues related to the analysis 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; the 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Design of Mechatronic Products	IDMPD5	English	5	2			2

Course description (Syllabus): Definition of mechatronics. Mechatronic systems. Definition of mechatronic systems. Sensors for mechatronic products. Examples of sensors integrated in mechatronic products. 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. Command and control. Feed before control. Feedback control. Analysis and design of control mechanisms. Microprocessors and microcontrollers. Applications of microcontrollers. Examples of representative mechatronic products.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Computer Aided Shape Modelling in Design	ID MAF06	English	4	2		2	

Course description (Syllabus): 1. Geometric, Functional and Constructive Form of Products (Geometric Form; Functional Form; Constructive Form; Mathematical Determination of the Products Shape. Surfaces and Edges Equations) 3. Constructive and technological form of the products (Dimensioning and tolerances establishment; Constructive and technological shape of the products in the mechanical process) 4. Guidelines for Embodiment Design (Designing for Production; Designing for Easy Assembling (Types of Assembly; General Guidelines for Easy Assembly; Guidelines for Improving Assembly Operations; Evaluating Ease of Assembly 5. Techniques of 3D Curves Modelling (Hermite Curves; Bezier Curves; B-Spline Curves)

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Mechanisms II (Computer Aided Modelling)	MAS05	English	6	3		2	1

Course description (Syllabus): Fundamental notions: mechanical system, modelling mechanical systems, computer aided modelling of mechanical systems. Structural modelling of mechanical systems using traditional methods. Structural modelling using the Theory of Multibody Systems (MBS): defining a multibody system. MBS kinematic modelling: the kinematic model, forward and invers kinematic, kinematic modelling of geometric restriction, general form of the positions, velocities and accelerations functions, examples.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Form-giving in Design I (Mock-up making)	IDMa06	English	3	2		1	

Course description (Syllabus): The discipline presents the function of the model in the conception of the new design products, the technologies and the modeling materials used in industrial design. Design model: definition, model types and their purposes; Designing with drawings and models; Choice of materials and techniques; The use of paper and cardboard in mock-up making; The use of foams in mock-up making; The use of styling clay in mock-up making; Thermoplastics and thermosets – basic differences; The thermoforming method for modeling; The casting method in mock-up making; Sanding and finishing the models.

Course title	Code	language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Conceptual Design II	IDDC06	English	3	2		1	

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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Conceptual Design II project	IDDC06P	English	2				2

Course description (Syllabus): Application of basic notions used in the Product Conceptual Design for an industrial product

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Practical Work 90 hours	IDPr06	English	4				

Course description (Syllabus): The practical work aims 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Product Design for Sustainable Development	IDSD	English	5	2		3	

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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Design (semiotics)	IDICD6	English	3	2		1	

Course description (Syllabus): The discipline aims at building up specific skills related to the understanding, analysis and interpretation of design concepts in a historic, analytic and comparative context. The students are expected to go through the mains steps of the evolution of design, starting with the genesis of the design concept and continuing with 20th century design highlights, with a special emphasis upon the innovations regarding functionality, form, composition, materials, technology, and ecology. Trends of the future are also discussed, attempting to understand the configuring of the 21st century challenges in industrial design. During the laboratory works the students are expected to develop their ability to analyze and understand several important design concepts and innovative personalities. Also they are expected to develop representational skills as well as personal creativity.

4th Year

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Actuation, command and control of mechanical systems	IDACC7	English	7	3		3	

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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Embodiment Design	DC07	English	3	2			

Course description (Syllabus): Introduction (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 relaxation, Designing against corrosion damage, Designing to standards).

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Embodiment Design - project	DC07Pr	English	2				2

Course description (Syllabus): Starting from the product design specification (PDS) and a structural scheme (result of the conceptual design phase), 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 drawing will be presented. The model will be created using CATIA package.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Design of Mechatronic Products	IDMDP7	English	4	2			2

Course description (Syllabus): Definition of mechatronics. Mechatronic systems. Definition of mechatronic systems. Sensors for mechatronic products. Examples of sensors integrated in mechatronic products. 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. Command and control. Feed before control. Feedback control. Analysis and design of control mechanisms. Microprocessors and microcontrollers. Applications of microcontrollers. Examples of representative mechatronic products.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Product Design for Solar Energy Conversion	CESID	English	4	2		1	

