"Dunarea de Jos" University of Galati

Faculty of Engineering

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
MECHANICAL ENGINEERING - BA						
Mechanical Engineering	**BA**	**Mechanical Engineering**	**1**	**1**	**Mathematical Analysis** Strings and series of real numbers. Differential calculus. Integral calculus. Differential equations.	5
					Physics Elements of physical mechanics. Fluid statics and dynamics. Oscillations and elastic waves. Elements of molecular physics. Elements of thermodynamics. Elements of quantum mechanics, atomic and nuclear physics.	5
					Chemistry Classification of chemicals. Aggregation states of matter. State transformations. The fundamental laws of chemistry. Elements of the structure of atoms. Atomic models. The periodic system of the elements. Chemical bonds. Dispersed systems. Colloidal systems. Redox reactions. Electrolysis. Hydrogen. Metals. Periodic system groups.	5
					Descriptive Geometry Projection systems. Representation of point, line and plan. Polyhedrons. Cylinder and cone. Sphere. Intersections of geometric bodies.	5
					Materials Science and Engineering Types of materials. Atomic architecture. Diffusion. Solidification of metallic materials. Alloy systems. Phase balance diagrams. Fe-C alloy system. Phase transformations in solid state. Heat treatments. Non-ferrous alloys. Ceramic materials. Plastic materials. Composite materials.	5
					Sports Front exercises and workouts. Notions of running school. Repeat the main processes in football (boys) and volleyball (girls). Educate the dynamic force at the level of the upper, lower limbs, abdomen and trunk by the method of working in the circuit and by working on workshops. Effort readjustment. Sports Games.	1

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**BA**	**Mechanical Engineering**	**1**	**1**	**English** Production. Specialized vocabulary and discourse situations. Grammar in focus: Present tenses. Research and Development. Specialized vocabulary and discourse situations. Grammar in focus: Past tenses (past simple, past continuous, past perfect). Information technology. Specialized vocabulary and discourse situations. Grammar in focus: Future forms. Logistics. Specialized vocabulary and discourse situations. Grammar in focus: Conditionals. Quality. Specialized vocabulary and discourse situations. Grammar in focus: Verb phrases. Health and Safety. Specialized vocabulary and discourse situations. Grammar in focus: Verb phrases.	2
					Communication Communication, principles, units and characteristics of communication, the effects of communication, the intelligibility of the message; levels of human communication. The emitting-receiver relationship in managerial and organizational communication. Language Functions. Effective communication principles. Characteristic units of communication. Nonverbal communication. Oral communication. Prepare and support an oral presentation. Types of interviews. Communication networks. Communication in conflict management. Communication and listening. Techniques for making oral and written scientific presentations. Formats for presentations. Organization of the presentation. Case Studies. Structure of technical and scientific works.	2
				2	**Linear Algebra, Analytic and Differential Geometry** Matrix operations. Determinants and their properties. Systems of linear equations. Vector spaces. Subspaces. Linear dependence and independence. Bases and Dimension. Coordinates. Change of basis. Linear transformations and Matrices. Eigenvalues and eigenvectors. Diagonalization of a matrix. Inner products and orthogonality. Gram–Schmidt orthonormalization process. Coordinates. Cartesian coordinate-system. Polar coordinates. Cylindrical and Spherical Coordinates. Products of Vectors. Equations of lines and planes. Equations of sphere. Quadric Surfaces. Local theory of Curves. Parametrized Surfaces. The Gauss Map. Curvatures.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**BA**	**Mechanical Engineering**	**1**	**2**	**Drawings and Infographics I** Arrangement of projections. Views, sections, breaks. Dimensioning of technical drawings. Representation of threads and flanges. Indication of surface condition, marking of dimensional deviations and geometric tolerances. The assembly drawing. Non-demountable joints. Removable assemblies. Mechanical Power Transmitters. Sealing elements.	5
					Computer Programming and Programming Languages Basics of computing. Components of a Computer Systems. The functional scheme of the structure of the computer. Types of computer memory. Introduction to Computers Programming. Forms of information. Data structures. Algorithms and components. Object orientation. Programming techniques. Computer Language Translation. Cloud Computing. Future of programming.	4
					Materials Technology The Structure of Crystalline Solids. Mechanical Properties of Materials. Physical properties of materials. Processing of Metal Alloys. Glass processing. Processing of ceramics. Cermet's. Processing of rubber.	4
					Mechanics I Statics. Fundamental concepts, systems of forces, moment of a force about a point, moment of a force about a given axis, reduction of a force, reduction of a system of forces, particular cases. Centers of gravity of a system of particles and a rigid body. Centers of gravity of some usual homogeneous bodies. Statics of free particles and particles with constraints. Equilibrium of rigid bodies and systems of rigid bodies. Trusses. Statics of the cables. Statics of the simple machines. Kinematics of particles: motion of particles in about various coordinate systems, particular motion of particles. Relative motion of particles.	5
					Electrotechnics Introduction to the basics of electrotechnics. Electricity. Production, transport, distribution. Quality of electricity. Analysis of circuits and electrical networks. Electromagnetism. Effects of electric current. Constructive, functional, and behavioral study of machines power.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**BA**	**Mechanical Engineering**	**1**	**2**	**Sports** Front and work team exercises. The jumping school exercises. Training the skills and motor skills specific to some sports.	1
					English Engineering. Automotive. Specialized vocabulary and discourse situations. Grammar in focus: Active vs. Passive. Relative clauses. Causation. Metallurgy. Specialized vocabulary and discourse situations. Grammar in focus: Obligation and requirements. Welding. Specialized vocabulary and discourse situations. Grammar in focus: Cause and effect. Construction. Specialized vocabulary and discourse situations. Grammar in focus: Ability and inability.	2
					Advanced digital competencies Presentation of the Microsoft Office software package. Presentation of the Microsoft Word program. Presentation of the Microsoft Excel program. Basic operations in Microsoft PowerPoint. Types of digital platforms. Web forums and newsgroups. Functional aspects of websites. Internet search strategies.	1
			2	**1**	**Numerical Methods** Algorithms & calculus errors. Numerical methods for solving algebraic equations. Numerical methods for solving systems of equations. Approximation of real functions. Numerical methods for calculating derivatives & integrals. Numerical methods for solving differential equations.	5
					Drawings and Infographics II AutoCAD - Overview. Basics for Drawing. Entering text into graphic files. Commands for multiplying objects. Dimensioning. Polylines. Editing commands. Advanced drawing commands. 3D drawing commands: nonprimitive. 3D drawing commands: primitive. 3D editing commands. Preparing technical product documentation.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**BA**	**Mechanical Engineering**	**2**	**1**	**Mechanics II** Kinematics of a rigid body. Kinematics of the systems of rigid bodies. Dynamics. Fundamental concepts. Moments of inertia of a body. Kinetic characteristics of a body: momentum, angular momentum, kinetic energy. Fundamental theorems in dynamics of a rigid body and system of particles. Dynamics of a rigid body with fixed axis, dynamics of a rigid body in plane-parallel motion, rigid body dynamics in general motion. Dynamics of a particle. Relative motion dynamics of a particle. Collision and percussions. Elements of analytical mechanics. D'Alembert's principle. Principle of virtual work. Lagrange Equations.	5
					Materials Strength I Introduction: Definitions, structural concepts (beams), approaches. Shearing forces and bending moments. Behavior of materials. Traction/Compression of beams. Cross section properties of beams.	5
					Mechanisms I Definitions. Structure and configuration of planar mechanisms. Kinematic element. The kinematic coupling. Kinematic chain. Mechanisms. Analysis of the configuration and kinematics of the mechanisms. Vector connection equations for configuration, velocities, and accelerations fields. Spatial mechanisms. Force analysis of mechanisms. Dynamics of mechanisms.	4
					Machine-tools and cutting processing Elementary notions about generating surfaces on machine tools. Elementary notions of the construction and geometry of cutting tools. Thermal phenomena in cutting processes. Cutting forces. Wear and durability of cutting tools. The parameters of the cutting regime. Turning processing. Processing by milling. Bore processing. Processing by planning. Processing by broaching. Processing by grinding.	3
					Sports Front and work team exercises. The throwing school exercises. Training the skills and motor skills specific to some sports.	1

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**BA**	**Mechanical Engineering**	**2**	**1**	**English** Electrical. Specialized vocabulary and discourse situations. Grammar in focus: Scale of likelihood. Electronics. Specialized vocabulary and discourse situations. Grammar in focus: Subordinate clauses of result and purpose. Energy. Specialized vocabulary and discourse situations. Grammar in focus: Countable and uncountable nouns. Adjectives and adverbs. Civil Engineering. Specialized vocabulary and discourse situations. Grammar in focus: Comparison of adjectives. Mining. Specialized vocabulary and discourse situations. Grammar in focus: Prepositions of time.	2
			2	**2**	**Materials Strength II** Compound stresses. Stability of elastic beams (buckling of beams). Energy methods in the calculation of elastic deformations of beam structures. Static undetermined systems of beams. Beam systems under dynamic loads.	3
					Mechanisms II Balancing mechanisms and machines. Synthesis of Lower Coupler Mechanisms. Gear Mechanisms. Cam – follower.	4
					Applied Informatics Overview of the software application. 3D modeling of parts. 3D modeling of sheet metal parts. 3D modeling of assemblies. 3D modeling of welded assemblies. 3D design of mechanical structures from profiles. Specific procedures for 3D modeling of plastic parts. Assisted design of mechanical transmissions.	2
					Fluid Mechanics Fluid statics. Basic equations of fluid mechanics. Dimensional analysis and similarity theory. Boundary layer theory. The flow through the pipes.	3
					Thermo-Technics I General thermodynamics. Status sizes. Mechanical work, heat, entropy, enthalpy. Simple transformations of perfect gases, Carnot cycle. Principles I and II of Thermodynamics. Reversible processes for thermodynamic systems. Irreversible processes for thermodynamic systems. Nozzles. The principle of operation of the turbines. Piston compressors. Perfect gas mixtures. Ideal cycles of internal combustion engines.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**BA**	**Mechanical Engineering**	**2**	**2**	**Machine Parts I** Principles of calculation of mechanical engineering. The mechanical characteristics of the materials used in the construction of machines. Shape and dimensional accuracy of machine parts. Calculation at simple and compound stresses. Calculation on variable loads. Reliability of machine parts. Elements of tribology. Permanent joints. Removable assemblies. Assemblies between the hub and the shaft. Assemblies on cone. Elastic assemblies.	4
					Tolerances and Dimensional Control Introduction. Dimensional accuracy. Micro-geometric accuracy. Accuracy of geometric shape. Precision of orientation and reciprocal position. Chains of size. Methods and means of measurement and control. Tolerances, fits and control of smooth tapered, bearings and key assemblies. Tolerances, fits and control of threaded assemblies. Tolerances, fits and control of gears and spur gears.	3
					Sports Front and work team exercises. The throwing school exercises. Training the skills and motor skills specific to some sports.	1
					English Electrical. Electronics. Specialized vocabulary and discourse situations. Grammar in focus: Scale of likelihood. Subordinate clauses of result and purpose. Energy. Specialized vocabulary and discourse situations. Grammar in focus: Countable and uncountable nouns. Adjectives and adverbs. Civil Engineering. Specialized vocabulary and discourse situations. Grammar in focus: Comparison of adjectives. Mining. Specialized vocabulary and discourse situations. Grammar in focus: Prepositions of time.	2
					Practice Activities in the Scientific Field General notions about metal cutting. Casting. Hot plastic deformation sectors. Thermal and thermo-chemical treatments. Galvanic coatings. Welding.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**BA**	**Mechanical Engineering**	**3**	**1**	**Machine Parts II** Gear drives. Belt drives. Chain drive. Friction wheel drives. Axles and shafts. Rolling bearings. Sliding bearings. The elements of the crank shaft mechanism. Couplings.	6
					Hydraulic and Pneumatic Drives Structure of a hydrostatic system. Organology of hydrostatic systems. Hydraulic pumps. Hydraulic motors. Distribution equipment. Pressure adjustment equipment. Flow adjustment equipment. Hydraulic diagrams. Structure of pneumatic schemes. Pressure valves. Directional Control Valves. Pneumatic motors. Pneumatic diagrams.	4
					Tribology Introduction to Tribology. Materials for tribology. Elements of contact mechanics (Hertz contact theory; The contact area; Plasticization of asperities; Adhesive contact). Friction (The coefficient of friction; Tribometers; Laws and theories of friction). Wear (Different form of wear; Wear maps; Interface tribology third body concept; The PV product). Lubrication (Oils; Greases; Anti-friction materials).	2
					Thermo-Technics II Thermodynamics of thermal agents. Thermodynamics of fuel combustion. Thermodynamics of thermal machine cycles.	5
					Elasticity Generalities regarding Elasticity Theory. Stress Theory. Strain Theory. Relations between stress and strain specific. The mechanical work and the potential energy of deformation. Cases of the stress state. Plane problems of elasticity theory.	5
					Mechanical Vibrations Mechanical Vibration - General considerations. The vibrations of structures with one degree of freedom. The vibrations of structures with more than one degree of freedom. The vibrations of continuous structures. The approximate methods in the study of vibrations. The vibration measurement.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**BA**	**Mechanical Engineering**	**3**	**1**	**Special Problems of Materials Strength** Calculation of helical spring resistance; stiffness of the helical spring. Beams of equal resistance to bending; calculation of resistance of leaf spring. Overview of the finite element method. Thin-walled rotating vessels. Tubes with thick walls; tube milling; discs in rotation motion. Equations of thin plane plates. Plate in plane stresses state. Flat plates with small transversal deformations.	4
				2	**Applied Electronics** Electronic devices of circuit. Amplifiers and oscillators. Uncontrolled low power rectifiers. Electronic stabilizers. Controlled low power rectifiers. Combinational and sequential logic circuits. Applications of combinational and sequential logic circuits.	3
					Plasticity Introductory elements in Plasticity Theory. One-dimensional elastoplastic stress. Elastoplastic stress of bars. Elastoplastic stress of plates. Tri-dimensional plasticity.	3
					Construction and Design of Structures Introduction in constructions. Lightweight construction - steel construction. Steel Structure - constructive systems for the future.	3
					Finite Element Method Generalities on Finite Element Analysis. The displacement method applied at bars systems. Finite Element Method. Mechanical applications using finite element method.	4
					The Static, Stability and Dynamics of Structures General aspects of the calculation of structures strength. Static determined structures made up of straight bars. Truss. Static indeterminate structures made up of straight bars - strain method. Indeterminate static structures made up of straight bars - The displacement method. Stability of bars and bar systems.	4
					Practice Activities in a Specific Scientific Field Modeling of complex structures and substructures with the finite element method using specialized programs. Evaluation of the strain state by the method of resistive electrical tensometry.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**BA**	**Mechanical Engineering**	**3**	**2**	**Optimization in Mechanical Engineering** Optimization algorithms for unrestricted problems. Transformation of optimization problems. Problems with linear constraints. Problems with nonlinear constraints. Multicriteria optimization. Optimization of structures. Reanalysis methods. Methods for solving problems with many variables. Methods for optimizing the reliability of structures.	3
					Lifting and Conveying Machines General theory and specific machine elements of lifting and transporting installations. Lifting equipment specific to various fields of activity. Auxiliary equipment. Operation of transport equipment.	3
					Biomechanics Introduction to Biomechanics. Basic aspects of anatomy and physiology. Presentation of programs for transforming the assembly of CT sections into 3D surfaces that delimit tissues according to their densities. Biomechanics of the osteo-articular system. Biomechanics of the muscular system. Anthropometry.	3
			4	**1**	**Contact Mechanics** Normal contact of elastic bodies as a problem of spatial elasticity. The contact theory of two elastic bodies - the Hertz theory. Strain state in the general case of the elliptical contact surface. Numerical developments in contact analysis using the finite element method. Consider the friction between the bodies in contact. Adherent contact. Contact algorithms. Elastoplastic contact problems. Bodies in contact from materials with nonlinear behavior.	5
					Assisted Analysis and Design of Mechanical Systems Basics of parametric design with Autodesk Inventor. Generation of frame structures (Frame generator). Design Accelerator - design and calculation of shafts, gears, keys, bearings, springs. Finite element analysis in Autodesk Inventor. Static analysis of parts. Parametric analysis. Exploded presentation of the assemblies. Animating the presentation of an assembly.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**BA**	**Mechanical Engineering**	**4**	**1**	**Dynamics of Mechanical Structures** Single Degree of Freedom Systems. Free Vibrations. Response to Harmonic Excitation. Transfer Functions. Forced vibrations periodic excitation and short excitation. Seismic Excitation. Multi Degree of Freedom Systems. Damping. Vibration Problems in Structures.	4
					Finite Element Method Review of finite element method. Assembling the system of finite-element equations. Linear elastic calculus. Nonlinear geometric calculus. Nonlinear physical calculation. Dynamic calculus. 2D and 3D bar systems: computer implementation. 2D and 3D plate systems: computer implementation. Implementing on the computer three-dimensional finite elements.	4
					Modeling and Simulation of Mechanical Systems Dynamics I General theorems in dynamics of mechanical systems. Movements of mechanical systems. Application of differential principles in the study of the dynamics of mechanical systems. Clashes and percussions. Gyroscope and gyroscopic effect. The vibrations of the systems with a finite and infinite number of degrees of freedom. Parametric and non-linear vibrations, vibrating machines. Modeling of torsional vibrations of mechanical systems for transmitting rotational motion.	5
					General Economy The economy and economic science. The contemporary market economy. The economic flow. The economic utility and behavior. Consumer. The production factors. The production costs. The demand. The offer. Market types and price training mechanisms. The remuneration of production factors. Macro economy.	3
					Composite Structures Overview of composite materials. Levels of analysis, topological coding, determination of engineering quantities, general relations between stresses and strains. General notions of fracture mechanics and theories regarding the boundary states of composite materials. The elastic behavior of the orthotropic plate with unidirectional continuous fibers. General theory of laminates. Methods of analysis of composite materials.	5

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Mechanical Engineering	**BA**	**Mechanical Engineering**	**4**	**2**	**Modeling and Simulation of Mechanical Systems Dynamics II** Integral principles and their use in the dynamics of material systems. Elements of continuous environment mechanics. Modeling, simulation in the dynamics of nonlinear systems. Modeling the kinematics and dynamics of 2D mechanical systems. Introductory notions of modeling, simulation in mechanics of robots, 3D mechanical systems.	6
					Collapse of Mechanical Structures Buckling of compressed bars. Ultimate strength of compressed bars. The flat plate buckling. Buckling of unidirectional stiffened plateau. Buckling of floors reinforced in two orthogonal directions.	5
					Management Theoretical fundamentals of company management. The company – economical aspects. Organizing the company. Production capacity. Fundamental concepts of production management in time and space. Serving processes.	2
					Completion of Graduation Paper	4
					Practical training for the graduation paper	2
					Thermoelasticity Kinematics: state of motion, small movements, continuity. Kinetics: general theorems, state of stress, energy theorem. Thermodynamics: classical theory, state variables, field theory, thermodynamic orthogonality. Properties of materials: basic concepts, fluids, elastic solids. Ideal liquids: the basic equations, potential flows, the plane problem. Linear elasticity: basic equations, torsion, crystals. Thermoelasticity. The nature and importance of thermal stresses. Thermal stress fields, thermoelastic and thermoplastic stresses. Thermal fatigue and thermal shock. The fundamental equations of thermoelasticity. The basic laws of thermoelasticity, conservation of mass, momentum, kinetic momentum and energy, kinematic equations and constitutive relations that complete the system of equations. The Clausius-Duhem inequality and the free energies of Helmholtz and Gibbs. Specific heats. Viscoelasticity. One-dimensional models. Constitutive mechanical relations. Thermomechanical extension.	4

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Mechanical Engineering	**BA**	**Mechanical Engineering**	**4**	**2**	**Numerical Modeling for Fluids Mechanics** Fundamentals of numerical modeling of fluid. Numerical methods in fluid dynamics (CFD - Computational Fluid Dynamics). Theory of fluid with free surface. Numerical models for fluids used in the technique.	4
