

# Transilvania University of Braşov, Romania

## Study program: Mechatronics

Faculty: Product Design and Environment

Study period: 4 years (bachelor)

1<sup>st</sup> Year

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Mathematical Analysis	MKTAM01	Romanian	5	2	3	-	-

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

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Chemistry	MKTCH01	Romanian	4	2	-	1	-

**Course description (Syllabus):** Principles of chemistry and properties of matter explained in terms of modern chemical theory with an emphasis on topics of general interest for Mechatronics; Understand the molecular structure and properties of chemical substances in describing and solving real technological problems. Demonstrate quantitative problem-solving skills in many aspects of chemistry, including solutions and properties of solutions, metals and corrosion, electrochemistry, polymers.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Computer-Aided Graphics I	DIDT01	Romanian	5	2	-	2	-

**Course description (Syllabus):** Drawing standards. Graphic representations used in technical drawing. Views and sectional views. Dimensioning. Representation of the machine parts and components. Designation of surface characteristics. Limits of size. Assembly drawing.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Computer Programming and Programming	MKTPC01	Romanian	4	1	-	2	-

**Course description (Syllabus):** Systemic presentation of programming languages, C++ program structure, arithmetic expressions, functions and outputs, entries in the program, applications writing, logical expressions and control structures for selection – loops, functions, and control structures.

Elementary algorithms, algorithm representation methods; Basic elements of the C++ language. Data types. Type modifiers. Constants. Variables; C++ language operators (arithmetic, relational, comparison, logical, assignment, conditional, etc.). Strings; C++ language instructions (empty statement, compound expression, if, while, do while, for, switch, break, continue, goto, return); Preprocessing. Structure of a program in C++. Arrays. Classification. One-dimensional arrays (vectors). Two-dimensional arrays (matrices); Functions. Formal and actual parameters. Local and global variables. Static and automatic variables. Mathematical functions. User-defined and void functions; Files. Declaration. File operations. Lower and higher level file processing.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Mechatronic Systems I	MKTGDO1	Romanian	5	2	2	-	-

**Course description (Syllabus):** The course is an introduction to the Mechatronic Systems. The main subjects are: Mechatronics concept – definitions, models; The structure of a Mechatronic System; Introduction to Mechatronic systems used in Industry (Industrial robots, mobile robots), Introduction to Mechatronic systems used in Medicine (Biomechatronic products; Mechatronic design of prosthetic equipment; Mechatronic product structures with applications in medicine), Introduction to Mechatronic systems used in Agriculture; Introduction to Mechatronic systems used in Services (Systems for serving the population; The general structure of the systems for serving the population; Vending machines; Vending machines for services); Intelligent equipment for office automation: Mechatronics and office automation; Mechatronic product structures applied in office automation

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Science and Engineering of Materials	MKTSMO1	Romanian	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 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	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Linear Algebra, Analytic Geometry and Differential Equations	DIAGAD	Romanian	4	2	2	-	-

Course description (Syllabus): Vector spaces. Linear transformations. Eigenvalues and eigenvectors. Free vectors. Line and plane in space. Conics. Quadrics. Surfaces generation. Differential equations bases – Cauchy's problem solution. Differential equations: Bernoulli, Riccati, Lagrange, Clairaut, Euler etc. Homogenous, linear and with exact total differential equations.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Computer-Aided Graphics II	MKTDT02	Romanian	5	2	-	2	-

**Course description (Syllabus):** Using coordinates and coordinate systems. Layout formats used in the technical field. Graphical elements of layout formats. Making drawings accurately by using OSNAP modes. Using the methods of selection. Control the drawing views. Making simple drawings using drawing commands according to the ISO projections disposal. Rules of projection representation in engineering graphics. Drawing graphical construction using editing techniques. Introduction to AutoLISP programming language. Making complex drawings using editing techniques and UCS system. Simple representation of threaded parts. Conventions of representation and dimensioning of threads. Using layers. Overview of text styles. Create texts. Create and insert blocks. Making semi-complex drawings. Representing sections. Overview of hatch patterns. Dimensioning. Using dimension styles, editing and updating dimensions. Making an assembly drawing. Representation and dimensioning of an assembly drawing. Creating a complex 3D model by solid modeling. Visualization and rendering.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Computer programming and programming languages II	MKTPC02	Romanian	4	1	-	2	-