Course description (Syllabus): Energy, renewable energy conversion, greenhouse effect; The Sun's position: Earth-Sun angles, Observer-Sun angles; The Sun energy: extraterrestrial radiation, atmospheric effect, component of solar radiation;. Instruments used to measuring solar radiation; solar thermal collectors; Solar thermal system components; Passive solar energy.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Graphic Design	IDDG7	English	3	2			1

Course description (Syllabus): Introduction in graphic design; Perception; Toward Dynamic balance; Gestalt Theory applied in Graphic Design; Using Text types; Color balance; Composition; Composition balance; Size and proportions; Theme and visual rhythm; Illustration and photography in design; Advertising design; Printings Production – tools and processes.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Creativity and Innovation in Design (10 weeks)	CID08	English	3	2		1	

Course description (Syllabus): The course objectives is: Development of personal creative capabilities. Effecting specific tests. Development of acquiring group techniques abilities. Introduction of some rigorous engineering calculations in the design of the interior (structure, composition, dimensions etc.) of products, as well as for the conception, as form and aesthetics, of their exterior. The study and rigorous application of some data and calculus regarding the proportions of components and products. The calculations for coloring the exterior of products. Surface-color correlations.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Innovation Management in Product Design (10 weeks)	MINOVID	English	3	2			2

Course description (Syllabus): Methods and techniques used in the intuitive technical creation. Preliminary formulation of the creation theme. Analysis of the creative theme. Specification and detailing of the creativity and brainstorming solutions and the physical principles of operation. Analysis of selected engineering solutions; theoretical analysis of the technical - economic estimation and implementation.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Virtual Prototyping (10 weeks)	PV08	English	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 mechatronic systems in the concurrent engineering concept; Operating characteristics of the virtual prototyping software solutions.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Web-design (10 weeks)	CDP08	English	3	2		1	

Course description (Syllabus): The course presents the main aspects regarding the development, upgrade and management of dynamic websites using software like Microsoft Frontage or Macromedia Dreamweaver: inserting and modifying objects like text, images, tables and other similar HTML objects; creating interactive behavior of websites (actions triggered by different events); designing of forms, which enables to capture information from the user who visits the website; information and examples of how a website can be transferred (uploaded) to a dedicated webserver and maintained.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Project Management (10 weeks)	MP08	English	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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Detail Design (10 weeks)	PD08	English	4	2			2

Course description (Syllabus): Information extracting from the assemble; Establishing the detail drawings shape (number of views, sections, details); Quotation rules (rules, conventions, quotations types, functional quotation); Surfaces state (manufacturing, roughness, thermic treatments); Dimensional exceptions (tolerances fields, adjustments types); Shape and position exceptions. Component assembling; Product using and maintenance; Dimensional control; Recycling; Applications.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Object Design (10 weeks)	ODID	English	3	1		2	

Course description (Syllabus): In this study the students are encouraged to create new objects, to think creatively, to be innovative and dedicated to improving the quality of life through design. Principles used to define the style of the products. Guided study of the various influence trends. Functional Analysis-effective tool for broadening the search range of design solutions. Analysis of user needs; analysis of the typology of users; analysis of the user rituals Technical specifications; study of materials; environmental analysis and life cycle Identify the main objectives, project planning, synthesis specification Creative research Development of the chosen concept - Case Study

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Eco-design and Products Recycling	RP07	English	4	2		2	

Course description (Syllabus): Why eco-design? (industrial design and eco-design motivation, eco-design. 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 minimization, design to minimize hazardous materials, design for energy efficiency); Eco-product management (legislation supporting eco-products, managing eco – product development, eco-labeling); Eco-design perspectives.

Course title	Code	language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Package Design (10 weeks)	IDDA08	English	3	1		2	

Course description (Syllabus): Package definition. Package types. Materials used for packages. Package functions. Package characteristics. Functional characteristics. Psycho-sensorial characteristics. Economic characteristics. Technical-economic characteristics. Package quality. Visual perception of package. Package form. Package color and graphics. Package design. Stages in package design. Package aesthetics. Technical efficiency and aesthetic qualities in package design. Ergonomic principles in package design. Specific items in package design. Package layers. Mono-functional package: protective packing. Poly-functional package: protective, aesthetic and promotional. Ergonomic and safety principles in package design. Ethical aspects in package design. Eco-package design. The environment protection in package design. Recyclable package and package made from recyclable materials. Reusable packages. Collecting, sorting and recycling the package or materials from package. Bio-degradable packages. Modern concepts of industrial design in package design. Standardization and modular construction of package. Normalized dimensions in packaging industry. Package batch production and one-off production. Promotion and advertising, Product/package rebranding