					Reliability of mechanical systems Reliability Basics. Definitions. The object of reliability. The place of reliability in engineering. Cost chart. Elements of probability theory. Getting started; events. Basic operations, examples. Application to system reliability. Series systems. Parallel systems. Mixed systems. Statistical elements with application to system reliability and maintainability. Random variables and distribution functions. The main statistical parameters of random variables. Classical distribution laws used in reliability: Gauss, exponential, Weibull. Statistical processing of experimental data. Reliability Basics. The concept of reliability; classifications. Defects: types and evolutions. Reliability indicators. Main indicators. Additional indicators. The mathematical model of reliability. Maintainability. The concept of maintenance and maintainability. Maintainability indicators and characteristics. Evaluation and predictive optimization of maintainability. Maintenance of mechanical systems. Definition of maintenance. Maintenance systems. Availability of products and systems. The concept of availability. Availability indicators.	3
MACHINE BUILDING TECHNOLOGY - BA						
Industrial Engineering	**BA**	**Machine Building Technology**	**1**	**1**	**Mathematical Analysis** Strings and series of real numbers. Differential calculus. Integral calculus. Differential equations.	5
					Physics Elements of classical mechanics. Oscillations and waves. Notions of thermodynamics. Fundamentals of electromagnetism. Fundamentals of optics. The origins of quantum physics. Elements of atomic physics. Elements of solid body physics.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Machine Building Technology**	**1**	**1**	**Descriptive Geometry** Representation of lines and particular plans. Representation of polyhedra. Representation of rotating bodies. Intersections of geometric bodies.	5
					Materials Science and Engineering Types of materials. Atomic architecture. Diffusion. Solidification of metallic materials. Alloy systems. Phase balance diagrams. Fe-C alloy system. Phase transformations in solid state. Heat treatments. Non-ferrous alloys. Ceramic materials. Plastic materials. Composite materials.	5
					Chemistry Classification of chemicals. Aggregation states of matter. State transformations. The fundamental laws of chemistry. Elements of the structure of atoms. Atomic models. The periodic system of the elements. Chemical bonds. Dispersed systems. Colloidal systems. Redox reactions. Electrolysis. Hydrogen. Metals. Periodic system groups.	5
					Sports Enhancing elements of the Running School and the Jumping School and coordination elements. Speed development through motion games. Football game. Volleyball game.	1
					English Production. Present Tenses. Research and Development. Past Tenses. Future Forms. Information Technology. Conditionals. Verb phrases. Logistics. Active versus Passive.	2
					Communication Structure of the communication process. Non-verbal communication. Communication networks. Communication in the management of conflicting states. Communication and listening. Final planning, organization and preparation of the message. Structure of the technical-scientific works: reports, works for the completion of studies, works and scientific articles, projects. Human-human interaction mediated by web and audio-video technologies.	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Machine Building Technology**	**1**	**2**	**Linear Algebra, Analytic and Differential Geometry** Vector spaces. Linear applications. Real Euclidean vector spaces. Free vectors. Line and plan in space. Conics on reduced equations. Quadrics on reduced equations. Curves in space. Surfaces.	5
					Materials Technology The Structure of Crystalline Solids. Mechanical Properties of Materials. Physical properties of materials. Processing of Metal Alloys. Glass processing. Processing of ceramics. Cermet's. Processing of rubber.	4
					Computer Programming and Programming Languages Basics of computing. Evolution of computer systems. Components of a Computer Systems. The functional scheme of the structure of the computer. Types of computer memory. Introduction to Computers Programming. Forms of information. Data structures. Algorithms and components. Object orientation. Programming techniques. Computer Language Translation. Cloud Computing. Future of programming.	4
					Mechanics I Statics. Fundamental concepts, systems of forces, moment of a force about a point, moment of a force about a given axis, reduction of a force, reduction of a system of forces, particular cases. Centers of gravity of a system of particles and a rigid body. Centers of gravity of some usual homogeneous bodies. Statics of free particles and particles with constraints. Equilibrium of rigid bodies and systems of rigid bodies. Trusses. Statics of the cables. Statics of the simple machines. Kinematics of particles: motion of particles in about various coordinate systems, particular motion of particles. Relative motion of particles.	5
					Electrotechnics Introduction to the basics of electrotechnics. Electricity. Production, transport, distribution. Quality of electricity. Analysis of circuits and electrical networks. Electromagnetism. Effects of electric current. Constructive, functional and behavioral study of machines power.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Machine Building Technology**	**1**	**2**	**Drawings and Infographics I** Arrangement of projections. Views, sections, breaks. Dimensioning of technical drawings. Representation of threads and flanges. Indication of surface condition, marking of dimensional deviations and geometric tolerances. The assembly drawing. Non-demountable joints. Removable assemblies. Mechanical Power Transmitters. Sealing elements.	4
					Sports Front and work team exercises. The jumping school exercises. Training the skills and motor skills specific to some sports.	1
					Advanced digital competencies Presentation of the Microsoft Office software package. Presentation of the Microsoft Word program. Presentation of the Microsoft Excel program. Basic operations in Microsoft PowerPoint. Types of digital platforms. Web forums and newsgroups. Functional aspects of websites. Internet search strategies.	1
					English Engineering. Automotive. Metallurgy. Welding. Construction. Specialized vocabulary and discourse situations. Grammar in focus: Active vs. Passive. Relative clauses. Causation. Obligation and requirements. Cause and effect. Ability and inability.	2
			2	**1**	**Drawings and Infographics II** AutoCAD - Overview. Basics for Drawing. Entering text into graphic files. Commands for multiplying objects. Dimensioning. Polylines. Editing commands. Advanced drawing commands. 3D drawing commands: nonprimitive and primitive. 3D editing commands. Preparing technical product documentation.	4
					Numerical Methods Algorithms & calculus errors. Numerical methods for solving algebraic equations. Numerical methods for solving systems of equations. Approximation of real functions. Numerical methods for calculating derivatives & integrals. Numerical methods for solving differential equations.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Machine Building Technology**	**2**	**1**	**Mechanics II** Kinematics of a rigid body. Kinematics of the systems of rigid bodies. Dynamics. Moments of inertia of a body. Kinetic characteristics of a body. Fundamental theorems in dynamics of a rigid body and system of particles. Dynamics of a rigid body with fixed axis, dynamics of a rigid body in plane-parallel motion, rigid body dynamics in general motion. Dynamics of a particle. Relative motion dynamics of a particle. Collision and percussions. Elements of analytical mechanics.	4
					Thermo-Technics Thermodynamic system. Thermodynamic balance. Status sizes. Process sizes. The postulates of thermodynamics. Temperature and pressure. The first principle of thermodynamics. Internal energy. Mechanical work. Mechanical movement work. Mechanical work. The heat. Enthalpy. The perfect gas. Simple laws. Specific heaters. Perfect gas mixtures. Simple state transformations. The second principle of thermodynamics. The entropy of perfect gases. Vapor. Wet air. Combustion of solid, liquid and gaseous fuels.	4
					Mechanisms I Definitions. Structure and configuration of planar mechanisms. Kinematic element. The kinematic coupling. Kinematic chain. Mechanisms. Analysis of the configuration and kinematics of the mechanisms. Vector connection equations for configuration, velocities and accelerations fields. Spatial mechanisms. Force analysis of mechanisms. Dynamics of mechanisms.	5
					Materials Strength I Introduction: Definitions, structural concepts (beams), approaches. Shearing forces and bending moments. Behavior of materials. Traction/Compression of beams. Cross section properties of beams.	5
					Sports Front and work team exercises. The throwing school exercises. Training the skills and motor skills specific to some sports.	1

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Machine Building Technology**	**2**	**1**	**English** Electrical. Electronics. Energy. Specialized vocabulary and discourse situations. Grammar in focus: Scale of likelihood. Subordinate clauses of result and purpose. Countable and uncountable nouns. Adjectives and adverbs. Civil Engineering. Specialized vocabulary and discourse situations. Grammar in focus: Comparison of adjectives. Mining. Specialized vocabulary and discourse situations. Grammar in focus: Prepositions of time.	2
				2	**Tolerances and Dimensional Control** Introduction. Dimensional accuracy. Micro-geometric accuracy. Accuracy of geometric shape. Precision of orientation and reciprocal position. Chains of size. Methods and means of measurement and control. Tolerances, fits and control of smooth tapered, bearings and key assemblies. Tolerances, fits and control of threaded assemblies. Tolerances, fits and control of gears and spur gears.	3
					Essentials of Surface Generation Elements of kinematic theory of surface winding. Generation of surfaces by winding. Generation of surfaces by winding by the rolling method. Crossing surfaces - interference of surfaces. Generation of helical surfaces. Tool profiling with materialized generators for generating helical surfaces.	3
					Applied Informatics Overview of the software application. 3D modeling of parts. 3D modeling of sheet metal parts. 3D modeling of assemblies. 3D modeling of welded assemblies. 3D design of mechanical structures from profiles. Specific procedures for 3D modeling of plastic parts. Assisted design of mechanical transmissions.	3
					Fluid Mechanics Fluid statics. Basic equations of fluid mechanics. Dimensional analysis and similarity theory. Boundary layer theory. The flow through the pipes.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Machine Building Technology**	**2**	**2**	**Machine Parts I** Principles of calculation of mechanical engineering. The mechanical characteristics of the materials used in the construction of machines. Shape and dimensional accuracy of machine parts. Calculation at simple and compound stresses. Calculation on variable loads. Reliability of machine parts. Elements of tribology. Permanent joints. Removable assemblies. Assemblies between the hub and the shaft. Assemblies on cone. Elastic assemblies.	4
					Mechanisms II Balancing mechanisms and machines. Synthesis of Lower Coupler Mechanisms. Gear Mechanisms. Cam – follower.	4
					Materials Strength II Compound stresses. Stability of elastic beams (buckling of beams). Energy methods in the calculation of elastic deformations of beam structures. Static undetermined systems of beams. Beam systems under dynamic loads.	4
					Sports Resumption of the main technical-tactical structures in football - boys and volleyball - girls. Development of the speed of reaction to auditory and visual stimuli. Improving the technique of speed running. Educating the segmental dynamic force at the level of the upper, lower limbs, abdomen and trunk by the method of working in the circuit and by working on workshops, differentiated, depending on the individual potential. Fixing and consolidating the main technical elements and procedures specific to sports games. Development of the elements of coordinative capacity - rhythm, precision, static and dynamic balance, spatial-temporal orientation, combination of movements, kinesthetic discrimination, ambidextry, agility. Educate the mixed and anaerobic lactacid resistance by the method of variable, progressive and interval training.	1

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Machine Building Technology**	**2**	**2**	**English** Materials Technology. Material Types. Material Properties. Forming, working, and heat-treating metal. Grammar in focus: Countable and uncountable nouns. Adjectives and adverbs. Prepositions of place. Writing in focus: Description. Manufacturing and Assembly. 3D Component features. Interconnection. Grammar in focus: Quantifiers. Writing in focus: Definition and exemplification.	1
					Practice Activities in the Scientific Field Cold processing of metals. Measurement and control equipment. Turning. Milling. Planning and mortising. Grinding. Hot processing of metals. Casting. Hot plastic deformation sectors. Thermal and thermo-chemical treatments. Galvanic coatings. Welding.	4
			3	**1**	**Machine Parts II** Gear drives. Belt drives. Chain drive. Friction wheel drives. Axles and shafts. Rolling bearings. Sliding bearings. The elements of the crank shaft mechanism. Couplings.	5
					Hydraulic and Pneumatic Drives Structure of a hydrostatic system. Organology of hydrostatic systems. Hydraulic pumps. Hydraulic motors. Distribution equipment. Pressure adjustment equipment. Flow adjustment equipment. Hydraulic diagrams. Structure of pneumatic schemes. Pressure valves. Directional Control Valves. Pneumatic motors. Pneumatic diagrams.	4
					Cutting-Tools Design I The structure of the cutting tools. Materials for cutting tools. The calculation and construction of lathe tools. The calculation and construction of tools for machining bores. Calculation and construction of broach.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Machine Building Technology**	**3**	**1**	**Machine Manufacturing I** Basics of manufacturing processes in the construction of machines. Types of production. Design of technological processes. Production processes, technological processes. Processing accuracy. Optimization of technological processes. The quality of the processed surfaces. Determination of processing additions and inter-operational dimensions. Technological criteria for the determination of cutting regimes. Technical standardization. Basic concepts regarding the workability of metallic materials.	3
					Machine-Tools I Fundamentals of machine-tools. The main kinematic chain. The kinematic chain of feed. Complex generating kinematic chains. Auxiliary kinematic chains. Special purpose mechanisms. Machine parts specific to machine tools.	3
					Welding Processes Welding as a thermochemical process. Classification of welding processes. Heat sources used for welding. Thermal field on welding. Changes in chemical composition during welding. Volume changes on welding. Structural changes to welding. Cracks, pores, inclusions. Technological particularities when welding different materials.	4
					Finite Element Method The basic concepts of the finite element analysis method. Finite element types. Boundary conditions and loads. Material modeling. Modeling and meshing. Finite element analysis. Numerical methods in mechanical and technological processes.	4
					Heat Treatments Classification and characterization of thermal and thermo-chemical treatments. The theory of solid-state transformations in metals and alloys. Characterization of the metallic materials that are thermally and thermo-chemically treated. Specific heating-cooling processes and their thermal regimes for thermal and thermo-chemical treatments. Technology of thermally and thermo-chemical treatments. Quality control of the products treated thermally and thermo-chemically.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Machine Building Technology**	**3**	**2**	**Cutting-Tools Design II** Calculation and construction of mills. Calculation and construction of tools for threading. Tools for toothing cylindrical and worm gears. Tools for toothing bevel gears. Calculation and construction of combined tools.	4
					Machine Manufacturing II Analysis of the main processing procedures. Analysis of the processing of special surfaces. Modern methods of processing based on Numerical control machine tools. Modern manufacturing systems.	4
					Machine-Tools II Lathe machines. Milling machines. Shaping, slotting and broaching machines. Drilling machines. Grinding machines. Reaming machines. Machines for processing gear teeth. Machines for grinding gear teeth.	4
					Cold Plastic Deformation Processes I Basics of cold plastic deformation processes. Plastic deformation of polycrystalline materials. The main laws of plastic deformation. The state of deformations of the body. Plasticity conditions. Deformation behavior of metals and alloys. Theoretical and experimental methods used in the analysis of cold plastic deformation processes. Characterization of cold plastic deformation processes and specific machines.	4
					Essentials of Devices Design I Structure of cutting systems. Principles of device design. Principles of orientation of semi-finished products. Orientation on flat surfaces. Orientation on outer and inner cylindrical surfaces. Orientation on outer and inner conical surfaces.	3
					Fusion Welding Technologies Welding processes and procedures. Arc welding. Calculation algorithm for electric arc welding technology. Welding behavior of materials. Remaining stresses and strains. Preheating.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
			3	2	**Essentials of Experimental Research** Experimental methods, measurements and devices of measuring physical quantities and acquiring experimental data. Statistical processing of experimental results. Classic and modern methods for planning experiments.	4
					Practice Activities in a Specific Scientific Field Measurement and control equipment. Turning. Milling. Planing and mortising. Grinding. Hot processing of metals. Casting. Hot plastic deformation sectors. Thermal and thermo-chemical treatments. Galvanic coatings. Welding.	4
			4	1	**Cold Plastic Deformation Processes II** Blanking and punching. Bending technologies and equipment's. Deep drawing technologies and equipment's. Shaping operations and equipment's. Bulk deformation technologies and equipment's. Elements of technology design and technological equipment for processing by cold plastic deformation. Non-conventional cold pressing technologies. CAD / CAM techniques for designing cold pressing technologies and equipment's.	5
					Fusion Welding Technologies II Electric arc welding with coated electrodes. WIG welding. MIG-MAG welding. Welding with tubular wire. Submerged arc welding. Electroslag welding. Gas welding.	5
					Pressure Welding Technologies Non-electric welding procedures. Butt welding through resistance. Butt welding by sparks. Spot welding.	3
Industrial Engineering	**BA**	**Machine Building Technology**	**4**	**1**	**Essentials of Devices Design II** The system of loads and moments that demand the semi-finished products in the technological process. Calculation of locking mechanisms with keys and with levers. Calculation of locking mechanisms with thread. Calculation of locking mechanisms with cams. Calculation of locking mechanisms with elastic elements. Indexing mechanisms. Locking mechanisms. Device body design.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Machine Building Technology**	**4**	**1**	**Processing Technologies of Polymeric Materials** Thermoplastic and thermoreactive materials. The principle of mixing. The principle of calendering. The principle of extrusion. The basis of the plastic injection process. Technological aspects of vulcanization in molds. Notions regarding the recycling of polymeric materials.	5
					Computer-Aided Technology Design Methods and principles in computer aided manufacturing. Basic elements in the methodology of computer assisted manufacturing of parts using machine tools with numerical control. Methodology of designing the process of processing parts on machine tools with numerical control.	4
					Numerical Control Systems and Equipment I Numerical control systems. Control systems implemented in wired logic. Control systems with automatic control systems with flexible structure. Programmable PLCs.	3
					Automation of Technological Processes Automatic manufacturing system. The technological subsystem of automated manufacturing. Storage and transport subsystem. Command subsystem. Automatic control used in the automation of technological processes. Programmable logic controllers. Synthesis of controllers using modeling with Petri nets.	3
				2	**Management** Theoretical foundations of company management. Enterprise - economic agent. Company organization. Production capacity. Basic concepts of production design in time and space. Serving processes.	4
					Unconventional Processing Technologies Processing by electric erosion. The effects of pulsed electric discharge. Technological characteristics when processing by electric erosion. Generation of surfaces by electrical erosion. Errors of processing in the erosive process. Principles of design of electro erosive technology. Industrial applications of electric erosion processing.	4
					Completion of Graduation Paper	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Machine Building Technology**	**4**	**2**	**Practical Training for the Graduation Paper**	1
					Concurrent Engineering Introduction. The management of a company where the concurrent engineering is implemented. ″The House of Quality″- a way of defining the ″voice of the consumer″ (VoC) and of gathering the development team effort. Gathering the information, methods of ideas generation, the AHP and the ANP methods. ″6 Sigma″. Robust design – Design for 6 Sigma (DFSS). Taguchi method. Software utilization for robust design. The risk management in a product development process. Design for Manufacturing and Assembly (DFMA). The acceleration of a product development.	4
					3D Modeling General notions regarding computer aided design (CAD) and computer aided manufacturing (CAM). Aspects regarding computer-aided design with CATIA. Sketcher module. Part Design module. Generative Shape Design module. Assembly Design module. Mock-up Kinematics module. Machining module.	4
					Rapid Prototyping Technologies The stages of rapid prototyping techniques. Stereolithography. Selective Laser Sintering. Fused Deposition Modeling. Selective Laser Melting. Laminated Object Manufacturing. Digital Light Processing. Three-Dimensional Printing. PolyJet Printing. Jetted Photopolymer. MultiJet Printing. Binder Jetting. Solid Ground Curing. Direct Ceramic Jet Printing.	3
					Processing Technologies on Numerical Control Machine-Tools Elements of CNC technology. The SINUMERIK programming system. Main movement functions. Technological cycles of drilling. Technological cycles of milling. The structure of a processing program. Subprograms.	3
					Actuators, Transducers, Sensors Characteristics and performances of transducers. Interfacing of peripheral systems. Interfacing of sensors and data communications. Interfacing of transducers. Actuators.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