**Course description (Syllabus):** General aspects regarding personal computers, process computers, development systems with microcontrollers. Structure of a microcontroller system (inputs, outputs, communication interfaces, ROM and RAM memories). Arduino Development Systems. Models. Description of the Arduino UNO development platform and presentation of the main types of applications in the field of Mechatronics, Robotics and Medical Engineering. Basics of programming Arduino platforms (Structure of an Arduino program, compiling and uploading sketches to the Arduino platform, digital and analog inputs and outputs, PWM signals, interrupts, LCDs). Sensor applications developed in Arduino (temperature and humidity measurement, illumination level measurement, force measurement etc.). Communication interfaces (serial interface, SPI interface, I2C interface). Bluetooth communication. LAN and Wi-Fi networks. Projects developed with Arduino platforms in the field of mechatronics, robotics, optoelectronics and medical engineering.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Physics	MKTFZ02	Romanian	4	2	-	1	-

**Course description (Syllabus):** Classical mechanics; The theory of special relativity. Thermodynamics and statistical physics. Electromagnetism. Optics. Elements of quantum physics.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Mechanics	MKTMC02	Romanian	5	3	2	-	-

**Course description (Syllabus):** Torsors, mass center, solid bodies statics, friction balance of rigid body, material point kinematics, rigid body kinematics, fundamentals in dynamics, d'Alembert principle.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Communication	TDCO	Romanian	3	1	-	1	-

**Course description (Syllabus):** Informational society, information and communication technology, documents-classification-library, international standards of information culture-access information-information retrieval tools, search strategies, information evaluation, information management, information communication, plagiarism.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Electrotechnics	MKEA02	Romanian	3	2	-	1	-

**Course description (Syllabus):** Electrostatics; Electrokinetics; Electrodynamics; AC circuits; Electrical engineering in industrial applications; Power circuits used in industrial installations; Industrial electrical installations.

## 2<sup>nd</sup> Year

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Special Mathematics and Mathematical Statistics	DIMS03	Romanian	4	2	1	-	-

**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
Strength of Materials	DIRM03	Romanian	5	3	1	1	-

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

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Applied Informatics	ANUM	Romanian	5	2	-	2	-

**Course description (Syllabus):** Introduction to the graphical programming environment, Programming elements, Data types and structures, Programming structures, Graphical representation, Objects of the frontal panel, Operations with files, Application planning.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Electronics	ELEC	Romanian	4	2	-	2	-

**Course description (Syllabus):** Introduction to circuit analysis, AC, circuit elements. Fundamentals of network analysis. Four-terminal networks: quadrupole. Quadrupole types, general theory, parameters. Solid-state devices. Semiconductors, conductivity, p-n junction, biasing junction capacities - varicap diodes. Principles of amplifiers. Power amplification. Classes A, B, AB, and C. Characteristics of semiconductor devices. Input and transfer characteristics in bipolar transistors and FET; Saturation. DC amplifiers. Amplifiers with Operational Amplifiers. Instrumentation amplifier. Power supplies. Rectifiers and stabilizers Concepts of Boolean algebra. Elementary logic functions. Implementing logic functions with bipolar and unipolar transistors. The family of integrated logic circuits. Sequential logic circuits: circuit dumps flip-flops, counters, registers

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Biomechanics	BMEC	Romanian	5	2	-	2	-

**Course description (Syllabus):** Mechanics and modern biology, Basic principles of mechanics, Basic laws, Principal models in mechanics, Physics – mechanics models of bodies, Biostatics, Bio-dynamics, Biomechanics of locomotors.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Optoelectronics	OPEL	Romanian	5	2	-	2	-