DIGITAL PRODUCTION SYSTEMS - BA						
Industrial Engineering	**BA**	**Digital Production Systems**	**1**	**1**	**Mathematical Analysis** Strings and series of real numbers. Differential calculus. Integral calculus. Differential equations.	5
					Physics Elements of classical mechanics. Oscillations and waves. Notions of thermodynamics. Fundamentals of electromagnetism. Fundamentals of optics. The origins of quantum physics. Elements of atomic physics. Elements of solid body physics.	5
					Descriptive Geometry Representation of lines and particular plans. Representation of polyhedra. Representation of rotating bodies. Intersections of geometric bodies.	5
					Materials Science and Engineering Types of materials. Atomic architecture. Diffusion. Solidification of metallic materials. Alloy systems. Phase balance diagrams. Fe-C alloy system. Phase transformations in solid state. Heat treatments. Non-ferrous alloys. Ceramic materials. Plastic materials. Composite materials.	5
					Chemistry Classification of chemicals. Aggregation states of matter. State transformations. The fundamental laws of chemistry. Elements of the structure of atoms. Atomic models. The periodic system of the elements. Chemical bonds. Dispersed systems. Colloidal systems. Redox reactions. Electrolysis. Hydrogen. Metals. Periodic system groups.	5
					Sports Enhancing elements of the Running School and the Jumping School and coordination elements. Speed development through motion games. Football game. Volleyball game.	1
					English Production. Present Tenses. Research and Development. Past Tenses. Future Forms. Information Technology. Conditionals. Verb phrases. Logistics. Active versus Passive.	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**1**	**1**	**Communication** Structure of the communication process. Non-verbal communication. Communication networks. Communication in the management of conflicting states. Communication and listening. Final planning, organization and preparation of the message. Structure of the technical-scientific works: reports, works for the completion of studies, works and scientific articles, projects. Human-human interaction mediated by web and audio-video technologies.	2
				2	**Linear Algebra, Analytic and Differential Geometry** Vector spaces. Linear applications. Real Euclidean vector spaces. Free vectors. Line and plan in space. Conics on reduced equations. Quadrics on reduced equations. Curves in space. Surfaces.	5
					Materials Technology The Structure of Crystalline Solids. Mechanical Properties of Materials. Physical properties of materials. Processing of Metal Alloys. Glass processing. Processing of ceramics. Cermet's. Processing of rubber.	4
					Computer Programming and Programming Languages Basics of computing. Evolution of computer systems. Components of a Computer Systems. The functional scheme of the structure of the computer. Types of computer memory. Introduction to Computers Programming. Forms of information. Data structures. Algorithms and components. Object orientation. Programming techniques. Cloud Computing. Future of programming.	4
					Mechanics I Statics. Fundamental concepts, systems of forces, moment of a force about a point, moment of a force about a given axis, reduction of a force, reduction of a system of forces, particular cases. Centers of gravity of a system of particles and a rigid body. Centers of gravity of some usual homogeneous bodies. Statics of free particles and particles with constraints. Equilibrium of rigid bodies and systems of rigid bodies. Trusses. Statics of the cables. Statics of the simple machines. Kinematics of particles: motion of particles in about various coordinate systems, particular motion of particles. Relative motion of particles.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**1**	**2**	**Electrotechnics** Introduction to the basics of electrotechnics. Electricity. Production, transport, distribution. Quality of electricity. Analysis of circuits and electrical networks. Electromagnetism. Effects of electric current. Constructive, functional and behavioral study of machines power.	4
					Drawings and Infographics I Arrangement of projections. Views, sections, breaks. Dimensioning of technical drawings. Representation of threads and flanges. Indication of surface condition, marking of dimensional deviations and geometric tolerances. The assembly drawing. Non-demountable joints. Removable assemblies. Mechanical Power Transmitters. Sealing elements.	4
					Sports Front and work team exercises. The jumping school exercises. Training the skills and motor skills specific to some sports.	1
					Advanced digital competencies Presentation of the Microsoft Office software package. Presentation of the Microsoft Word program. Presentation of the Microsoft Excel program. Basic operations in Microsoft PowerPoint. Types of digital platforms. Web forums and newsgroups. Functional aspects of websites. Internet search strategies.	1
					English Engineering. Automotive. Metallurgy. Welding. Construction. Specialized vocabulary and discourse situations. Grammar in focus: Active vs. Passive. Relative clauses. Causation. Obligation and requirements. Cause and effect. Ability and inability.	2
			2	**1**	**Drawings and Infographics II** AutoCAD - Overview. Basics for Drawing. Entering text into graphic files. Commands for multiplying objects. Dimensioning. Polylines. Editing commands. Advanced drawing commands. 3D drawing commands: nonprimitive and primitive. 3D editing commands. Preparing technical product documentation.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**2**	**1**	**Numerical Methods** Algorithms & calculus errors. Numerical methods for solving algebraic equations. Numerical methods for solving systems of equations. Approximation of real functions. Numerical methods for calculating derivatives & integrals. Numerical methods for solving differential equations.	5
					Mechanics II Kinematics of a rigid body. Kinematics of the systems of rigid bodies. Dynamics. Moments of inertia of a body. Kinetic characteristics of a body. Fundamental theorems in dynamics of a rigid body and system of particles. Dynamics of a rigid body with fixed axis, dynamics of a rigid body in plane-parallel motion, rigid body dynamics in general motion. Dynamics of a particle. Relative motion dynamics of a particle. Collision and percussions. Elements of analytical mechanics.	4
					Thermo-Technics Thermodynamic system. Thermodynamic balance. Status sizes. Process sizes. The postulates of thermodynamics. Temperature and pressure. The first principle of thermodynamics. Internal energy. Mechanical work. Mechanical movement work. Mechanical work. The heat. Enthalpy. The perfect gas. Simple laws. Specific heaters. Perfect gas mixtures. Simple state transformations. The second principle of thermodynamics. The entropy of perfect gases. Vapor. Wet air. Combustion of solid, liquid and gaseous fuels.	4
					Mechanisms I Definitions. Structure and configuration of planar mechanisms. Kinematic element. The kinematic coupling. Kinematic chain. Mechanisms. Analysis of the configuration and kinematics of the mechanisms. Vector connection equations for configuration, velocities and accelerations fields. Spatial mechanisms. Force analysis of mechanisms. Dynamics of mechanisms.	5
					Materials Strength I Introduction: Definitions, structural concepts (beams), approaches. Shearing forces and bending moments. Behavior of materials. Traction/Compression of beams. Cross section properties of beams.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**2**	**1**	**Sports** Front and work team exercises. The throwing school exercises. Training the skills and motor skills specific to some sports.	1
					English Electrical. Electronics. Energy. Specialized vocabulary and discourse situations. Grammar in focus: Scale of likelihood. Subordinate clauses of result and purpose. Countable and uncountable nouns. Adjectives and adverbs. Civil Engineering. Specialized vocabulary and discourse situations. Grammar in focus: Comparison of adjectives. Mining. Specialized vocabulary and discourse situations. Grammar in focus: Prepositions of time.	2
				2	**Tolerances and Dimensional Control** Introduction. Dimensional accuracy. Micro-geometric accuracy. Accuracy of geometric shape. Precision of orientation and reciprocal position. Chains of size. Methods and means of measurement and control. Tolerances, fits and control of smooth tapered, bearings and key assemblies. Tolerances, fits and control of threaded assemblies. Tolerances, fits and control of gears and spur gears.	3
					Fundamentals of Surface Generation Fundamentals of machining. Elements of cutting tool and chip. Machining forces and resistances. Theory of surface generation. Fundamentals of kinematic theory for surface enwrapping. Surface generation by enwrapping. Enwrapping surface generation by the rolling method. Surface interference. Minimum rolling radius. Helical surface generation. Profiling of tools with materialized cutting edge for generating helical surfaces.	3
					Applied Informatics Overview of the software application. 3D modeling of parts. 3D modeling of sheet metal parts. 3D modeling of assemblies. 3D modeling of welded assemblies. 3D design of mechanical structures from profiles. Specific procedures for 3D modeling of plastic parts. Assisted design of mechanical transmissions.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**2**	**2**	**Fluid Mechanics** Fluid statics. Basic equations of fluid mechanics. Dimensional analysis and similarity theory. Boundary layer theory. The flow through the pipes.	3
					Machine Parts I Principles of calculation of mechanical engineering. The mechanical characteristics of the materials used in the construction of machines. Shape and dimensional accuracy of machine parts. Calculation at simple and compound stresses. Calculation on variable loads. Reliability of machine parts. Elements of tribology. Permanent joints. Removable assemblies. Assemblies between the hub and the shaft. Assemblies on cone. Elastic assemblies.	4
					Mechanisms II Balancing mechanisms and machines. Synthesis of Lower Coupler Mechanisms. Gear Mechanisms. Cam – follower.	4
					Materials Strength II Compound stresses. Stability of elastic beams (buckling of beams). Energy methods in the calculation of elastic deformations of beam structures. Static undetermined systems of beams. Beam systems under dynamic loads.	4
					Sports Resumption of the main technical-tactical structures in football - boys and volleyball - girls. Development of the speed of reaction to auditory and visual stimuli. Improving the technique of speed running. Educating the segmental dynamic force at the level of the upper, lower limbs, abdomen and trunk by the method of working in the circuit and by working on workshops, differentiated, depending on the individual potential. Fixing and consolidating the main technical elements and procedures specific to sports games. Development of the elements of coordinative capacity - rhythm, precision, static and dynamic balance, spatial-temporal orientation, combination of movements, kinesthetic discrimination, ambidextry, agility. Educate the mixed and anaerobic lactacid resistance by the method of variable, progressive and interval training.	1

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**2**	**2**	**English** Materials Technology. Material Types. Material Properties. Forming, working, and heat-treating metal. Grammar in focus: Countable and uncountable nouns. Adjectives and adverbs. Prepositions of place. Writing in focus: Description. Manufacturing and Assembly. 3D Component features. Interconnection. Grammar in focus: Quantifiers. Writing in focus: Definition and exemplification.	1
					Practice Activities in the Scientific Field Cold processing of metals. Measurement and control equipment. Turning. Milling. Planing and mortising. Grinding. Hot processing of metals. Casting. Hot plastic deformation sectors. Thermal and thermo-chemical treatments. Galvanic coatings. Welding.	4
			3	**1**	**Hydraulic and pneumatic drives** General elements for hydraulic and pneumatic drives. The structure of a hydrostatic system. Components of hydrostatic systems. Hydraulic pumps. Hydromotors. Pressure control equipment. Flow control equipment. Structure of pneumatic schemes. Classification of schemes. Symbolization of pneumatic devices. Pressure valves. Pneumatic Engines. Classification of pneumatic cylinders. Pneumatic schemes for different cycles.	4
					Machine-Tools I Fundamentals of machine-tools. The main kinematic chain. The kinematic chain of feed. Complex generating kinematic chains. Auxiliary kinematic chains. Special purpose mechanisms. Machine parts specific to machine tools.	5
					Welding Technologies and Processes I Welding as thermochemical process. Principles of fusion and pressure welding, brazing and soldering. Classification of welding procedures and processes. Heat transfer in welding. Temperature field developed in fusion and pressure welding. Applications of temperature field. Filler metals. Alloying of weld. Structure of Heat Affected Zone (HAZ). Cracks, pores. Hot cracking. Cold cracking. Reheat cracking. Lamellar cracking.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**3**	**1**	**Basics of constructive product design** Manufacturing. History of machine tool development.The process of manufacturing a product. Manufacturing as a component of the production process. Manufacturing digital product manufacturing. Manufacturing Interface. CNC machines. Principles of numerical control. Types of machine tools CNC. The process of creating an operation in NX. Description of the operation window. Operation Navigator. Checking the tool path. Materials for parts and tools. Define parent groups. Part materials. Tool materials. Defining parent groups. Definition of tools. Defining geometry. Parameters of machining movements. Parameters Non-machining movements. Turning. Working principle and machine tools used. Common elements of turning operation windows. Checking the tool path. Rough turning. Turning Finishing turning. Axial machining. Flat surface milling. Generalities of the process milling process. Plane milling in the NX Manufacturing module. Face milling. Planar milling. Milling of contoured surfaces. The semi-finished product concept intermediate. Types of contouring operations. Milling operation Cavity Mill volume milling. Z-Level Milling operation. Type operations Fixed Contour. Multi-axis milling. Multi-axis milling operations in NX Manufacturing application. Variable Contour operations. Variable axis ZLevel operation. Machining operations Rotor blade machining. Programming of CNC machine tools. Cycles Fixed cycles. Programming concepts for machine tools numerical control. Interpolation. Trajectory calculation. APT (Automatically Programmed Tool). Post-processing. Documentation generation documentation. Hole processing (point-to-point). Fixed cycles.	3
					Finite Element Method Basic concepts of the finite element method. Formulation of finite element methods for linear static analysis of solids and structures. Finite element types. Shape functions. Finite element discretization. Boundary conditions and loads. Overview of material modeling and constitutive laws. Numerical simulation of mechanical and technological processes.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**3**	**1**	**Elements of virtual reality – EVR** Introduction to Augmented Reality (AR) and Virtual reality (VR). The current status of VR technologies. The advantages and disadvantages of VR technology. Devices used in VR. VR systems that operate with a mobile phone. Types of VR glasses. Methods and technologies for 3D digitization. Hardware and software for 3D scanning. Domains and examples of VR applications. VR in the industrial field. Software for VR. UNITY 3D. The use of AR in virtual manufacturing. The evolution of AR technologies. Advantages and current limitations in the use of AR technology. AR in engineering. Domains and examples of AR applications. AR and Mixed Reality (MR) using commercial software variants for 3D design and visualization in the field of virtual manufacturing: PTC-Vuforia, Festo-Cosimir, Cadmatic-eShare, AVEVA -VR.	4
					Sensors and data acquisition Introduction. Characteristics and performance of translators. Main components of translators. Translators for travel. Transducers for geometrical quantities Transducers for angular displacements Transducers for angular displacements Proximity translators. Transducers for dimensional control. Speed and speed transducers. Speed and speed transducers. Vibration and acceleration transducers. Force and torque transducers.	4
					Entrepreneurial development Introduction to entrepreneurship - definition, characteristics, role and importance of entrepreneurship in industry. Entrepreneurship and enterprising. Business opportunity. Starting a business. The structure of the business plan. Management of a business. Marketing strategies. Marketing in small and medium enterprises. Financial resources - financing a business.	3
				2	**Welding Technologies and Processes II** Thermal sources used for welding and particularities. Manual Metal Arc welding (MMA). Gas Metal Arc Welding (GMAW). Gas Tungsten Arc Welding (GTAW). Submerged Arc Welding (SAW). Oxygas Welding. Pressure welding. Friction welding. Friction Stir Welding (FSW). Materials and consumables. Equipment. Case studies.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**3**	**2**	**Logistics Management Sistems** The importance of logistics. Storage. Supply. Introduction to industrial logistics. Planning the commercial logistics of the company. Upstream production logistics. Logistics upstream of production. Logistics in distribution. Information system of the logistic activity. Logistics and marketing. Logistics services.	4
					Technological fixturing devices Manufacturing system. Manufacturing process. The system of machining errors. The structure of cutting systems. The chains of dimensions and surfaces. The principles of designing fixturing devices. Technological and computing stages. The principles of blank guidance. Types of guidance bases. Guidance on plane surfaces. Guidance on inner and outer cylindrical surfaces. Choosing and dimensioning the guidance elements. Orientation on plane surfaces. Orientation on inner and outer cylindrical surfaces. The system of cutting forces and torques. Designing of fixturing device parts.	4
					Equipments for 3D printing Introduction to 3D printing technologies. History of 3D printing technologies. 3D printing steps. Stereolithography. Selective Laser Sintering. Fused Deposition Modeling. Selective Laser Melting. Laminated Object Manufacturing. Digital Light Processing. Three-Dimensional Printing. PolyJet Printing. Binder Jetting. Solid Ground Curing. Direct Ceramic Jet Printing.	4
					Cuting tools Assimilation of the necessary knowledge for the design of different types of tools in order to remove the machining allowance by chipping and generate the surfaces of the parts.* Knowledge of the constructive and functional geometry of cutting tools;* Identification of tool materials and fields of use within each type of tool;* Knowledge of the constructive form for each type of tool, the ability to calculate the profile, the strength and shape of the teeth, the positioning-fixing method, the sharpening scheme, the fixing elements of removable teeth, etc.Knowledge of the constructive-functional solutions of tools developed in the country and abroad.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**3**	**2**	**Machine-Tools II** Lathe machines. Milling machines. Shaping, slotting and broaching machines. Drilling machines. Grinding machines. Reaming machines. Machines for processing gear teeth. Machines for grinding gear teeth.	4
					Project Management Introduction to project management. National, European and international funding sources. National and international programs. Operational programs, regional programs, financing instruments. General aspects of project management. Types of projects, the stages of project implementation, the role and responsibilities of the project manager. Identifying the opportunity and purpose of project implementation. Defining the purpose and objectives of the project, analyzing the project strategy. Project team management. Planning project activities. Financial management of projects. Project risk management. The operational resources of the project. Procurement plan, procurement procedures. Projects communication management. Project quality management. Support tools for project development. Business plan, sustainability strategy, post-project economic effects.	3
			4	**1**	**Machine tools for processing by plastic deformation** Cold pressing processing operations. General problems regarding the construction of machines for metals processing by cold plastic deformation. Mechanical presses. Design elements of the main subassemblies of mechanical presses. Hydraulic presses. Cutting machines. Bending machines. Straightening machines. Machines for roll profiling. Special machines for bulk deformation.	6
					Industrial Design Introduction. The management of a company where the product development takes place. ″The House of Quality″- a way of defining the ″voice of the consumer″ (VoC) and of gathering the development team effort. Gathering the information, methods of ideas generation, the AHP and the ANP methods. ″6 Sigma″. Robust design – Design for 6 Sigma (DFSS). Taguchi method. Software utilization for robust design. Design for Manufacturing and Assembly (DFMA). The risk management in a product development process. The acceleration of a product development.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**4**	**1**	**Machine Manufacturing** Introduction to product manufacturing technology. Blanks used in machine manufacturing. Manufacturing technology. Machining pression. Determination of the sequence of technological process operations. Quality of machined surfaces. Calculation of machining clearance. Technological criteria for determining machining parameters. Technical standardization of machining operations. Machining fluids.	4
					Reliability and maintenance Quality and reliability. Mathematical bases of reliability theory. Optimization of systems. Reliability of systems. Product maintainability and availability. Systems maintenance. Maintenance strategies. Totally productive maintenance. Management Methods of maintenance activities.	4
					Control and programming of CNC machines I Elements of CNC technology. Schemes of drilling and milling, parameters, types of cutting tools; SINUMERIK programming code. Functions, coordinate systems, geometric paramaters of the cutting tools; Main functions for movement. Linear and circular interpolation; Drilling cylces; Milling cycles; Structure of a cutting program. Subprogrames.	4
					Robotics Fundamentals of Robotics. Generalities, classification, components, tasks, workspace, mechanical structure, applications. Transmission systems of industrial robots. Mechanical structure of industrial robots, kinematic and dynamic model of industrial robots. Gripping devices. Actuation systems for gripping devices; Reconfigurable grippers. Electric, Pneumatic, hydraulic actuation systems for industrial robots. Sensorial system of an Industrial Robot. Industrial Internet of Things (IIoT). Programming and simulating the operation of industrial robots. Programming by learning; Programming through specialized languages; Programming through textual programming languages.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**4**	**1**	**Intelligent Manufacturing Systems – IMS** Production systems. Manufacturing systems. Intelligent manufacturing systems. Industry 4.0. Connected and collaborative factories. Systems theory basis. The basics of industrial robots. Control systems, sensors, transducers. Industrial Internet of Things (IIoT). Control systems for industrial robots equipped with artificial intelligence. PLM – Product Lifecycle Management. Analysis of the structure of intelligent manufacturing systems (IMS). Principles and stages of IMS synthesis. Elaboration of the overall concept of IMS. Synthesis of the location plan of the components and the IMS cyclogram. Economic efficiency analysis in IMS.	4
					Industrial Metrology (Metrologie industrială) Definition of coordinate systems of coordinate measuring machines. Realization of CMM alignments. Establishing references. Establishing translations. Establishing rotations. Measured geometric elements. Constructed geometric elements. Volumetric compensation. Contact measurement methods.	3
				2	**Command and programming of numerically controlled machine tools II** Tools and devices used in CNC machines. Regimes and lifespan of the inserts. Allocation of tools. Programming of 3/5-axis CNC machines.	5
					Industrial Management Fundamentals of company management. Management functions. General principles of company management. Management systems. Production capacity. Maintenance activities planning. Production costs of an industrial company. Technological and production costs. Planning of projects – Critical path method. Decision making. Choosing the optimal technological option. Determination of the duration of technological cycle. Launching into manufacturing of products.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**BA**	**Digital Production Systems**	**4**	**2**	**Modelling and simulation of production systems** Simulation as an evaluation technique. General information on the need to evaluate the performance of production systems. Performance evaluation techniques. Interpretation of evaluation results. Managerial simulation - Team building (firms). Simulation and disturbances. Definition of disruption. Typical disturbances in production systems. Simulation, disturbances and management strategies. Definition of fundamental concepts in simulation: System, Timing in simulation, Event, Activity, Process, Entities, Attributes, Resources, Variables, Logic of state change. Stages of a modelling and simulation process. Classical" modelling methods: event-based approximation. Marketing Investment Classical" modelling methods: activity-based approximation. Investment in R&D. Classical" modelling methods: process-based approximation. Capital investment. Modelling and simulation of the operation of production systems using the theory of waiting wires. Introduction to using the ARENA modelling and simulation software product. Performance analysis of waiting systems. Statistical analysis of the data obtained by simulation in ARENA of waiting systems. Evaluation of firm performance in simulation.	4
					Flexible manufacturing systems Manufacturing systems flexibility. Classification of manufacturing flexible systems. Manufacturing flexible systems typology. Economic design of manufacturing flexible systems (general aspects). Transportation systems in manufacturing flexible systems. Classification of methods used for parts transportation in manufacturing flexible systems. Robocar transportation systems. Economic efficiency of manufacturing flexible systems with robocar. Industrial robots. Running and programming systems of industrial robots. Programmable logic controller (PLC). Robots in cartesian coordinates system. Robots in cylindrical coordinates system. Robots in spherical coordinates system.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
AUTOMOTIVE VEHICLES - BA						
Automotive Engineering	**BA**	**Automotive Vehicles**	**1**	**1**	**Mathematical Analysis** Strings and series of real numbers. Differential calculus. Integral calculus. Differential equations.	5
					Physics Elements of physical mechanics. Fluid statics and dynamics. Oscillations and elastic waves. Elements of molecular physics. Elements of thermodynamics. Elements of quantum mechanics, atomic and nuclear physics.	5
					Chemistry Classification of chemicals. Aggregation states of matter. State transformations. The fundamental laws of chemistry. Elements of the structure of atoms. Atomic models. The periodic system of the elements. Chemical bonds. Dispersed systems. Redox reactions. Electrolysis. Hydrogen. Metals. Periodic system groups.	5
					Descriptive Geometry Projection systems. Representation of point, line and plan. Polyhedrons. Cylinder and cone. Sphere. Intersections of geometric bodies.	5
					Materials Science and Engineering Types of materials. Atomic architecture. Diffusion. Solidification of metallic materials. Alloy systems. Phase balance diagrams. Fe-C alloy system. Phase transformations in solid state. Heat treatments. Non-ferrous alloys. Ceramic materials. Plastic materials. Composite materials.	5
					Sports Front exercises and workouts. Notions of running school. Repeat the main processes in football (boys) and volleyball (girls). Educate the dynamic force at the level of the upper, lower limbs, abdomen and trunk by the method of working in the circuit and by working on workshops. Effort readjustment. Sports Games.	1
					English Production. Research and Development. Information technology. Logistics. Quality. Health and Safety. Grammar in focus: Present tenses. Past tenses. Future forms. Conditionals. Verb phrases.	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**BA**	**Automotive Vehicles**	**1**	**1**	**Communication** Principles, units and characteristics of communication. The emitting-receiver relationship in managerial and organizational communication. Language Functions. Effective communication principles. Characteristic units of communication. Nonverbal communication. Oral communication. Prepare and support an oral presentation. Types of interviews. Communication networks. Communication in conflict management. Communication and listening. Techniques for making oral and written scientific presentations. Formats for presentations. Organization of the presentation. Case Studies. Structure of technical and scientific works.	2
				2	**Linear Algebra, Analytic and Differential Geometry** Matrix operations. Determinants and their properties. Systems of linear equations. Vector spaces. Subspaces. Linear dependence and independence. Bases and Dimension. Coordinates. Change of basis. Linear transformations and Matrices. Diagonalization of a matrix. Coordinates. Products of Vectors. Equations of lines and planes. Equations of sphere. Quadric Surfaces. Local theory of Curves. Parameterized Surfaces. The Gauss Map. Curvatures.	4
					Drawings and Infographics I Arrangement of projections. Views, sections, breaks. Dimensioning of technical drawings. Representation of threads and flanges. Indication of surface condition, marking of dimensional deviations and geometric tolerances. The assembly drawing. Non-demountable joints. Removable assemblies. Mechanical Power Transmitters. Sealing elements.	4
					Computer Programming and Programming Languages Basics of computing. Evolution of computer systems. Components of a Computer Systems. The functional scheme of the structure of the computer. Types of computer memory. Introduction to Computers Programming. Forms of information. Data structures. Algorithms and components. Object orientation. Programming techniques. Computer Language Translation. Cloud Computing. Future of programming.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**BA**	**Automotive Vehicles**	**1**	**2**	**Materials Technology** The Structure of Crystalline Solids. Mechanical Properties of Materials. Physical properties of materials. Processing of Metal Alloys. Glass processing. Processing of ceramics. Cermets. Processing of rubber.	5
					Mechanics I Statics. Fundamental concepts, systems of forces, moment of a force about a point, moment of a force about a given axis, reduction of a force, reduction of a system of forces, particular cases. Centers of gravity of a system of particles and a rigid body. Centers of gravity of some usual homogeneous bodies. Statics of free particles and particles with constraints. Equilibrium of rigid bodies and systems of rigid bodies. Trusses. Statics of the cables. Statics of the simple machines. Kinematics of particles: motion of particles in about various coordinate systems, particular motion of particles. Relative motion of particles.	5
					Electrotechnics and Electric Machines Introduction to the basics of electrotechnics. Electricity. Production, transport, distribution. Quality of electricity. Analysis of circuits and electrical networks. Electromagnetism. Effects of electric current. Constructive, functional and behavioral study of machines power.	4
					Sports Front and work team exercises. The jumping school exercises. Training the skills and motor skills specific to some sports.	1
					English Engineering. Specialized vocabulary and discourse situations. Grammar in focus: Active vs. Passive. Relative clauses. Automotive. Specialized vocabulary and discourse situations. Grammar in focus: Causation. Metallurgy. Specialized vocabulary and discourse situations. Grammar in focus: Obligation and requirements. Welding. Specialized vocabulary and discourse situations. Grammar in focus: Cause and effect. Construction. Specialized vocabulary and discourse situations. Grammar in focus: Ability and inability.	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**BA**	**Automotive Vehicles**	**1**	**2**	**Advanced digital competencies** Presentation of the Microsoft Office software package. Presentation of the Microsoft Word program. Presentation of the Microsoft Excel program. Basic operations in Microsoft PowerPoint. Types of digital platforms. Web forums and newsgroups. Functional aspects of websites. Internet search strategies.	1
			2	**1**	**Numerical Methods** Algorithms & calculus errors. Numerical methods for solving algebraic equations. Numerical methods for solving systems of equations. Approximation of real functions. Numerical methods for calculating derivatives & integrals. Numerical methods for solving differential equations.	3
					Drawings and Infographics II AutoCAD - Overview. Basics for Drawing. Entering text into graphic files. Commands for multiplying objects. Dimensioning. Polylines. Editing commands. Advanced drawing commands. 3D drawing commands: nonprimitive. 3D drawing commands: primitive. 3D editing commands. Preparing technical product documentation.	4
					Essentials of Automotive Engineering Engines for motor vehicles. Mechanical clutches used in motor vehicles. Mechanical gearboxes used in vehicles. Longitudinal transmissions. Front deck. Rear axle. Steering systems. Braking systems of vehicles. Suspension of vehicles. Car bodies, underframes and rolling systems of vehicles.	4
					Mechanics II Kinematics of a rigid body. Kinematics of the systems of rigid bodies. Dynamics. Fundamental concepts. Moments of inertia of a body. Kinetic characteristics of a body. Fundamental theorems in dynamics of a rigid body and system of particles. Dynamics of a rigid body with fixed axis, dynamics of a rigid body in plane-parallel motion, rigid body dynamics in general motion. Dynamics of a particle. Relative motion dynamics of a particle. Collision and percussions. Elements of analytical mechanics. D'Alembert's principle. Principle of virtual work. Lagrange Equations.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**BA**	**Automotive Vehicles**	**2**	**1**	**Finite Element Method** Matrix algebra fundamentals. Strong and weak formulations. Choice of approximating functions for the FE method. Choice of weight functions - weighted residual method. Guidelines for element meshes and global nodal numbering. Stresses and strains. Linear elasticity. Approximating functions for the FE method. FE formulation of beams. FE formulation of plates. Numerical integration.	4
					Materials Strength I Introduction: Definitions, structural concepts (beams), approaches. Shearing forces and bending moments. Behavior of materials. Traction/Compression of beams. Cross section properties of beams.	4
					Mechanisms I Definitions. Structure and configuration of planar mechanisms. Kinematic element. The kinematic coupling. Kinematic chain. Mechanisms. Analysis of the configuration and kinematics of the mechanisms. Vector connection equations for configuration, velocities and accelerations fields. Spatial mechanisms. Force analysis of mechanisms. Dynamics of mechanisms.	4
					Sports Front and work team exercises. The throwing school exercises. Training the skills and motor skills specific to some sports.	1
					English Electrical. Specialized vocabulary and discourse situations. Grammar in focus: Scale of likelihood. Electronics. Specialized vocabulary and discourse situations. Grammar in focus: Subordinate clauses of result and purpose. Energy. Specialized vocabulary and discourse situations. Grammar in focus: Countable and uncountable nouns. Adjectives and adverbs. Civil Engineering. Specialized vocabulary and discourse situations. Grammar in focus: Comparison of adjectives. Mining. Specialized vocabulary and discourse situations. Grammar in focus: Prepositions of time.	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**BA**	**Automotive Vehicles**	**2**	**2**	**Materials Strength II** Compound stresses. Stability of elastic beams (buckling of beams). Energy methods in the calculation of elastic deformations of beam structures. Static undetermined systems of beams. Beam systems under dynamic loads.	3
					Mechanisms II Balancing mechanisms and machines. Synthesis of Lower Coupler Mechanisms. Gear Mechanisms. Cam – follower.	3
					Tolerances and Dimensional Control Introduction. Dimensional accuracy. Micro-geometric accuracy. Accuracy of geometric shape. Precision of orientation and reciprocal position. Chains of size. Methods and means of measurement and control. Tolerances, fits and control of smooth tapered, bearings, and key assemblies. Tolerances, fits and control of threaded assemblies. Tolerances, fits and control of gears and spur gears.	3
					Applied Informatics Overview of the software application. 3D modeling of parts. 3D modeling of sheet metal parts. 3D modeling of assemblies. 3D modeling of welded assemblies. 3D design of mechanical structures from profiles. Specific procedures for 3D modeling of plastic parts. Assisted design of mechanical transmissions.	3
					Fluid Mechanics Fluid statics. Basic equations of fluid mechanics. Dimensional analysis and similarity theory. Boundary layer theory. The flow through the pipes.	3
					Thermo-Technics I General thermodynamics. Status sizes. Mechanical work, heat, entropy, enthalpy. Simple transformations of perfect gases, Carnot cycle. Principles I and II of Thermodynamics. Reversible and irreversible processes for thermodynamic systems. Nozzles. The principle of operation of the turbines. Piston compressors. Perfect gas mixtures. Ideal cycles of internal combustion engines.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**BA**	**Automotive Vehicles**	**2**	**2**	**Machine Parts and Tribology I** General elements underlying the design of machine parts. Transmissions through belts and chains. Friction wheel drives. Spur Gears. Axles and shafts straight. Sliding and rolling bearings. Clutches. Removable assemblies. Non-removable assemblies by welding.	4
					Sports Consolidation of the main processes of football - boys and volleyball – girls. Settling in attack and defense game systems. Bilateral games. Development of the elements of coordinative capacity. Educate the general force on the upper, lower limbs, abdomen and trunk.	1
					English Materials Technology. Material Types. Material Properties. Forming, working, and heat-treating metal. Grammar in focus: Countable and uncountable nouns. Adjectives and adverbs. Prepositions of place. Writing in focus: Description. Manufacturing and Assembly. 3D Component features. Interconnection. Grammar in focus: Quantifiers. Writing in focus: Definition and exemplification.	2
					Practice Activities in the Scientific Field Checking the technical state of the engines using the specific stands and devices existing in the service unit. Organization of workshops for the diagnosis and repair of vehicles.	4
			3	**1**	**Machine Parts and Tribology II** Mechanical transmissions by gear. Transmissions through belts. Friction wheel drives. Chain transmissions. Axles and shafts. Rolling bearings. Clutches. Tribosystem. Types of wear. Friction regimes.	6
					Hydraulic and Pneumatic Drives Structure of a hydrostatic system. Organology of hydrostatic systems. Hydraulic pumps. Hydraulic motors. Distribution equipment. Pressure adjustment equipment. Flow adjustment equipment. Hydraulic diagrams. Structure of pneumatic schemes. Pressure valves. Directional Control Valves. Pneumatic motors. Pneumatic diagrams.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**BA**	**Automotive Vehicles**	**3**	**1**	**Thermo-Technics II** Thermodynamics of thermal agents. Thermodynamics of fuel combustion. Thermodynamics of thermal machine cycles.	4
					Mechanical Vibrations The vibrations of the elastic linear systems with a degree of freedom. Vibrations of elastic linear systems with finite number of degrees of freedom. Vibrations of continuous systems. Approximate methods in vibration study. Vibration measurement.	3
					Fuels, Lubricants and Special Materials for the Vehicle Chemical composition and structure of fuels and lubricants. Physical-chemical and operating characteristics of fuels. Alternative fuels. Physical-chemical and operating characteristics of lubricants. Hydraulic fluids for telescopic shock absorbers. Brake Fluids. Coolants for engines. Friction gaskets.	4
					Vehicle System Dynamics I General organization and main parameters of vehicles. The process of self-propelling and running of vehicles. Resistances to motion of vehicles. The reactions of the treadmill on the wheels of vehicles. The reactions of the roadway on the wheels of vehicles.	4
					Internal Combustion Engine I The operation, the actual operating schemes and the operating regimes of the internal combustion engines with piston. Ideal thermodynamic processes in internal combustion engines. Fluids used in the operation of internal combustion engines. Processes of gas change in internal combustion engines. Characteristic parameters of internal combustion engines. Supercharging of internal combustion engines. Static operating characteristics of internal combustion engines.	5
				2	**Vehicle System Dynamics II** Vehicle performance. Calculation of traction of vehicles. Stability of vehicles. Vehicle maneuverability. Fuel consumption of the vehicle.	6

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**BA**	**Automotive Vehicles**	**3**	**2**	**Internal Combustion Engine II** Elements of kinematics and dynamics of the crank-piston mechanism. Piston group: piston, bolt, piston ring. Connecting rod. Crankshaft. Gas distribution system. The fixed parts of the engine mechanism. The installations of internal combustion engine.	5
					Construction and Calculation of Motor Vehicles I The main parameters of the vehicles. Operating conditions and establishing the calculation regimes for the parts of vehicles. The strength calculation of vehicle parts. Determination of operating resistance. Motion transmission systems. Clutch. Gearboxes. Front deck.	5
					Applied Electronics Electronic devices of circuit. Amplifiers and oscillators. Uncontrolled and low power rectifiers. Electronic stabilizers. Controlled low power rectifiers. Combinational and sequential logic circuits. Applications of combinational and sequential logic circuits.	4
					Fundamentals of Automation Systems Mathematical modeling of signals. Temporal analysis of the automatic adjustment system in functional representation. The stability of the automatic adjustment system. Analysis of the stationary regime of the automatic adjustment system. Analysis of the dynamic regime of the automatic adjustment system. Design of automatic adjustment systems.	3
					Traffic and Traffic Safety Traffic and road traffic. Component factors of the road traffic system. Traffic engineering. Basic characteristics of road traffic. Geometrical characteristics of the roads. Road traffic capacity. Traffic of vehicles in crossroads.	3
					Practice Activities in a Specific Scientific Field Practical operations for checking, adjusting and repairing the transmission elements, of the elements of the braking system, of the elements of the steering system, of the elements of the electrical installation and of air conditioning, of the suspension elements of the vehicles, of the car body elements. Organization of workshops for the diagnosis, repair and maintenance of road vehicles.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**BA**	**Automotive Vehicles**	**4**	**1**	**Construction and Calculation of Motor Vehicles II** Construction and calculation of: the steering mechanisms, braking systems, suspension systems, car bodies.	6
					Manufacture and Repairing of Motor Vehicles The production process, the technological process, the method and the processes for the manufacture and repair of vehicles. Technologies for manufacturing the main car parts. Wear of auto parts. Methods to determine the wear of parts and to reworking them. Technologies for repair of vehicle parts and component parts. Car body painting. Final control of vehicles.	5
					Electrical and Electronic Equipment for Motor Vehicle Distribution and interconnection elements. Switching and protection elements. Electricity supply system. Starting system. Ignition systems. The injection system. Active and passive control electronic systems for safety. Lighting and signaling system, internal and external. Embedded monitoring and control systems.	3
					Motor Vehicle Diagnosis General diagnosis of engine and powertrain. In-depth engine diagnostics. General and in-depth diagnosis of transmission. Diagnosis of the front axle and the rear axle. Diagnosis of steering system. Diagnosis of suspension. Diagnosis of the braking system. Diagnosis of lighting and optical signaling installations. Diagnosis of comfort and safety equipment.	4
					General Economy The economy and economic science. The contemporary market economy. The economic flow. The economic utility and behavior. Consumer. The production factors. The production costs. The demand. The offer. Market types and price training mechanisms. The remuneration of production factors. Macro economy.	4
					Construction and Calculation of Motor Vehicle Auxiliary Installations Ventilation, heating and air conditioning systems. Diagnosing and repairing automotive air conditioning systems. Passive protection system with airbag and seat belt.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**BA**	**Automotive Vehicles**	**4**	**1**	**Computer Aided Design** Introduction to CATIA assisted design. Generating sketches. Solids generation - Part Design module. Generation of surfaces. Drawing generation - Drafting module. Assembly drawing - Assembly Design module. Generative Sheetmetal Design module. Finite element analysis - Generative Structural Analysis module.	4
				2	**Practical Training for the Graduation Paper**	2