**Course description (Syllabus):** Introduction to optoelectronics, nature of light, Maxwell's equations, electromagnetic spectrum; Introduction to geometric optics: Laws, postulates, reflection and refraction of light, total reflection; Luminescence and associated phenomena: photoluminescence, cathode luminescence, electroluminescence; Liquid crystals: properties, devices, applications, display systems; Light Emitting Diodes: properties, devices, applications, display systems; Photodetectors: properties, photonic devices, applications; Laser diode, laser diode devices, applications; Optical fibers: classification, propagation of radiation, manufacturing technologies, couplings and joints, applications; Optical fiber communications, fiber channel distribution information; Optical modulation of information, modulation circuits.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Digital Electronics	DIM3D	Romanian	3	2	-	1	-

**Course description (Syllabus):** Logic support for digital systems: Boolean logic formalism; Logic support- gates; Noise sources and rejection. Logic combinational circuits (CLC): Synthesis and implementation of the CLC; De facto standard

CLC types: coders, decoders, multiplexers/demultiplexers, ROM, PLA, arithmetic circuits. Sequential Logic Circuits, SLC); Synthesis and implementation of the SLC; De facto standard SLC types: flip-flops and related devices, counters, registers, RAMs. Circuits support for applications design.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Mechanisms and Machine Elements	DIOM04	Romanian	5	3	-	1	1

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

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Processing Technologies	THPL	Romanian	4	2	-	2	-

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

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Numerical Methods	MNUM	Romanian	4	2	-	2	-

**Course description (Syllabus):** Errors (absolute and relative errors, error sources, error propagation, graphs of Procedure); Solving algebraic and transcendental equations (function representation method, the method half interval, recursive definition of the variable method, Newton-Raphson method); Matrix algebra and linear systems of equations (adding matrices, multiplying matrices, calculate determinants, matrix transposition, matrix adjoint calculation, matrix inversion, solving linear systems of equations - Gauss-Jordan method, Gauss-Seidel method); Interpolation method (Newton polynomial of the first case, the Lagrange polynomial, interpolation by polynomials of degree three); Numerical derivation (derivation formulas of interpolation, Taylor series method development, method differences symmetrical function by polynomial approximation method); Numerical integration (trapezoids rule, Simpson's rule, Romberg's method, Gauss); Applications in mechatronics.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Fundamentals of Mechatronic Systems	BSMT	Romanian	5	3	-	2	-

**Course description (Syllabus):** Introduction: The concept of mechatronics - definitions, models, development of mechatronic systems; Classification of mechatronic systems, mechatronics system design considerations; The automotive as a mechatronic product: General, automotive mechatronics elements, structures used in building mechatronic modern car; Robots: industrial and mobile robots; Overall structure of the systems for serving populations; Commercial and automatic services; Smart office equipments: Mechatronics and office equipments; structures of the mechatronic products used in office; Bio-mechatronic products, Mechatronic product structures with applications in medicine; Modeling of mechatronic systems: general considerations, analogies between the mechanical and electrical components of mechatronic systems generalized sizes: Effort and flow; Bond Graphs; Motor assembly - actuator - task: Equations of equilibrium of forces / moments, reduced masses / moments of inertia and

forces / moments, customizing for different drives. Kinematic profiles; Drives, classification, stepper motors, DC servo motors, piezoelectric actuators, and shape memory actuators; Control in mechatronics systems: case studies.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Techniques and Measurement Systems	TCDI	Romanian	3	2	-	1	-

**Course description (Syllabus):** Dimensional precision, ISO system of tolerances and fits, basic notions of technical measurements, statistical study of machining and measuring errors, dimensions chains.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Domain Practice	PRAC1	Romanian	4	3 weeks x 30h = 90h			

**Course description (Syllabus):** High precision processing technologies; Specific assembly manufacturing technologies of mechatronics parts; Repair technologies for measuring and control devices; Design for manufacturing technology and machine tools parts of mechatronics.