					Completion of Graduation Paper	4
					Motor Vehicles Mechatronics Mechatronic systems from modern cars. Structure of mechatronic systems specific to the automotive field. Smart sensors. Intelligent control systems. Analysis, modeling and simulation of the operation of mechatronic subsystems in automobiles. Presentation of the specific software Simulink, AMESIM, dSpace, Carsim, Fluidsim, Modelica. Mechatronics of comfort and anti-theft systems. Intelligent navigation systems (autonomous vehicles).	3
					Controlling Pollution Generated by Internal Combustion Engines Regulations regarding pollution due to vehicles. Pollutants produced by road vehicles. Origin of pollutants from exhaust gases. Technologies for reducing polluting emissions. Methods and equipment for measuring the concentration of pollutants in the exhaust gases of road vehicles.	3
					Unconventional propulsion systems Vehicles with electric and hybrid propulsion, the solution for reducing pollution and fuel consumption. General objectives and design specifications for electric and hybrid vehicles. Accumulators used on electric and hybrid vehicles. Command and control of hybrid electric vehicles. Electric motors used for the propulsion of electric and hybrid electric vehicles.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**BA**	**Automotive Vehicles**	**4**	**2**	**Reliability and Terotechnology of Motor Vehicles** Defects of the component parts of the vehicles. Elements of probability theory and statistics with application in reliability problems. Reliability indicators and distribution laws. Reliability of systems. Reliability of vehicles in operation. FMEA method and FTA method - applications to the transmission system. Terotechnology applied to car technical systems.	4
					Car Bodies and Load-Bearing Structures for Motor Vehicle General considerations on the construction of car bodies and of load-bearing structure. Design of the car body shape and the load-bearing structure. Materials used in car body construction. Technologies for the manufacture of car body components. Technologies for the assembly of car bodies. Painting technologies in the automotive industry. Car body sealing and soundproofing. Active and passive safety.	4
					Organization of Motor Services Organization of motor services. Organizational framework. Regulation of service activity. Conditions for ensuring compliance. Rules of procedure for the assessment of the technical capacity and the authorization of the economic operators. Services activities. Supply of spare parts, materials and lubricants. Technical representation of a brand. Revisions. Guarantees.	3
					Management Managerial strategies applied within the vehicle manufacturing company. Production capacity of industrial companies. Constructive and technological preparation of industrial production. Material and organizational preparation of industrial production. Stochastic phenomena and the management process. Quality management of industrial production. Strategic management of industrial production.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
INDUSTRIAL ECONOMIC ENGINEERING - BA						
Engineering and Management	**BA**	**Industrial Economic Engineering**	**1**	**1**	**Mathematical Analysis** Strings and series of real numbers. Differential calculus. Integral calculus. Differential equations.	5
					Physics Classical mechanics. Elements of restricted relativity theory. Thermodynamics, Molecular Physics and Heat. Electricity and Magnetism. Optics. Introduction to Quantum Physics.	5
					Chemistry Classification of chemicals. Aggregation states of matter. State transformations. The fundamental laws of chemistry. Elements of the structure of atoms. Atomic models. The periodic system of the elements. Chemical bonds. Dispersed systems. Colloidal systems. Redox reactions. Electrolysis. Hydrogen. Metals.	5
					Descriptive Geometry Projection systems. Representation of point, line and plan. Polyhedrons. Cylinder and cone. Sphere. Intersections of geometric bodies.	5
					Materials Science and Engineering Types of materials. Physical and mechanical properties of materials. Chemical stability of materials. Corrosion resistance. Interatomic connections. Crystalline and amorphous structure. Structure of real crystals. Solidification of metallic materials. The diffusion. Alloy systems. Phase balance diagrams. Fe-C alloy system. Steels. Cast iron. Heat treatments. Plastic deformation. Non-ferrous alloys. Polymers. Ceramic, sintered and composite materials. Advanced materials.	5
					Sports Enhancing elements of the Running School and the Jumping School and coordination elements. Speed development through motion games. Football game. Volleyball game.	1

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Engineering and Management	**BA**	**Industrial Economic Engineering**	**1**	**1**	**English** Production. Specialized vocabulary and discourse situations. Grammar in focus: Present tenses (present simple, present continuous, present perfect). Research and Development. Specialized vocabulary and discourse situations. Grammar in focus: Past tenses. Information technology. Specialized vocabulary and discourse situations. Grammar in focus: Future forms. Logistics. Specialized vocabulary and discourse situations. Grammar in focus: Conditionals.	2
					Communication Getting Started in professional communication techniques. Communication techniques. Oral communication. Preparation and support of a presentation / speech / scientific papers. Types of interviews. Employment interview. Written communication. The experimental study. How to make a presentation on areas of professional competence.	2
				2	**Linear Algebra, Analytic and Differential Geometry** Vector spaces. Linear applications. Real Euclidean vector spaces. Free vectors. Line and plan in space. Conics on reduced equations. Quadrics on reduced equations. Curves in space. Surfaces.	5
					Industrial Design Introduction. The management of a company where the product development takes place. ″The House of Quality″- a way of defining the ″voice of the consumer″ (VoC) and of gathering the development team effort. Gathering the information, methods of ideas generation, the AHP and the ANP methods. ″6 Sigma″. Robust design – Design for 6 Sigma (DFSS). Taguchi method. Software utilization for robust design. The risk management in a product development process. Design for Manufacturing and Assembly (DFMA). The acceleration of a product development.	4
					Computer Programming and Programming Languages Introduction to C Language in the Qt environment. Presentation of the Turbo C programming environment. Variables. Constants. Structures. Conditioning instructions. Repetitive structure for. Panels. The repetitive instruction while. Matrices. Files. Strings of characters. Functions. Pointers. Classes in C ++.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Engineering and Management	**BA**	**Industrial Economic Engineering**	**1**	**2**	**Mechanics** Introduction to vector operations, principles and axioms of mechanics. Moment theory. Static moments and center of gravity. Equilibrium of the rigid to ideal connections. Methods and theorems in the static of the material systems. Friction in technique. Wire statics. Technical applications of statics. Kinematics of the point.	5
					Electrotechnics Basics of electrotechnics. Electricity. Production, transport, distribution. Quality of electricity. Analysis of circuits and electrical networks. Electromagnetism. Effects of electric current. Constructive, functional and behavioral study of machines power.	3
					Drawings and Infographics Arrangement of projections. Views, sections, breaks. Dimensioning of technical drawings. Representation of threads and flanges. Indication of surface condition, marking of dimensional deviations and geometric tolerances. The assembly drawing. Non-demountable joints. Removable assemblies. Mechanical Power Transmitters. Sealing elements.	5
					Sports Enhancing elements of the Running School and the Jumping School and coordination elements. Speed development through motion games. Football game. Volleyball game.	1
					English Quality Control. Obligation and Requirements. Health and Safety. Ability and Inability. Relative Clauses. Engineering. Countable and uncountable nouns. Adjectives and adverbs. Prepositions and conjunctions. Medicine.	2
					Advanced digital competencies Presentation of the Microsoft Office software package. Presentation of the Microsoft Word program. Presentation of the Microsoft Excel program. Basic operations in Microsoft PowerPoint. Types of digital platforms. Web forums and newsgroups. Functional aspects of websites. Internet search strategies.	1

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Engineering and Management	**BA**	**Industrial Economic Engineering**	**2**	**1**	**Computer Aided Graphics** AutoCAD - Overview. Basic elements for drawing. Entering text into graphic files. Notions of quotation. Polylines. Editing commands. Advanced drawing commands. 3D drawing commands: nonprimitive. 3D drawing commands: primitive. 3D editing commands. Preparing technical product documentation.	4
					Materials Strength Overview. Shearing forces and bending moments. Behavior of materials. Traction/Compression of beams. Cross section properties of beams. Bending of beams. Torsion of beams having circular or annular section; torsion of rectangular cross-section bars. Methodology of dimensioning and verifying beams.	6
					Numerical Methods Algorithms and computational errors. Approximation of functions by interpolation. Solving systems of linear equations. Solving systems of nonlinear equations. Numerical derivation. Numerical integration. Numerical solution of ordinary equations. Numerical solution of higher order differential equations. Numerical solution of differential equations with partial derivatives.	4
					Thermo-Technics and Thermal Equipment General thermodynamics. Status sizes. Mechanical work, heat, entropy, enthalpy. Simple transformations of perfect gases. Principles I and II of Thermodynamics. Reversible and irreversible processes for thermodynamic systems. Reversible and irreversible processes of stabilized flow systems. Nozzles. Homogeneous and non-unitary thermodynamic system. Perfect gas mixtures. Cycles of machines and thermal installations with perfect gas as a working fluid. Heat exchangers.	5
					Processing by cutting Basics about generating surfaces on machine-tools. Basics of the construction and geometry of cutting tools. Thermal phenomena in cutting processes. Cutting forces. Wear and durability of cutting tools. Wear and durability of cutting tools. The parameters of the cutting regime. Turning processing. Processing by milling. Bore processing. Processing by planning. Processing by broaching. Processing by grinding.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Engineering and Management	**BA**	**Industrial Economic Engineering**	**2**	**1**	**Operational Research** Linear programming. The mathematical model of linear programming problems. Solving linear programming problems. Graph theory. Basic concepts. Calculation procedures in graphs. Optimal flow in transport networks. The critical path method. Transportation problems.	4
					Sports Resumption of the main technical-tactical structures in football - boys and volleyball - girls, completed in year 1. Settling in attack and defense game systems. 3x3, 4x4 games on small field, in conditions of moderate or increased difficulty. Bilateral games in compliance with the regulation. Development of the speed of reaction to auditory and visual stimuli. Improving the technique of speed running. Development of the speed of travel through accelerations on variable distances 20-60m. Educating the segmental dynamic force at the level of the upper, lower limbs, abdomen and trunk by the method of working in the circuit and by working on workshops, differentiated, depending on the individual potential. Fixing and consolidating the main technical elements and procedures specific to sports games. The application of the combinations of specific procedures under adverse conditions, within the bilateral game, with respect to the tasks in positions. Development of the elements of coordinative capacity - rhythm, precision, static and dynamic balance, spatial-temporal orientation, combination of movements, kinesthetic discrimination, ambidextrousness, agility. Educate the mixed and anaerobic lactacid resistance by the method of variable, progressive and interval training.	1
					English Design. Drawings. Design Development. Design Solutions. Grammar in focus: Scale of likelihood. Measurement. Locating and setting out. Dimensional Accuracy. Grammar in focus: Subordinate clauses of result and purpose. Measurement. Numbers and Calculations. Measurable parameters. Grammar in focus: Comparison of adjectives.	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Engineering and Management	**BA**	**Industrial Economic Engineering**	**2**	**2**	**Accounting** Patrimonial structures of assets. Patrimonial structures of liabilities. Incomings and outgoings structures. Accounting method. Valuation of assets in accounting. Balance sheet. Analysis and operation of accounts. Inventory of patrimony. Trial balance. Synthesis and accounting reporting.	3
					Fluid Mechanics and Hydraulic Equipment Fluid statics. Basic equations of fluid mechanics. Dimensional analysis and similarity theory. Boundary layer theory. The flow through the pipes.	3
					Fundamentals of Economy Factual economics and theoretical economics. Contemporary market economy. Economic flow. Economic utility and consumer behavior. Production factors. Production costs. Demand. Supply. Types of markets and price formation mechanisms. Remuneration of production factors. Macroeconomics.	3
					Quality Management Concept of quality. Quality costs. Quality features. The role of quality in increasing the technical level. The spiral of quality. Traditional management. International quality standards. Evaluation of the quality system. Audit. ISO 9000 and ISO 9001 certification. Statistical tools of quality. New management tools.	3
					Prices and Costs Calculus Cost calculation. Delimitation of expenditure by carriers and sectors. Procedures for the allocation of indirect costs, for the separation of expenses, for separating production costs into variables and fixed, for calculating the cost per unit of product, for calculating the costs of interdependent manufacturing production. Budgeting of accounts. Accounting of internal management operations.	3
					Tolerances and Dimensional Control Introduction. Dimensional accuracy. Micro-geometric accuracy. Accuracy of geometric shape. Precision of orientation and reciprocal position. Chains of size. Methods and means of measurement and control. Tolerances, fits and control of smooth tapered, bearings and key assemblies. Tolerances, fits and control of threaded assemblies. Tolerances, fits and control of gears and spur gears.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Engineering and Management	**BA**	**Industrial Economic Engineering**	**2**	**2**	**Mechanisms and Machine Parts I** Structure and configuration of plane mechanisms. Kinematic element. Kinematic couple. Kinematic chain. Mechanisms. Analysis of the configuration and kinematics of the mechanisms. Analysis of forces at mechanisms. Dynamics of mechanisms. Balancing mechanisms and machines. Synthesis of mechanisms with lower couplings. Gear mechanisms. Cam mechanisms.	5
					Sports Resumption of the main technical-tactical structures in football - boys and volleyball - girls. Development of the speed of reaction to auditory and visual stimuli. Improving the technique of speed running. Educating the segmental dynamic force at the level of the upper, lower limbs, abdomen and trunk. Fixing and consolidating the main technical elements and procedures specific to sports games. Development of the elements of coordinative capacity. Educate the mixed and anaerobic lactacid resistance by the method of variable, progressive and interval training.	1
					English Materials Technology. Material Types. Material Properties. Forming, working, and heat-treating metal. Grammar in focus: Countable and uncountable nouns. Adjectives and adverbs. Prepositions of place. Writing in focus: Description. Manufacturing and Assembly. 3D Component features. Interconnection. Grammar in focus: Quantifiers. Writing in focus: Definition and exemplification.	2
					Practice Activities in the Scientific Field Knowledge of the sectors of the company and the organizational chart of the company. Study of machining processes on different types of machine tools. Study of relevant examples of related technical-economic documentation as well as the learning of the methodology for its preparation. Study of the implementation mode and the specific procedures for quality control.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Engineering and Management	**BA**	**Industrial Economic Engineering**	**3**	**1**	**Mechanisms and Machine Parts II** General problems of machine construction. Non-removable assemblies. Removable assemblies. Elastic assemblies. Mechanical transmissions by gear. Transmissions through belts. Friction wheel drives. Chain transmissions. Axles and shafts. Rolling bearings. Clutches.	5
					Systems and Technologies for Plastic Deformation Introduction. Classification of sheet metal forming operations. Classification of metal forming tools. Presses for metal forming. Applications. Blanking and punching. Bending technologies and equipments. Deep drawing technologies and equipments. Shaping operations and equipments. Bulk deformation technologies and equipments. Elements of technology design and technological equipment for processing by cold plastic deformation. Non-conventional cold pressing technologies. CAD / CAM techniques for designing cold pressing technologies and equipments.	6
					Tools and Devices I The structure of the cutting tools. Materials for cutting tools. The calculation and construction of lathe tools. The calculation and construction of tools for machining bores. Calculation and construction of broach. Calculation and construction of mills.	5
					Accounting Structural and comparative analysis of economic means, sources and processes. Factorial analysis of turnover. Intermediate management balance account. Self-financing capacity. Financing table. Cash flow statement. Accounting of financial results and funds. Profitability analysis. Bankruptcy risk analysis.	5
					Product Manufacturing Technology I Basics of manufacturing processes in the machine construction. Production types. Design of technological processes. Production processes, technological processes. Processing accuracy. Optimization of technological processes. The quality of the processed surfaces. Determination of processing additions and inter-operational dimensions. Technological criteria for determining cutting regimes. Technical standardization. Basic concepts regarding the workability of metallic materials.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Engineering and Management	**BA**	**Industrial Economic Engineering**	**3**	**1**	**Integrated CAE Systems** Global vision on PLM (Product Lifecycle Management) and virtual enterprise. Integration of the development stages and the management of the technical documentation about the product. Integration of product data into the virtual enterprise. Structures of products in the virtual enterprise. The flow of technical documentation about the product in the virtual enterprise. Revision management in the virtual enterprise. Manufacturing process management. Management of product specifications and regulations. Management of the entire product development process.	3
					Project Management Types of programs and projects. Project management in organizational context. Identification of projects and establishing their objectives. Time management. Project cost management. Project quality management. Project team management. Communication management. Risk management in projects. Management of material resources and of procurement for projects.	4
				2	**Tools and Devices II** Calculation and construction of tools for threading. Tools for toothing cylindrical and worm gears. Tools for toothing bevel gears. Calculation and construction of combined tools.	4
					Marketing Marketing research design. The marketing information system. Methods and techniques for collecting and analyzing information in marketing research. Measurement and scaling of phenomena in marketing research. Methods and techniques for obtaining information. Analysis of marketing information. The survey.	3
					Product Manufacturing Technology II Analysis of the main processing procedures. Analysis of the processing of special surfaces. Modern methods of processing based on the numerical control of machine tools. Modern manufacturing systems.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Engineering and Management	**BA**	**Industrial Economic Engineering**	**3**	**2**	**Engineering of Assembly Processes** Types of production processes. The architecture of the production systems. Assembly processes through different modes of energy activation. Thermal sources used to make non-removable assemblies. The algorithm for designing an assembly technology by thermal energy activation. Welding procedure specifications (WPS) for shipbuilding industry. Welding procedure specifications (WPS) for pipelines production.	3
					Fundamentals of Data Processing Processing of statistical data specific to engineering. Error assessment. Notions of probability theory. Distribution laws. Statistical hypotheses. Verification of statistical assumptions. Variation analysis. Experiment planning. Signal-to-noise analysis. Determination of optimal parameters. The study of the influence of parameters and interactions.	3
					Manufacturing Equipment Main kinematic chains. Feeding kinematic chains. Kinematic chains for continuous speed control. Systems for individual and centralized control. Notions regarding the electrical control of machine tools. Notions regarding the numerical control of machine tools. Lathe machines. Milling machines. Drilling machines. Planing machines. Grinding machines.	3
					Fundamentals of Computer Aided Technological Design Methods and principles in computer aided manufacturing. Basic elements in the methodology of computer assisted manufacturing of parts using machine tools with numerical control. Methodology of designing the process of processing parts on machine tools with numerical control.	3
					Practice Activities in a Specific Scientific Field Programming, adjusting and operating different types of mechanical processing equipment. The practical implementation of the concepts of accounting learned in the profile courses.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Engineering and Management	**BA**	**Industrial Economic Engineering**	**4**	**1**	**Entrepreneurship** The concept of the project. The entrepreneurial process. Developing successful business ideas. Entrepreneurial activity. Designing the business plan. Social entrepreneurship. Entrepreneurship and innovation.	3
					Plastics Processing Technologies Thermoplastic and thermoreactive materials. The principle of mixing. The principle of calendering. The principle of extrusion. The basis of the plastic injection process. Technological aspects of vulcanization in molds.	5