### 3<sup>rd</sup> Year

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Processing Machines and NC	MLCnc	Romanian	4	2	-	4	-

**Course description (Syllabus):** Introduction in classical study of the technological process, Numerical Control Programming elements, Types of NC machines, turning and milling operations.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Processing Machines and NC - Project	MLCnp	Romanian	2	-	-	-	1

**Course description (Syllabus):** Design a complex NC program that includes turning and milling operations. Writing the program and simulating it using specialized software.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Drive Systems	SIAC	Romanian	4	2	-	2	-

**Course description (Syllabus):** Introduction for drives systems; Actuators, distributors, adjustment elements. Auxiliary systems for drive systems; Examples of drive circuits, Drive circuits design.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Manufacture and Assembly in Mechatronics using Flexible Systems	FMMT	Romanian	5	2	-	2	-

**Course description (Syllabus):** Introduction to Flexible manufacturing and assembly systems; Flexible manufacturing and assembly equipment: The concept of numerical control; Processing centers; Flexible manufacturing cells; Flexible manufacturing systems; Flexible systems; Modern concepts regarding material handling; Command and control of material flows; Equipment used in material handling; Storage systems; Communication networks and protocol standards: structures, access methods, ISO/OSI model, data interfaces and communication profiles.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Fundamentals of Automated Systems	BSAT	Romanian	5	2	-	2	-

**Course description (Syllabus):** Introduction to mechatronic systems automation, definition of terms used, History; Typology of mechatronic systems, automation problem definition in continuous and discrete time; Modeling of mechatronic systems, electrical and hydraulic modeling of mechanical systems, the analogy between models; Transfer function of the systems, Laplace and Z transforms, solving the differential equations and finite differences; Block diagram algebra, numerical solution of the dynamic model using Matlab-Simulink software; Modeling in state space, transfer function obtained from state equation, systems stability; Analysis and design of control systems with feedback: objectives and methods, definitions; Root locus method, procedures for finding roots, PID control, using MATLAB program; Frequency response method, stability in frequency domain; Systems analysis of order 1, 2 and higher order.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Sensors and Sensory Systems	SEnz	Romanian	5	2	-	2	-

**Course description (Syllabus):** Overview of sensors and transducers, the structure of the chain measuring. The role of the transducer in the chain measuring system; Classification of sensors and transducers, sensors and transducers characteristics and performance; Parametric electrical transducers, inductive transducers; Resistive, capacitive, magnetostrictive and piezoelectric transducers; Displacement transducers, proximity sensors for measuring time, sensors and transducers for measuring velocities and speeds; Sensors and transducers for measuring vibration and acceleration, transducers for measuring fluid parameters; Microsensors, Sensors, CCD sensors, fiber optic sensors, laser sensors.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Heat Engineering and Fluid Mechanics	TMFL	Romanian	5	3	-	2	-

**Course description (Syllabus):** Thermodynamics. Fundamental measures. The first principle of thermodynamics. Ideal gas. Mixtures of ideal gases. Ideal gas state transformations. The 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
Medical Equipment	APLAc	Romanian	3	2	-	1	-

**Course description (Syllabus):** Introduction to physiological measurements; Design and construction of equipment for biological sample preparation; Installation, Diagnostics, and troubleshooting for optical analysis equipment; Construction and troubleshooting for peristaltic pumps, dispensers, and centrifuges; Design, construction, and adaptation of automated equipment for biological testing; Design, construction, and adaptation of computerized test equipment; Management and maintenance of equipment and instruments used in laboratory testing.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Measurement and Instrumentation	MASlc	Romanian	3	2	-	1	-

**Course description (Syllabus):** Measurement and its influence factors; measuring methods and means; length measurement; angles measurement; mass measurement; measuring the characteristic quantities of fluids: capacity, pressure, flow, density, viscosity, and humidity; temperatures measurement; electric current measurement.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Computer-Aided Design	PRAC	Romanian	4	2	-	2	-