					Integrated Production Systems Elements of CNC technology. The SINUMERIK programming system. Main functions of movement. Linear and circular interpolation. Technological cycles of drilling. Technological cycles of milling. The structure of a processing program.	3
					Deformation Systems and Technologies Operations and punches for cutting, for bending, for embossing, for trimming and for volumetric deformation. Elements of technology design and technological equipment for processing by cold plastic deformation. Non-conventional cold pressing technologies. CAD / CAM techniques for designing cold pressing technologies and equipment.	5
					Logistics Management The importance of logistics. Storage. Supply. Introduction to industrial logistics. Planning the commercial logistics of the company. Upstream production logistics. Logistics upstream of production. Logistics in distribution. Information system of the logistic activity. Logistics and marketing. Logistics services.	3
					The Simulated Enterprise The structure, organization and functioning of a simulated enterprise. Presentation and analysis of a simulation model for the accounting and financial management module of an enterprise. Presentation and analysis of a simulation model for the human resources and payroll module of an enterprise. Presentation and analysis of a simulation model for the inventory, logistics and production module of an enterprise. Integrated Enterprise Resource Planning - ERP platforms.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Engineering and Management	**BA**	**Industrial Economic Engineering**	**4**	**1**	**Production Management** Fundamentals of company management. Enterprise - economic agent. The decision-making system. The information system. Structural and procedural organization of the company. Production capacity.	3
					Value Engineering Introduction to value analysis. The logical and chronological process of carrying out the value analysis. Methods for investigating or producing ideas. Methods of evaluation. Case studies. Creativity - an important element in the value analysis approach.	3
					Labor Legislation Labor law: notion, object, sources, principles. Individual labor law. Individual labor contract. Collective labor law. Collective labor agreement.	3
				2	**Production Management** Basic concepts of production design in time and space. Servicing processes. Organization and planning of maintenance and repair of machinery. Organization of insurance activity with tools, devices and verifiers. Organizing the internal transport activity. Production costs of an industrial production enterprise. Modern production management systems.	4
					E-commerce Fundamentals in e-commerce. Techniques used to organize and operate e-commerce platforms. Solutions for simulation development dedicated to e-commerce applications. Applications for e-commerce - B2C and B2B. Integrated e-commerce platforms. Cloud applications for e-commerce.	3
					Management of SMEs Definition, characteristics, typology of the entrepreneur. The real and perceived entrepreneurial environment. Management functions within SMEs. Strategic behavior models applicable to SMEs. Human resources / talent management. Organizational culture in SMEs. Social entrepreneurship. Competitiveness and innovation in the SME sector. Developing anticipatory capacity in the context of the complexity of the environment.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Engineering and Management	**BA**	**Industrial Economic Engineering**	**4**	**2**	**Informatics Systems in Management**	4
					Completion of Graduation Paper	4
					Practical Training for the Graduation Paper	1
					Environmental Management Institutional framework specific to environmental protection and nature conservation. Legislative framework in the field of the environment. The scope of the environmental management system. Requirements of the environmental management system. The elements of the environmental management system. Assessment of environmental performance. Environmental audit. Product life cycle assessment. Environmental labels and declarations.	4
					Competition Law or **Business Law**	3
					Economic Analysis Theoretical and methodological bases of the economic-financial analysis. Diagnostic analysis of the production and marketing activity. Analysis of human resources management. Analysis of material resource management. Cost analysis. Profitability analysis. Analysis of the financial position based on the balance sheet.	4
HYDROTECHNICAL IMPROVEMENTS AND ENVIRONMENTAL PROTECTION - BA						
Environmental Engineering	**BA**	**Hydrotechnical Improvements and Environmental Protection**	**1**	**1**	**Mathematical Analysis** Strings and series of real numbers. Differential calculus. Integral calculus. Differential equations.	4
					Physics Classic mechanics. Thermodynamics, Molecular Physics and Heat. Electricity and Magnetism. Optics. Introduction to Quantum Physics.	5
					Descriptive Geometry Projection systems. Representation of point, line and plan. Polyhedrons. Cylinder and cone. Sphere. Intersections of geometric bodies.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**BA**	**Hydrotechnical Improvements and Environmental Protection**	**1**	**1**	**Mechanics** Moment theory. Static moments and center of gravity. Static mechanical systems. Kinematics. The dynamics of the material point. The kinematics and dynamics of the relative motion of the point.	5
					Materials Science and Engineering Types of materials. Atomic architecture. Diffusion. Fe-C alloy system. Phase transformations in solid state. Heat treatments. Non-ferrous alloys. Ceramic materials. Plastic materials. Composite materials.	3
					Chemistry Classification of chemicals. Aggregation states of matter. State transformations. The fundamental laws of chemistry. Elements of the structure of atoms. Atomic models. The periodic system of the elements. Chemical bonds. Dispersed systems. Colloidal systems. Redox reactions. Electrolysis. Hydrogen. Metals.	5
					Sports Resumption of the main technical-tactical structures in football (boys) and volleyball (girls). Games on small field, in conditions of moderate or increased difficulty. Bilateral games in compliance with the regulation. Development of the speed of reaction to auditory and visual stimuli. Improving the technique of speed running. Educating the segmental dynamic force at the level of the upper, lower limbs, abdomen and trunk.	1
					English Production. Specialized vocabulary and discourse situations. Grammar in focus: Present tenses. Research and Development. Specialized vocabulary and discourse situations. Grammar in focus: Past tenses. Information technology. Specialized vocabulary and discourse situations. Grammar in focus: Future forms. Logistics. Specialized vocabulary and discourse situations. Grammar in focus: Conditionals. Quality. Specialized vocabulary and discourse situations. Grammar in focus: Verb phrases. Health and Safety. Specialized vocabulary and discourse situations. Grammar in focus: Verb phrases.	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**BA**	**Hydrotechnical Improvements and Environmental Protection**	**1**	**2**	**Topography** General Elements of Topography. General Elements of Cartography. Marking and signaling of topographic points. Tools used in Topography. Planimetric determinations. Elements specific to measurements using GPS technology. Elements related to the drawing on the ground of the designed elements.	5
					Linear Algebra, Analytic and Differential Geometry Vector spaces. Linear applications. Real Euclidean vector spaces. Free vectors. Line and plan in space. Conics on reduced equations. Quadrics on reduced equations. Curves in space. Surfaces.	4
					Ecology Biosphere. Biotope - the abiotic environment of the living creatures. Ecology of populations. The causes of the emergence and aggravation of ecological imbalances. The ecosystem as a formation in space and time. The main ecosystems in Romania. Biome. The biocenotic order in the ecosystem. Trophic chains. Ecosystem successions.	4
					Applied Informatics Hardware architecture of computers. Operating systems. Installation. Operations. Internet. Intranet. The MS Word text editor. Calculation in the form of tables in MS Excel. MS PowerPoint presentations. Database Management with MS Access. Editing advertising content with MS Publisher. Cyber security.	4
					Hydrology and Hydrogeology Introduction to hydrology study. The water circuit in nature. General properties of water. Notions of hydrogeology. The hydrographic basin. Danube. Elements of flowing waters hydrometry. Limnology.	5
					Meteorology and Climatology Temperature gradient, temperature variability. Baric formations. Static and thermodynamic of the atmosphere. Humidity. Fog and clouds. Rain. Dynamics of the atmosphere. The wind. Radiative budget. Atmospheric circulation. Types of climate. Climate elements of Romania.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**BA**	**Hydrotechnical Improvements and Environmental Protection**	**1**	**2**	**Sports** Fixing and consolidating the main technical elements and procedures specific to sports games. The application of the combinations of specific procedures under adverse conditions, within the bilateral game, with respect to the tasks in positions. Development of the elements of coordinative capacity - rhythm, precision, static and dynamic balance, spatial-temporal orientation, combination of movements, agility. Educate the mixed and anaerobic lactacid resistance by the method of variable, progressive and interval training.	1
					English Engineering. Automotive. Metallurgy. Welding. Construction. Specialized vocabulary and discourse situations. Grammar in focus: Active vs. Passive. Relative clauses. Causation. Obligation and requirements. Cause and effect. Ability and inability.	2
					Advanced digital competencies Presentation of the Microsoft Office software package. Presentation of the Microsoft Word program. Presentation of the Microsoft Excel program. Basic operations in Microsoft PowerPoint. Types of digital platforms. Web forums and newsgroups. Functional aspects of websites. Internet search strategies.	1
			2	**1**	**Thermodynamics** Thermodynamic system. Thermodynamic balance. Status sizes. Process sizes. The postulates of thermodynamics. Temperature and pressure. The first principle of thermodynamics. Internal energy. Mechanical work. Mechanical movement work. Mechanical work. The heat. Enthalpy. The perfect gas. Simple laws. Specific heaters. Perfect gas mixtures. Simple state transformations. The second principle of thermodynamics. The entropy of perfect gases. Vapor. Wet air. Combustion of solid, liquid and gaseous fuels.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**BA**	**Hydrotechnical Improvements and Environmental Protection**	**2**	**1**	**Drawings and Infographics I** Arrangement of projections. Views, sections, breaks. Dimensioning of technical drawings. Representation of threads and flanges. Indication of surface condition, marking of dimensional deviations and geometric tolerances. The assembly drawing. Non-demountable joints. Removable assemblies. Mechanical Power Transmitters. Sealing elements.	4
					Geology The structure of the Earth's globe. The chemical and mineralogical composition of the globe. Notions of petrology. Elements of cartography and structural geology. Elements of global tectonics.	4
					Numerical Methods Errors in numerical methods. Systems of linear equations (direct methods, iterative methods). Numerical interpolation. Numerical quadrature.	5
					Materials Strength I Elements of materials strength. Cross sections. Axial load. Bending load. Methodology of dimensioning and verifying beams. Torsion of beams having circular section. The stability of the elastic equilibrium (buckling).	4
					Fluid Mechanics Fluid statics. Basic equations of fluid mechanics. Dimensional analysis and similarity theory. Boundary layer theory. The flow through the pipes.	5
					Sports Consolidation of the main processes in football - boys and volleyball - girls, known from previous cycles. Settling in attack and defense game systems. Bilateral games. Development of the elements of coordinative capacity. Educate the general force on the upper, lower limbs, abdomen and trunk by the method of working in the circuit and by working on workshops.	1

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**BA**	**Hydrotechnical Improvements and Environmental Protection**	**2**	**2**	**English** Design. Drawings. Design Development. Design Solutions. Grammar in focus: Scale of likelihood. Measurement. Locating and setting out. Dimensional Accuracy. Numbers and Calculations. Measurable parameters. Grammar in focus: Subordinate clauses of result and purpose. Comparison of adjectives.	2
					Drawings and Infographics II AutoCAD - Overview. Basics for Drawing. Entering text into graphic files. Commands for multiplying objects. Dimensioning. Polylines. Editing commands. Advanced drawing commands. 3D drawing commands: nonprimitive. 3D drawing commands: primitive. 3D editing commands. Preparing technical product documentation.	4
					Environment Chemistry The object of environmental chemistry. The atmosphere as an environmental factor. Chemistry of the aquatic environment (hydrosphere). Soil chemistry. Chemical interactions at the soil-water-atmosphere interface.	4
					Materials Strength II Compound stresses. Stability of elastic beams (buckling of beams). Energy methods in the calculation of elastic deformations of beam structures. Static undeterminated systems of beams. Beam systems under dynamic loads.	4
					Hydraulics Hydrodynamics. The permanent and non-permanent movement of the currents with free surface. Uniform movement in channels. Gradually varied non-uniform movement. Quickly varied non-uniform movement. Downflows. Energy dissipators. Water storage. Hydro technical constructions. Groundwater movement.	3
					Risk Management and Disaster Management The concept of risk. Stages of the risk assessment process. Elements of disaster management. Hydrological disaster management. Planning for emergencies. Disaster risk prevention and management. Risk assessment methods.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**BA**	**Hydrotechnical Improvements and Environmental Protection**	**2**	**2**	**Elements of Electrochemistry and Corrosion** Corrosion processes. Chemical and electrochemical corrosion. Thermodynamics of metal corrosion in aqueous solutions. Kinetics of electrochemical corrosion. Factors that influence the rate of electrochemical corrosion. Corrosion investigation methods. Methods of corrosion protection of metallic materials. Methods for treating the corrosive environment. Corrosion inhibitors. Methods of coating the metal surfaces with anti-corrosion layers.	4
					Sports Consolidation of the main processes in football - boys and volleyball - girls, known from previous cycles. Settling in attack and defense game systems. Bilateral games. Development of the elements of coordinative capacity. Educate the general force on the upper, lower limbs, abdomen and trunk by the method of working in the circuit and by working on workshops.	1
					English Materials Technology. Material Types. Material Properties. Forming, working, and heat-treating metal. Grammar in focus: Countable and uncountable nouns. Adjectives and adverbs. Prepositions of place. Writing in focus: Description. Manufacturing and Assembly. 3D Component features. Interconnection. Grammar in focus: Quantifiers. Writing in focus: Definition and exemplification.	2
					Practical training Documentation and carrying out of practical work in the specialized laboratories - Galati Regional Environmental Agency, Wastewater treatment plant - APA CANAL SA Galati, Ecological waste dump Tirighina - Ecosal Public Service Galati, Barbosi Sorting and Composting Station, Department of environmental protection - Liberty Galati, SETCAR S.A. Braila, Environmental laboratories - Faculty of Engineering.	4
			3	**1**	**Instrumental analysis** Variables, Instruments and Measurements; Instrument structures: Sensors, amplifiers, analog/digital conversions, microprocessors; Instrumental analysis for thermodynamic variables: temperatures, pressures, and geometric quantities (volumes, levels, displacements, expansions/contractions, etc.).	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**BA**	**Hydrotechnical Improvements and Environmental Protection**	**3**	**1**	**Geographic information systems** Assessment of the consequences of geographic phenomena and processes on natural and anthropogenic systems and statistical and spatial analysis of data. The use of Geographic Information Systems (GIS) for the processing of information specific to geographic systems. Analysis of geographic components in investment feasibility studies.	5
					Technologies and equipments for water treatment and purification Knowledge of the mechanical, thermogasodynamic, chemical and biological processes in wastewater treatment plants, their operating and sizing conditions and their regulation principles in accordance with user requirements	5
					Hydrotechnical constructions Hydrotechnical constructions: dams, water supplies, dykes, industrial and drinking water purification and treatment plants, water bank reinforcement, diversions, galleries, water towers, boreholes and injections, etc.	5
					Ecological management The factors that stimulated the emergence of ecological management. The purpose, objectives and functions of ecological management. Ecological management tools (action, verification, analysis, economic-financial). ISO 14000 series of standards.	3
					Alternative energy sources Solar energy; wind energy; geothermal energy; hydropower; ocean energy; bioenergy.	4
					Management of environmental projects One of the best ways to manage the project environment is by following the project phases. A project has five phases: initiation, planning, execution, monitoring and control and close.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**BA**	**Hydrotechnical Improvements and Environmental Protection**	**3**	**2**	**Hydrotechnical arrangements and constructions** Hydrographic network and river system: power hydraulics and its use. Primary energy sources. The hydropower potential of watercourses. The characteristic parameters of the hydrographic basins. Hydrotechnical installations and constructions. Hydrotechnical calculation of constructions. Linear contour infiltration method. The hydrodynamic method. Infiltration velocities and flow rates.	4
					Remote sensing and atmospheric hazards Electromagnetic radiation; Principles of active remote sensing, LIDAR and RADAR systems; Principles of passive remote sensing. Radiometers, photometers; Satellites – types; Ground Remote Sensing; IR and UV remote sensing; Low and high atmosphere; Atmospheric effects.	4
					Acquisition, monitoring and diagnosis techniques of environmental quality environmental monitoring objectives; environmental monitoring scheme; related activities; what means to characterize the quality of the environment; the importance of the environmental monitoring activity; the structure of the monitoring systems – flow scheme and related activities; the necessary activities to undergo for the pollutants measurements from environmental samples.	4
					Technologies and equipments for water treatment and purification Disinfection - Processes and installations; Membrane filtration processes - Processes and equipment.	4
					Hydrotechnical constructions Hydrotechnical constructions include: dams, water supplies, dykes, industrial and drinking water purification and treatment plants, water bank reinforcement, diversions, galleries, water towers, boreholes and injections, etc.	3
					Specific Equipment to environmental engineering Description, operation and calculation of the main parameters of machines and installations in the field of environmental engineering.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	BA	Hydrotechnical Improvements and Environmental Protection	3	2	**Treatment of toxic and hazardous waste** Hazardous waste can be treated by chemical, thermal, biological, and physical methods. Chemical methods include ion exchange, precipitation, oxidation and reduction, and neutralization. Among thermal methods is high-temperature incineration, which not only can detoxify certain organic wastes but also can destroy them.	3
					Practical training Documentation and carrying out of practical work in the specialized laboratories - Galati Regional Environmental Agency, Wastewater treatment plant - company APA CANAL SA Galati, Ecological waste dump Tirighina - Ecosal Public Service Galati, Barbosi Sorting and Composting Station - Galati Ecosal Public Service, Department of environmental protection - ArcelorMittal Galati, SETCAR S.A. Braila, Environmental laboratories - Faculty of Engineering.	4
			4	1	**Environmental impact assessment** Environmental Impact Assessment (EIA) is a tool used to assess the significant effects of a project or development proposal on the environment. EIAs make sure that project decision makers think about the likely effects on the environment at the earliest possible time and aim to avoid, reduce or offset those effects.	5
					Legislative and technical regulations in environmental protection 1. Environmental Law - general framework of manifestation 2. Environmental Law as an autonomous branch of law 3. Legal Environmental Law Reports 4. The legal relations on protection of environment abiotic factors 5. The legal relations concerning the protection of natural resources and sustainable conservation of biodiversity Environmental protection in settlements Population and Environment 6. Pollution and Waste 7. Procedures regulating human and economic activities that have an impact on the environment. 8. Environmental law on chemicals, chemical products and waste of any kind 9. Environmental law on the protection of nuclear pollution 10. The legal liability in environmental Law Liability for environmental damages under Government 11. International environmental law	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**BA**	**Hydrotechnical Improvements and Environmental Protection**	**4**	**1**	**Regularization of rivers and dams** According to the analitical program, the discipline suggests the deepening of the theoretical and practical knowledges in the application of hydraulics, hydrology and hydrogeology in the works of watercourses regularization, the revaluation of these knowledges in engineering purposes, the knowing of designing, execution and exploitation of watercourses regularization, as well as the appreciation of the importance of these things and the evaluation of the material and financial effort regarding the rational use of the area, mentenance and uprising the potential of soil preservation, while under the conditions of environment protection.	5
					Treatment and recovery technologies of waste The contents of the course includes: i) Introduction to waste management, technology, economics, policy and regulation, ii) Generation and characterization of waste, iii) Life cycle assessment of waste systems, iv) Waste collection, iv) Waste minimization, material recycling and mechanical treatment, vi) Thermal treatment, vii) Biological treatment, viii) Landfilling, ix) Solution for selected waste types (e.g. hazardous waste, WEEE, plastic waste).	5
					Biotechnology The course is an introduction to environmental biotechnology and focuses on the utilization of microbial processes in waste and water treatment, and bioremediation. Topics included are microbial energy metabolism, microbial growth kinetics and elementary chemostat theory, relevant microbiological processes, microbial ecology, approaches for studying microbial communities, and basic principles in bioremediation and biological water and waste treatment.	4
					Communication Recognizing and Understanding Communication Styles; Verbal Communication; Nonverbal Communication; Communicating in Writing; Cultivating Conversational Skills; Group Communication; Communications Technology; Barriers to Communication; Disagreements and Conflicts; Negotiation.	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**BA**	**Hydrotechnical Improvements and Environmental Protection**	**4**	**1**	**Ecological warehouses** Exploitation of landfills; Requirements for the closure of hazardous waste storage facilities; Collection and treatment of leachate; Treatment, controlled combustion, utilization of deposit gas; Collecting water from covered surfaces.	4
				2	**Environment geomorphology** Knowledge of the fields of application of engineering geomorphology. Environmental management: lithosphere, hydrosphere, atmosphere and biosphere. Principles and methods of geomorphological analysis for the realization of a study for engineering works, for local and regional analysis and for environmental impact assessment. Knowledge of the main geomorphological hazards, and related risks, relating to different types of geomorphological environments and for the proper land management. The tools of applied geomorphology: geomorphological mapping applied to land management and geomorphological hazards. Examples of studies and applications of engineering geomorphology.	4
					The economy of the environment This course introduces you to economic perspectives on modern environmental issues. We will study economic theories related to natural resources, with an emphasis on the strengths and weaknesses of alternative viewpoints. You will learn that economic objectives do not necessarily conflict with environmental goals, and that markets can be harnessed to improve environmental quality. We will also discuss the limitations of economic analysis to provide policy guidance on environmental issues.	3
					Technologies and equipments for the treatment of polluted soils Treatment of contaminated soils by biological treatment, thermal desorption, solidification/stabilization, composting, and slurry bioreactor methods are discussed. Treatment methods for liquid wastes are briefly discussed. Several methods such as, biological and stabilization/solidification may be applicable for treating contaminated liquid wastes. Remedial actions performed at a contaminated site must comply with federal and state regulations.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**BA**	**Hydrotechnical Improvements and Environmental Protection**	**4**	**2**	**Hydroedilitar networks** Water supply systems; Sources and catchments of water; Adductions; Water storage; Distribution networks; Sewerage network for the collection of wastewater and meteoritic water.	3
					Databases and statistical processing Structure of Information Systems. Basics of IS planning. Statistical analysis of data. Numeric and linguistic data. Data clustering. Statistical models for data processing.	4
					Elaboration of the diploma project A Diploma Project is prepared by a final-year student, during the seventh and eighth semesters of study in accordance with the Programme of Studies of the Department.	4
					Practical training for the elaboration of the diploma project The main objective of the Final Degree Project is for the student to demonstrate the acquisition of the knowledge and skills acquired during their training.	2
					Sustainable development What is Sustainable Development? Economic Development – How We Measure It, How It Varies Around the World; A Short History of Economic Development; Why Did Some Countries Advance While Others Remained in Poverty?; Human Rights and Gender Equality; Education; Universal Health Coverage	3
					Integrated pollution prevention and control This course will give details on the various types of contaminants and the new frontiers in eliminating or minimizing these contaminants, effective non-hazardous products in your company, and environmentally acceptable disposal methods for both hazardous and non-hazardous wastes.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
MEDICAL ENGINEERING - BA						
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**1**	**Mathematical Analysis** Strings and series of real numbers. Convergence of strings and series of real numbers. Convergence criteria. Differential calculus. Differentiability of the real function of the real variable. Taylor's formula. Series of powers. Functions of several variables. Limit, continuity, derivability and differentiability for functions of several variables. Higher order partial derivatives. Free and bound extremes. Field theory elements (gradient, divergence, rotor). Integral calculation. Primitives. Methods of determining primitives. The definite integral. Improper integrals. Curvilinear integrals of type I and II. Curvilinear integrals independent of the road. Multiple integrals (double, triple, surface integral). Integral formulas. Differential equations. Differential equations of the first order: differential equations with separable, homogeneous, linear variables, Bernoulli, Riccati, Lagrange, Clairaut. Cauchy's problem. Linear differential equations of higher order..	5
					Chemistry I History of the development of chemistry. Basic notions. Classification of chemical substances. Aggregation states of matter. State transformations. The fundamental laws of chemistry. Elements of the structure of atoms. Atomic models. Atomic orbitals. Quantum numbers. Electronic layers. Electronic substrates. The periodic system of the elements. The law of periodicity and the properties of the elements. Rules for determining oxidation numbers. Electronic configurations of atoms. Chemical bonds. Ionic bond. Covalent bond. Coordinative link. Metal link. Intermolecular bonds. Dispersed systems. Classification of solutions. Laws of solutions. Suspensions. Colloidal systems. Types of chemical reactions. Acid-base reactions. pH indicators. Equilibria in salt solutions. Redox reactions. Types of redox reactions. Redox activity series. Galvanic cells. Electrolysis. Laws of electrolysis. Applications of electrolysis. Precipitation reactions. Complexation reactions. Hydrogen: natural state, production, physical and chemical properties, main combinations, uses. Metals: natural state, general methods of obtaining and purifying metals, general physical properties of metals, general chemical properties	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					of metals. Alloys. Group 1 and 2 (IA and IIA) of the periodic system. General characterization of elements and combinations. Natural state, production, physical and chemical properties, main combinations, uses. GROUP 13 and 14 (IIIA and IVA) of the periodic system. General characterization of elements and combinations. Aluminum, carbon and silicon: natural state, production, physical and chemical properties, main combinations, uses. GROUP 15 and 16 (VA and VIA) of the periodic system. General characterization of elements and combinations. Phosphorus, oxygen and sulphur: natural state, production, physical and chemical properties, main combinations, uses. GROUP 17 and 18 (VIIIA and VIIIA) of the periodic system. General characterization of elements and combinations. Chlorine: natural state, production, physical and chemical properties, main combinations, uses. Transitional metals: general characterization of elements and combinations. Natural state, production, physical and chemical properties, main combinations, uses. Notions of electrochemistry. Electrolysis. Electrolytic industrial processes. Battery. Accumulators. Fuel cells. Notions of corrosion. Corrosion testing and evaluation methods. Anticorrosive protection methods. Corrosion in different corrosive environments.	
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**1**	**Materials Science** Course content: Introductory concepts. Types of materials. The link between chemical composition-processing conditions-structure properties. Atomic architecture. Crystal structure, Crystal imperfections. Amorphous structure. Diffusion. Laws of diffusion; Solidification of metallic materials. Alloy systems. Phasic balance diagrams. The Fe-C alloy system. Phase transformations in the solid state. Thermal treatments. Non-ferrous alloys. Aluminum, copper and their alloys. Ceramic materials; Plastic materials. Composite materials. The content of the seminar or practical work: Metallographic Microscope. Researching the structure of materials through optical microscopy. Preparation of samples for optical microscope examination. Macroscopic analysis of metallic materials. Determination of non-metallic inclusions in steels. Quantitative structural determinations. Structural constituents in metallic materials. The Fe-	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					Fe3C system. Carbon steels and white cast irons. The Fe-graphite system. Gray cast iron. The structure of plastically deformed steels. The structure of heat-treated steels. The structure of thermochemically treated steels. Structure and properties of welded joints. The structure of alloy steels. The structure of non-ferrous alloys. Plastic materials, structure and properties. The structure of ceramic and composite materials.	
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**1**	**Physics** Classical mechanics. Kinematics (law of motion, trajectory, velocity, acceleration, types of rectilinear and circular motions, graphs of motions; Dynamics (forces: weight, elastic force, contact forces: normal reaction and frictional force, viscosity in fluids); Variation Theorems and conservation laws (mechanical work, kinetic and potential energy, momentum, collisions); Statics and fluid dynamics; Oscillations and elastic waves (Harmonic, damped, sustained oscillations, resonance, composition of parallel and perpendicular oscillations, elastic waves: plane wave equation , speed of wave propagation, notions of acoustics); Applications in Classical Mechanics Engineering. Thermodynamics, Molecular Physics and Heat Thermodynamic system, state of a thermodynamic system, state parameters, fundamental quantities of gases; Thermal agitation, temperature, thermal equilibrium; Pressure and units of measurement for its expression. Normal conditions. Applications; Fundamental formula of kinetic-molecular theory; Mechanical work in Thermodynamics, internal energy and heat; notions of Calorimetry; First Principle of Thermodynamics; Simple ideal gas transformations; The Second Principle of Thermodynamics. Thermal engines. Carnot cycle; Entropy, reversible and reversible processes, Clausius' (in)equality; The Third Principle of Thermodynamics. Engineering Applications of Thermodynamics and Molecular Physics and Heat Electricity and Magnetism. Electrostatics (Electric charge. Electric charge distributions; Electric field. Electric field intensity; Electric flux. Gauss's law in a vacuum; Electric energy, electric voltage, electric potential; Electric capacity. Capacitors); Electrokinetics (electric current: definition, classifications, characteristic quantities; electrical resistance. Ohm's law; electrical networks.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					Kirchhoff's laws; grouping of resistors; grouping of electric voltage generators/sources; increasing the measuring range for ammeter and voltmeter; electrical energy and power. the efficiency of an electric circuit. the maximum power transfer theorem; the effects of electric current); Notions of Magnetostatics (general characterization of the magnetic field. magnetic field lines; the magnetic field produced by the electric current – cases: linear conductor, coil, solenoid). Crystal structure. Classification. Crystal networks. Defects in the crystal structure. The energetic structure of crystalline solids. Dielectrics. Semiconductors. Conductors. Engineering Applications of Electricity and Magnetism. Introduction to Quantum Physics The external photoelectric effect. Planck's hypothesis. Corpuscular conception of light; The de Broglie relation. Electron Diffraction. Bragg's law. The electron microscope; Engineering applications of the external photoelectric effect and electron microscopy.	
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**1**	**Computer Aided Graphics** AutoCAD – Overview. Basic elements for drawing. Inserting texts into graphic files. Commands for multiplying objects. Quotation notions. Polylines. Editing commands. Advanced drawing commands. 3D drawing commands: nonprimitive. 3D drawing commands: primitives. 3D editing commands. Preparation of technical product documentation.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**1**	**English I** Introduction to the study of technical language. Production. Terminological aspects of the production process. Present Tense. Recapitulation of present tenses in English. Research and Development. Lexical aspects of engineering research and development. Past Tense. Recapitulation of past tenses in English. Research and Development. Lexical aspects of engineering research and development. Case study: abstract/summary scientific paper. Future Forms. English future forms (will, going to, about to, present tenses with future uses). Information Technology. Terminological aspects of computerized technology. Conditionals. Presentation of conditional forms in English. Information Technology. Lexical and terminological aspects of computer technology. Verb phrases. Introductory information on the use	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					of verbal expressions in specialized technical language. Logistics. Lexical-terminological aspects from the field of logistics. Active versus Passive. The use of the passive diathesis in specialized scientific language.	
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**1**	**Sports I** Presentation of a minimal theoretical content regarding the activity of physical education, carrying out the instruction for labor protection, presentation of the objectives and requirements of the discipline, supporting the initial tests. Repetition of the main procedures in football - boys and volleyball - girls, known from previous cycles. Settling in attack and defense game systems. Bilateral games. Development of reaction speed to auditory and visual stimuli. Repetition of the standing start and the launch from the start, development of movement speed through accelerations over variable distances of 20 - 60m. Educating dynamic strength in the upper and lower limbs, abdomen and trunk through the method of working in the circuit and through working in workshops. Evaluation with a grade through specific tests, of the level of development of movement speed and segmental muscle strength Evaluation with a grade through specific tests, of the level of resistance development and the degree of mastery of a sports game.	2
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**1**	**Professional Communication Techniques** Introductory notes on professional communication techniques. Professional communication techniques. Oral communication-transmission of information. Preparing and supporting a presentation/speech/scientific work. Types of interviews. The job interview. Written communication. Experimental study. How to make a presentation on areas of professional competence. Data collection and interpretation, free discussion. Formulation of the research report. The scientific report.	3
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**2**	**Linear Algebra, Analytic and Differential Geometry** Linear algebra. Vector spaces. Definition of vector spaces, properties, examples. Vector subspaces. Linear dependence of vector systems. Bases of a vector space. The coordinates of a vector in a basis. The basis change matrix. Linear applications. Definition of linear applications, properties, examples. The core and image of a	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					linear application. The matrix associated with a linear application. Vectors and eigenvalues of an endomorphism. The diagonal form of an endomorphism. III. Real Euclidean vector spaces. Orthogonality. The Gram-Schmidt orthogonalization procedure. Analytic geometry. Free vectors. Definitions. Notations. The vector space of free vectors. The scalar product of two vectors. The vector product of two vectors. Products of three vectors. The right and the plane in space. Equations of the line in space. Equations of the plane in space. Angles in space. Distances in space. Conics on reduced equations. Circle, ellipse, hyperbola, parabola (definition, equation, representation). The intersection between a straight line and a conic. Quadriceps on reduced equations. Sphere, ellipsoid, one-sheet hyperboloid, two-sheet hyperboloid, elliptic paraboloid, hyperbolic paraboloid Intersection of a quadric with a line or a plane. Differential geometry. Curves in space. Analytical definition of curves. The Frenet landmark associated with a curve in space. Frenet's formulas for a curve in space. Curvature and torsion of a curve in space. Surfaces. Analytical definition of surfaces. The tangent plane at a point of the surface. The normal to a surface. The first fundamental form of a surface. The second fundamental form of a surface. Main curves. Total curvature. Medium curvature.	
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**2**	**Chemistry II** Definition and object of organic chemistry, Classification of organic compounds: brief presentation. The composition of organic compounds, crude formulas and molecular formulas, the structure of organic compounds, the covalent bond in organic compounds, the quantum theory of covalence, hybridization. Properties of chemical bonds in organic compounds, factors that influence the electron density of the covalent bond, qualitative factors that influence the electron density of the covalent bond, reactions of organic compounds, classification of chemical reactions, isomerism of organic compounds. Alkanes, cycloalkanes: production, physical and chemical properties, identification methods, representatives and uses. Alkenes, dienes and polyenes, production, physical and chemical properties, identification methods, representatives and uses. Alkynes, arenes: production, physical and chemical properties, identification methods, representatives and uses.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					Halogenated compounds, alcohols: production, physical and chemical properties, identification methods, representatives and uses. Phenols, ethers: production, physical and chemical properties, identification methods, representatives and uses. Sulfur compounds, nitrogen compounds: production, physical and chemical properties, identification methods, representatives and uses. Carbonyl compounds (Aldehydes and ketones), Carboxylic acids: production, physical and chemical properties, identification methods, representatives and uses. Functional derivatives of carboxylic acids: production, physical and chemical properties, identification methods, representatives and uses. Fatty acids, glycerides: production, physical and chemical properties, identification methods, representatives and uses. Food dyes, medicines, pesticides: production, physical and chemical properties, identification methods, representatives and uses. Macromolecular compounds: production, physical and chemical properties, identification methods, representatives and uses	
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**2**	**Biophysics** Biomechanics of the muscular system. Biophysics of the Rigid Solid. Fluid Mechanics. Molecular phenomena in liquids. Elements of hemodynamics. Biophysics of dispersed systems. Sound waves. Sound techniques and methods used in Medicine. Electromagnetism. The radiations. Elements of photobiology. Elements of Radiobiology. The physical basis of medical imaging. Materials with medical applications.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**2**	**Computer Programming and Programming Languages** Introductory concepts. Data, operators and expressions. Control structures. Paintings. Pointers. Functions. User-defined data types. The preprocessor. The standard library.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**2**	**Medicine Elements for Engineering** Anatomical terms and plans. Terminology of body segment movements. Medical terminology. Glossary of medical terms. Epithelial tissues. Definition, classification according to structure and function. Connective tissues. General description, classification, functions. Muscle tissue. Definition, classification, function. Nervous tissue. Definition, structure, function. Physiology of the cardiovascular system	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					Physiology of the respiratory system. Physiology of the nervous system. Physiology - the excretory system. Physiology of the muscular system. Physiology of the digestive system. Cell, DNA, atoms	
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**2**	**Concepts of Mechanical Engineering** Recapitulatory notions regarding operations with vectors, principles and axioms of mechanics. Theory of moments: Moment of force in relation to a point and an axis; Central axis reduction cases; Reduction of particular force systems; Center of parallel forces. Static moments and centers of gravity, Guldin's theorems. Equilibrium of the rigid subject to ideal links, types of links. Methods and theorems in the statics of material systems: The element isolation method; Solidification method; The method of isolating parts. Lattice beams. Friction in technique: Sliding friction; Rolling friction; Pivoting friction; Friction in joints and bearings. Statics of wires: General equation of wires; Friction of threads. Technical applications of statics: Lever and inclined plane; Pulleys and pulley systems; Even the screw; Band brake and shoe brake. Kinematics of the point: Coordinate systems; Speed and acceleration; Particular movements of the point.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**2**	**English II** Quality Control. Lexical-terminological aspects in the field of quality control in production. Obligations and Requirements. Introductory notions about the lexical-grammatical means of expressing the obligation. Health and Safety. Lexical-terminological aspects regarding safety at work. Ability and Inability. Relative Clauses. Introductory notions regarding the lexical-grammatical means to express the ability. Relative clauses. Engineering 1. Lexical-terminological aspects from the technical field (general). Countable and uncountable nouns. Notions about the peculiarities of countable and uncountable nouns. Agreement with the predicate. Irregular plural forms for scientific nouns. Engineering 2. Lexical elements specific to the engineering field. Adjectives and adverbs. The use of adjectives and adverbs in specialized language. Degrees of comparison. Engineering 3. Lexical-terminological elements specific to medical engineering. Prepositions and conjunctions. The use of prepositions and conjunctions in specialized technical	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					language. Medicines. Lexical-terminological elements from the medical field. Revision - grammar/ Recap lesson grammatical notions. Revision - vocabulary. Recap lesson lexical-terminological notions. Presentation of glossary of specialized terms.	