**Course description (Syllabus):** Aided design objectives and possibilities. Aided design concept phases of a product; Presentation of the specific CAD software (CATIA and ProENGINEER); CATIA modules: Sketches and Assembly Design; ProENGINEER modules: Sketcher, Part Design, and Assembly Design.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Microcontrollers, Microprocessors	MICR	Romanian	4	2	-	2	-

**Course description (Syllabus):** The general structure of a digital control system. Information flow in a control system; Central Processing Unit. Architecture. Component blocks. Data Bus, Address Bus, Control Bus; Working with memory; Von Neumann Architecture. Harvard Architecture; Control Unit; Arithmetic Logic Unit. Registers; RISC, CISC, SISC; Memory. RAM, ROM. ICP and ISP concepts; I/O unit. Port mapping. Parallel ports. Serial ports. Timers; 8 bit and 16-bit microprocessors; 8-bit microcontrollers. MCS51 Family; 8051 microcontroller; Architecture. Signals; Buses; Memory structure; Interrupts; Timers; Serial communication; 8051 microcontroller; Applications.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Mechatronic Systems II	SIMT02	Romanian	4	2	-	2	-

**Course description (Syllabus):** Elements of Mechanical Engineering; Elements of Tribology; Prosthetic components; Elements of robotics; Photometry; Technical optics applications based on the phenomena of interference and diffraction of light; Optics of anisotropic media; Elements of quantum optics (thermal radiation, photoelectric effect, laser effect).

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Mechatronic Systems II – Project	SIMTP02	Romanian	2	-	-	-	2

**Course description (Syllabus):** Automated system for sorting parts – Project. Critical analysis of existing systems. Project objectives. Design requirements. Theoretical considerations about sorting systems (Block diagram, subsystems identification and description, pre-sizing). Sizing of mechanical and electrical components. Design of the automated system for sorting parts (functional diagram, computer-aided design of mechanical parts, control system design, PLC programming).

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Programming industrial robots	PRI	Romanian	3	2	-	2	-

**Course description (Syllabus):** Industrial Robots: definition, structure, classification, characteristics; Kinematics and dynamics of industrial robots; Defining locations (position and orientation) learning opportunities or assignment of coordinates; Instructions for movements and actions of the robot; Instructions for interfacing with computers; Processing information from sensors, interfacing with sensors systems; Examples of programs for operations PTP, CP, parts storage and handling of pallets, adapting work programs based on information from sensors.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
PLCs (Programmable Logic Controllers)	AUTP	Romanian	3	2	-	2	-

**Course description (Syllabus):** The structure of a control system; Programmable Logic Controllers: Classification; Block Diagram; Inputs/ Outputs; How a PLC works; GRAFCET; Programming languages for PLC; IEC-1131 Standard; SFC (Sequential Function Chart); Statement List (STL); Structured Text (ST); Ladder Diagram (LD); Function Block Diagram (FBD); Examples. FESTO PLCs: Classification; Architecture; Working with variables and constants. FESTO FEC FC6XX: Using Counters and Timers; Programming. Examples.



Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Specialized Practice	PRAC2	Romanian	3	3 weeksx30h=90h			

**Course description (Syllabus):** Actuator control circuit design; Designing of the electronic circuits with microcontrollers; Designing electronic circuits for implementing special sensors; Execution technologies of the electrical and electronic circuits; Computer-aided design applications in the mechanical and electrical fields.

#### 4<sup>th</sup> Year

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Manufacturing technologies and micro / nanotechnologies	TMNS	Romanian	6	3	-	1	1

**Course description (Syllabus):** Introduction to micro-systems technology: concepts and principles, materials and methods, Micro-fabrication techniques: ultra-precision manufacturing, lithography, surface and bulk microfabrication, LIGA, Non- conventional technologies, Nano-cutting manufacturing.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Image Processing, Artificial Vision and Medical Imaging	PIVI	Romanian	4	2	-	2	-

**Course description (Syllabus):** Hardware and software acquisition systems; images treatment systems; procedures for modifying the primary characteristics of images; procedures for improving the images; color image processing in different ranges; compression and storage systems; image deformation, addition and structural changing systems; geometric operations for image processing; segmentation; determining the edges and the contours of a color or monochrome image.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Microcontroller Programming	MPMC	Romanian	4	2	-	2	-

**Course description (Syllabus):** Assembly Languages for microcontrollers; 8051 microcontroller family assembly language; Memory mapping in control systems; Using and addressing external ports; Applications in assembly language using Mikroelektronika UNI-DS6 development board: Using LEDs, keypads, Interrupts, Timers etc.; High-level programming languages for microcontrollers. MikroC; Applications in high-level programming languages using Mikroelektronika UNI-DS6 development board: LCD text programming, Graphical LCD programming, 7-segment display programming, Data acquisition using microcontrollers, Remote control using Serial-to-Ethernet interfaces; ATmega microcontroller family. High-level programming languages; Creating GUI in Visual Basic, for PC control of the microcontrollers systems.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Microcontroller Programming – Project	MPMP	Romanian	2	-	-	-	1

**Course description (Syllabus):** The topics refer to the design, practical realization and programming of an autonomous mobile system controlled by the microcontroller (working in teams of up to 4 students) or to the design of microcontroller display systems using MikroElektronika UNI-DS6 development board with AT89S8253 microcontroller (LED matrix, 7 segments, LCD text, LCD graphics) and programming in both assembly language and high level language (individual themes).

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Artificial Intelligence	IART	Romanian	4	2	-	2	-

**Course description (Syllabus):** Artificial Intelligence. Definitions. Impact. Applications. Evolution; Neural networks. Biological neuron. Artificial neural model. Basis functions. Activation functions; Neural networks. Architecture. Classification. Training. Training strategies and algorithms. Supervised and unsupervised training; Neural networks. Perceptron. ADALINE. Multilayer Perceptron. Backpropagation training algorithm. Considerations on the training process. Designing a processing system with neural networks. Deep learning; Fuzzy Logic. Structure of a Fuzzy Logic System. Linguistic Variables. Membership Functions. Fuzzy Rules. Fuzzy Set Operations. Defuzzification; Examples; Genetic algorithms.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Pneumatic and Hydraulic Automation	APHI	Romanian	5	2	-	2	-

**Course description (Syllabus):** Introduction in pneumatic and hydraulic circuits, Working with proximity sensors, Pneumatic elements with logic circuits, Designing pneumatic and hydraulic circuits with logical elements, Applications in drives and automation.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Pneutronics and Hydronics	PNHI	Romanian	5	2	-	2	-

**Course description (Syllabus):** Sequence modular block; Starting modes; Emergency stops; Single way circuits; Parallel multi-way circuits; Multiple programming; Step by step remote.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Data Acquisition Systems and Interfaces	SAIN	Romanian	5	2	-	2	-

**Course description (Syllabus):** Introduction to data acquisition and processing systems; Signals, signal types, classification in terms of the energy spectrum, the signal representation, analog signal processing; Signal conditioning circuits; Analog to digital and digital to analog signal conversion; Acquisition systems with microcontrollers; Interfaces with microcontrollers and computers: RS232, USB, I2C, GPIB, FIELDBUS, CAN; Communication in data acquisition systems; Virtual instrumentation, architectures, Data acquisition systems software design.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Signals and Systems	SESI	Romanian	5	2	-	2	-

**Course description (Syllabus):** Traditional hardware instrumentation systems; the concept of a synthetic instrument; signals, signal types, classification in terms of the energy spectrum, the signal representation, analog signal processing; Communication in data acquisition systems; Virtual instrumentation, architectures, software. Data acquisition systems design.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Mechatronics of Biomedical Systems	MTSB	Romanian	4	2	-	2	-

**Course description (Syllabus):** Biomechanical systems, Mechatronics of instrumentation used to determine the kinematic and dynamic parameters of the human body, Mechatronics of instrumentation for investigation and recovery of biological functions.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Databases and Statistical Processing	BDPS	Romanian	3	2	-	2	-

**Course description (Syllabus):** The course objectives are meant to familiarize the students with the existent database types, their way of selection according to their purpose, and the way of organizing and processing information characteristic for their field of activity. The students will have to select the way to organize and process the data in correlation with their type of activity and have the required knowledge to properly manage the information related to their profession and the subjects they are in contact with.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Coordinate Measuring Machines	MMCO	Romanian	3	2	-	2	-

**Course description (Syllabus):** To familiarize the students with the coordinate measuring machines typology and construction; Knowing the coordinate machines measuring principle; To acquire the main software interface working in coordinate measuring machines; Knowing the main steps necessary for working with *DEA GLOBAL* coordinate measuring machine; Knowing the PC-DMIS software environment associated to *DEA GLOBAL* coordinate measuring machine; Learning how operations work on the car prior *DEA GLOBAL* machine; Learning how to measure geometrical and form parameters for simple and complex geometry components; Learning how to scan and generate some CAD models for simple and complex geometry components.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
General Economy	ECOG	Romanian	2	1	1	-	-

**Course description (Syllabus):** Identification of the fixed costs and variable costs of an organization; Using the economic efficiency indicators characteristic of an investment project; Use of indicators specific to the calculation of the production capacities of an organization; Understanding and using the demand and supply mechanism; Identify the main quality control procedures and industrial management techniques.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Mechatronics in Agriculture	MTAG	Romanian	2	1	-	1	-

**Course description (Syllabus):** Computer-aided systems for measuring the active substance content from agriculture products. Mobile laboratory for weather parameters measuring and soil parameters measuring; Equipment for measuring the electrical conductivity of soil; Mechatronics of Agriculture Machines.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Automotive Mechatronics	MAUT	Romanian	2	1	-	1	-

**Course description (Syllabus):** The discipline aims to familiarize students with classic car construction, especially with the implementation and use of sensory systems and advanced mechatronic systems in modern cars. **Specific aims are:** Knowledge of building a classic car; Knowledge of the role and functioning of mechatronic systems for the vehicle behavior optimizing; Knowledge of operation and performance of mechatronic systems in the vehicle structure, as sensors, actuators, and control systems.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
CAD/ CAM/ CIM	PCAM	Romanian	4	2	-	1	1

**Course description (Syllabus):** Production System, Manufacturing System, Process Planning, Production types and organization methods, CAPP Systems, CAD-CAM concepts and principles, Integrated Manufacturing Systems.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
NC Programming	PMCN	Romanian	4	2	-	1	1

**Course description (Syllabus):** CNC information system; NC manual programming; Basic standards, origins, axes, movements, addresses; Speed and revolution coding, Preparing functions, auxiliary functions; Position programming; CNC software; CNC peripherals.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Automatic Control and Serving	ACSI	Romanian	4	2	-	2	-

**Course description (Syllabus):** Quality. Basic principles in quality assurance; Considerations on the selection of the type of control. Mechatronics concept of automatic control systems. Mechatronics Concept of handling systems. Mechatronics Concept of supply systems for automatic control. Mechatronics Concept of dosing systems, transport, and storage of parts in automatic control systems. Mechatronics design considerations for vending machines. Outstanding issues regarding the construction and operation of the main components of construction machines services.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
ATMs and Vending Machines	AUBC	Romanian	4	2	-	2	-

**Course description (Syllabus):** Vending machines; ATMs, Sensors, Control for ATM and vending machines; Magnetic card readers and recorders; Structure, technical characteristics; different types of vending machines, etc.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Elaboration of the Diploma Project	PTEM	Romanian	4	-	-	-	4

**Course description (Syllabus):** Design, implementation, and maintenance of mechatronic systems.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Practice for Diploma Project	PRAC3	Romanian	4	60 + 36 = 96 hours total			

**Course description (Syllabus):** Design, implementation, and maintenance of mechatronic systems.