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**2**	**Sports II** Presentation of a minimal theoretical content regarding the activity of physical education, carrying out the instruction for labor protection, presentation of the objectives and requirements of the discipline, supporting the initial tests. Presentation of the topic covered in the semester. Readaptation to effort. Sports Games. Consolidation of the main elements and technical procedures specific to sports games. Their repetition in adverse conditions, in a bilateral game. Development of the elements of coordinative capacity - rhythm, precision, static and dynamic balance, spatio-temporal orientation, combination of movements, kinesthetic discrimination, ambidexterity, agility. Training of aerobic and mixed resistance through the method of uniform and variable efforts. Evaluation with grade through specific tests, of the level of development of resistance and the degree of mastery of a sports game.	2
Applied Engineering Science	**BA**	**Medical Engineering**	**1**	**2**	**Advanced digital skills** Introduction. Hardware and software basics. Presentation of the Microsoft Office software package. Presentation of the Microsoft Word program. Editing text in Microsoft Word. Font Format, Paragraph Format. Working with text styles. Working with tables. Inserting objects into documents (images, graphics). Changing the format of the document, working with headers and footers. Presentation of the Microsoft Excel program. Working with spreadsheets, working with rows and columns, data types and formatting, editing and deleting information, facilities for entering information, sorting data, merging and fitting data into cells, essential formulas and functions, basic math formulas, standard errors of formula output, using comparison operators, creating a chart, chart elements - adding, selecting, removing. Basic operations in Microsoft PowerPoint - creating presentations with text and images. Alternative for presentations (Prezi). Types of digital platforms.	1

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					Web forums and newsgroups. Functional aspects of websites. Institutional sites Internet search strategies.	
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**1**	**Numerical Methods** Errors in numerical methods. Introduction. Truncation errors. Representation of numbers in the computer. Rounding errors. Systems of linear equations. Direct methods. Introduction. Gauss elimination and Gauss-Jordan elimination. Standard Gaussian pivoting and elimination. Matrix operations. The inverse of a matrix. The determinant of a matrix. Particular matrices. Iterative methods. Introduction. Vector and matrix norms. The Jacobi method and the Gauss-Seidel method. Relaxation methods. Numerical interpolation. Introduction. Lagrange interpolation formula. Newton interpolation formulas through equidistant nodes. Analysis of polynomial interpolation. Cubic spline functions. Numerical quadrature. Introduction. The rectangle rule and the trapezoid rule. The Simpsons Rules. Newton – Cotes quadrature formulas. Gauss quadrature.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**1**	**Biomaterials** Biomaterials - Introductory notions: definitions, history, evolution and dynamics of biomaterial development Basic theoretical elements in the elaboration/obtaining, processing and characterization of biomaterials. Basic structures of biomaterials/ Types of chemical bonds. Crystalline structure/Solidification of metals and alloys. Basic notions of polymer chemistry/Polymer formation reactions/Polymer structure. Diffusion in sintering processes. Surface phenomena and adhesion. Biocompatibility and biofunctionality. General properties of biomaterials. Classes of biomaterials, comparative analysis of properties through the prism of advantages and disadvantages in applications and uses. Metallic materials used as biomaterials. The influence of metal biomaterials on the biological environment (metal toxicity, release of metal ions in tissues, tissue reactions, sensitization and allergies). The influence of the biological environment on metallic biomaterials (matting, corrosion, wear...). Metals and alloys used in restorative dentistry. Metals and alloys used in implantology. Metals and alloys used in orthodontics. Metallic biomaterials used in orthopedics. Performances and limits in the use of metallic biomaterials.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					Polymeric biomaterials. Obtaining and characterization of polymers used as biomaterials. The relationship between composition-processing conditions-structure-properties. The main physical (thermal conductivity, electrical resistivity, coefficient of thermal expansion, volumetric mass) and mechanical properties. Polymeric materials used as implants. Ceramic biomaterials. Obtaining, processing of ceramic biomaterials/Controlling the properties of bioceramics through processing. Inert ceramic biomaterials. Bioactive ceramic biomaterials. Resorbable ceramic biomaterials. Carbon-based biomaterials. Ceramic biomaterials used in bone replacement. Composite biomaterials/Biocomposites. Compatibility criteria of matrix-reinforcement material systems. Biocomposites with metallic matrix. Biocomposites with polymer matrix. Ceramic/ceramic biocomposites. Peculiarities of polymer biocomposites with micro and nano type additions. Intelligent biomaterials and tissue engineering techniques. Optimal design and advanced surface processing to improve implant biointegration	
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**1**	**Biomechanics** Introduction to biomechanics Notions of vector calculation. The force vector in the biomechanical system. The moment of a force and the torque of forces. The structure and configuration of the biomechanical system. Statics of the biomechanical system. Kinematics of the biomechanical system. Anthropometry. Muscular system	5
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**1**	**Materials Strength** Elements of material resistance. Equivalence relationships between efforts and stresses. Efforts in straight bars (definitions, differential relations, effort diagrams, use of symmetry and antisymmetry of external forces). Stresses in curved bars and bar systems. Transverse sections. Centers of gravity of plane areas. Centers of gravity of compound areas. Moments of inertia of plane areas. The variation of the moments of inertia when rotating the axes. Polar plane moments of inertia. Centrifugal moments of inertia. Main axes and main moments of inertia. Axial demand. Axial stresses. Allowable voltages. Safety coefficients. Calculation relations for axially loaded bars. Statically indeterminate axially loaded systems. Bending	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					request. Normal stresses in pure bending of straight bars (Navier's formula). Tangential stresses when bending straight bars (Juravski's formula). Principal stresses in simple bending of straight bars. Deformations of straight bars required for bending (differential equation of the deformed average fiber, integration of the differential equation of the bending of straight bars). Methodology for dimensioning / verification of bars Synthesis of procedures for dimensioning a beam. Calculation of displacements of a beam (method of parameters at the origin). Torsion of bars with circular section Generalities. Torque diagrams. Stresses and strains in pure shear. Relationships between the elasticity modules E and G. The stability of the elastic equilibrium. Buckling - concepts, definitions. Buckling in the elastic domain (establishment of the differential equation and its integration, boundary conditions, Euler's formula, fundamental cases of buckling. Elasto-plastic buckling (Tetmajer-Iasinski's law and Johnson's parabola). Calculations for verification of straight bars in buckling.	
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**1**	**English III** Design. Drawings. Design Development. Design Solutions. Grammar in focus: Scale of likelihood. Measurement. Locating and setting out. Dimensional Accuracy. Grammar in focus: Subordinate clauses of result and purpose. Measurement. Numbers and Calculations. Measurable parameters. Grammar in focus: Comparison of adjectives. Assessment test.	2
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**1**	**Sports III** Presentation of a minimal theoretical content regarding the activity of physical education, carrying out the instruction for labor protection, presentation of the objectives and requirements of the discipline, supporting the initial tests. Consolidation of the main procedures in football - boys and volleyball - girls, known from previous cycles. Settling in attack and defense game systems. Bilateral games. Development of the elements of coordinative capacity - rhythm, precision, combination of movements, ambidexterity, agility. Education of general strength at the level of the upper and lower limbs, the abdomen and the trunk through the method of working in the circuit and through working in workshops. Graded	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					evaluation through specific tests, of the level of development of movement speed and segmental muscle strength.	
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**1**	**Devices for laboratory tests** Introduction. Means of measurement. Methods of measurement. Signals. Static characteristics of measuring instruments. Dynamic features. Errors in measurement systems. The structure of the means of measurement. Data acquisition systems. Measurement information retrieval systems. Measurement information processing systems. Measurement information display systems. The content of the seminar or the practical works: Study of the signals of the means of measurement. The study of disturbances in a measurement process. Introduction to virtual instrumentation. Functions for numerical calculation. Graphic representations. Signal generation and filtering. Data acquisitions.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**1**	**Renewable sources** Current and perspective situation of energy sources. The potential of renewable energy resources. Solar energy. Characteristics of solar energy. Thermal analysis of solar collectors. Applications of solar collectors. Photovoltaic systems. Biomass. Biomass resources. Potential and availability. Conversion of biomass into energy. Wind energy. The theoretical potential. Design and execution of wind turbines with horizontal and vertical axis. Uses of wind energy. Hydraulic power. The hydropower potential. Geothermal energy. Exploitation of geothermal resources. Use of geothermal resources. Hybrid thermal and electrical energy production systems.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**2**	**Electrotechnics** Introduction of electrical and magnetic quantities. Electric and magnetic states (electrostatic field in vacuum and substance, electrokinetic state, magnetic field in vacuum and substance) Laws and theorems of the electromagnetic field. Direct current circuits. Theorems. Direct current circuits. Methods of analysis. Alternating current circuits. Symbolic calculus. Single-phase alternating current circuits. Analysis methods Three-phase alternating current circuits. Methods of analysis. Measurement of electrical and magnetic quantities. Measurement of non-electric quantities. The electrical transformer. Classification. Symbolization. Operating	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					principle. Equivalent scheme. Characteristics. Applications. Asynchronous machine. Classification. Symbolization. Operating principle. Equivalent scheme. Characteristics. Speed regulation methods. Applications. Synchronous machine. Classification. Symbolization. Operating principle. Equivalent scheme. Characteristics. Energy regimes. Voltage and power regulation. Applications. Elements of electric actuators. The fundamental equation. Type services. Low voltage electrical appliances. Elements of electric actuators. The choice of electric motors. Order schemes.	
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**2**	**Basics of Technical Thermodynamics** General notions of thermodynamics. Historic. Thermodynamic system. State of thermodynamic equilibrium. State sizes. The postulates of thermodynamics. Temperature and pressure. The first principle of thermodynamics. Internal energy. Mechanical work. The heat. Enthalpy. Formulations of the first principle of thermodynamics. The first principle of thermodynamics for closed systems. The first principle of thermodynamics for open systems. Perfect gases: perfect gas laws, caloric equations for perfect gases, perfect gas mixtures, simple thermodynamic state transformations of perfect gases. The second principle of thermodynamics: reversible and irreversible processes, thermodynamic cycles, cyclic processes, the reversible Carnot cycle. Entropy of perfect gases, T-S diagram, entropy variation in irreversible processes. Vapors. Simple vapor transformations. Humid air. Simple transformations of moist air. Combustion of solid, liquid and gaseous fuels. Cycles of machines and thermal installations: compressors and fans; gas turbine installations; refrigeration installations; heat pumps. Introductory notes on heat transfer phenomena. The fundamental heat transfer processes.	3
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**2**	**Specific Processes for Biomaterials Casting** Definition and classification of metallic biomaterials. Brief history regarding the evolution of the use of metals in medicine. Classification of metallic materials used in medicine. Properties of metallic biomaterials. Technologies for obtaining metallic biomaterials. Stainless steels. Definitions and classifications. Technological principles of elaboration, casting and processing. Titanium and titanium-based	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					alloys. General characterization. The influence of some alloying elements on the properties of titanium. Titanium-based alloys. Titanium compounds and titanium-based alloys used as biomaterials. Elaboration and casting of titanium and its alloys. Cobalt and its alloys. General properties of cobalt. Cobalt alloys for medical use. Principles of elaboration, casting and processing of cobalt-based alloys. Noble metals and alloys. General characterization. Gold and its alloys. Colloidal gold. Platinum and platinum metals. Silver and its alloys. Noble casting alloys. Malleable noble alloys processed by plastic deformation. Noble bonding alloys for dental work. Elaboration, casting and processing of noble metals and alloys. Metallic materials used as electrodes and electronic components. Metallic materials used in dental implantology. Metal materials used for dental prostheses.	
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**2**	**Electronics** Electronic circuit devices. Notions regarding electrical conduction in semiconductors. Electronic components: Diodes, Bipolar transistors, Unipolar transistors, Special semiconductor devices. Amplifiers and oscillators. General properties and characteristics of amplifiers. Alternating current amplifiers (voltage amplifiers, power amplifiers). DC amplifiers. Negative reaction to amplifiers and its consequences. Operational amplifiers. Oscillators. Uncontrolled low power rectifiers. Unordered single-phase rectifiers. Single-phase monoalternation rectifiers with resistive load. 3.3. Double alternating single-phase rectifiers with resistive load. 3.4. Rectified voltage filtering. Three-phase rectifiers. Electronic stabilizers. Stabilizer parameters. Parametric stabilizers. Reaction stabilizers. Integrated voltage stabilizers. Low power controlled rectifiers. The principle of vertical and horizontal order. Specialized circuits for grid control of thyristors. Combinational and sequential logic circuits. Elementary logical functions. Fundamental relations in the algebra of logic. Logic circuits. Integrated logic circuits. Combinational logic circuits. Elementary sequential logic circuits. Applications of combinational and sequential logic circuits. Encoders and decoders. Electronic counters. Digital-Analog converters. Analog-Digital Converters. Memory circuits. The structure of a microprocessor and a microcomputer.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**2**	**Applied Informatics** Introductory notions specific to computer-aided design. CAD concept. Defining. Terminology and principles of computer-aided design. Basics of parametric design with Autodesk Inventor. Specific file formats in Inventor. Sketch - drawing up sketches through specific operations. Establishing geometric and dimensional constraints. Modification of sketches by using the commands: Fillet, Chamfer, Trim, Extend, Offset, Copy, Rotate. Features - 3D modeling of solids in Inventor. Obtaining solid models through the extrusion operation. Ways of editing the pieces. Obtaining solid models of revolution obtained by rotating the profile nui around an axis, command Revolve. Obtaining solid models obtained by translating a profile along a path, Sweep type bodies. Obtaining solid models obtained by translating a profile along a path, Loft type bodies. Modifying solid models through specific operations: Hole, Thread, Fillet, Chamfer, Shell, Draft. Creation of auxiliary elements – Work Features. Making simple assemblies by imposing assembly constraints. Editing of patches within the ensemble. Making sheet metal parts in Inventor. Activating the specific module, specific modeling tools, getting the deployment. Realization of assemblies from profiles. Exploded view of assemblies. Animate the presentation of an assembly. Creation of assembly drawings and execution drawings. Views, projections, getting details, creating broken views. Organization of views - alignment, editing, visibility.	3
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**2**	**Phase Structure and Structural Imaging of Biocompatible Materials** Techniques and equipment for the imaging study of biocompatible materials. Techniques and principles of operation of optical microscopy equipment. Fundamentals of scanning electron microscopy. Transmission electron microscopy - principles and equipment. Imaging phases and structural constituents of iron-based metallic biomaterials. Phase diagrams. Structural transformations. Phases and constituents. Analysis by optical microscopy, SEM, TEM, XRD. Interpretation of mirostructures. Imaging of phases and structural constituents of cobalt-based metallic biomaterials. Phase diagrams. Structural transformations. Phases and constituents. Analysis by optical microscopy, SEM, TEM, XRD. Interpretation of	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					mirostructures. Phase imaging and structural constituents of titanium-based metallic biomaterials. Phase diagrams. Structural transformations. Phases and constituents. Analysis by optical microscopy, SEM, TEM, XRD. Interpretation of mirostructures. Phase and structural constituent imaging of zirconium-based and precious metal biomaterials. Phase diagrams. Structural transformations. Phases and constituents. Analysis by optical microscopy, SEM, TEM, XRD. Interpretation of mirostructures. Imaging of phases and structural constituents of cast alloys for dentistry. Aluminum bronzes. Phase diagrams. Structural transformations. Phases and constituents in cast aluminum bronzes. Analysis by optical microscopy, SEM, TEM, XRD. Interpretation of mirostructures. Imaging of phases and structural constituents of metallic biomaterials with shape memory. Phase diagrams. Structural transformations. Phases and constituents. Analysis by optical microscopy, SEM, TEM, XRD. Interpretation of mirostructures. Notions of structural imaging of biocompatible ceramic materials. Phase diagrams. Structural transformations. Phases and constituents. Analysis by optical microscopy, SEM, TEM, XRD. Interpretation of mirostructures. Concepts of structural imaging of polymeric biocompatible materials. Phase diagrams. Structural transformations. Phases and constituents. Analysis by optical microscopy, SEM, TEM, XRD. Interpretation of mirostructures.	
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**2**	**English IV** Materials Technology. Material Types. Material Properties. Grammar in focus: Countable and uncountable nouns. Adjectives and adverbs. Materials Technology. Material Properties 2. Forming, working, and heat-treating metal. Grammar in focus: Prepositions of place. Writing in focus: Description. Manufacturing and Assembly. 3D Component features. Interconnection. Grammar in focus: Quantifiers. Writing in focus: Definition and exemplification. Assessment test.	2
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**2**	**Sports IV** Presentation of a minimal theoretical content regarding the activity of physical education, carrying out the training for labor protection, presentation of the objectives and requirements of the discipline, supporting the initial tests.	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					Consolidation of the main procedures in football - boys and volleyball - girls, known from previous cycles. Settling in attack and defense game systems. Bilateral games. Development of the elements of coordinative capacity - rhythm, precision, combination of movements, ambidexterity, agility. Education of general strength at the level of the upper and lower limbs, the abdomen and the trunk through the method of working in the circuit and through working in workshops. Graded evaluation through specific tests, of the level of development of movement speed and segmental muscle strength.	
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**2**	**Practical training** General training on labor protection. Knowledge of the operating principles and main components of laboratory devices and equipment. The design, construction, maintenance and reliability assurance of medical devices and systems for insurance, investigation, recovery and intervention. Management of medical engineering systems and action skills in a social context for the promotion and exploitation of biomedical systems. Monitoring the operation of computerized systems for monitoring patients during surgery or intensive care. Modern investigation methods: electron microscopy, DTA analysis (derivatograph), diffractometric analysis (DRON 2, DRON 3). Designing and developing strategies for decision-making based on expert systems and artificial intelligence, such as computerized systems for assisting people with severe pathologies.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**2**	**2**	**Physical chemistry** The subject of physical chemistry. Concepts and notions used in physical chemistry. Chemical kinetics. General aspects (Kinetic parameters. Classification of reactions according to kinetic, Ways of expressing reaction speed). Formal kinetics of simple elementary reactions and complex reactions. The influence of temperature and pressure on the rate of reactants. Theories on reaction rates. Elements of electrochemistry. Equilibrium phenomena in electrolyte solutions (Electrolytic Dissociation, Ionic Theory, Debye-Huckel Theory). Transport phenomena in electrolyte solutions (Transport numbers. Electrical conductivity). Phenomena at the metal/electrolyte interface (Electric double layer, Electrode potential, Nernst	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					equation); Galvanic cells (General aspects. Classification. Thermodynamics of galvanic cells. Electrochemical processes generating electric current/electrochemical cells). Thermodynamics: First principle of thermodynamics. The heat. The thing. Internal energy. Enthalpy. Caloric capacity at constant volume or constant pressure. The Robert Mayer Relationship. Applications of the first law of thermodynamics to isochoric, isobaric, isothermal and adiabatic processes. Thermal effects of phase transformations. Thermochemistry. Hess's law. Calculation of the standard enthalpy of reaction using the standard enthalpies of formation, combustion, dissociation of chemical bonds and by the process combination method. Dependence of reaction enthalpy on temperature. Kirchhoff's law. The second principle of thermodynamics. Entropy. Dependence of entropy on state parameters. The third principle of thermodynamics. Absolute entropy. Entropy of reaction. Standard reaction entropy. Dependence of reaction entropy on temperature. Thermodynamic potentials. Gibbs energy. Gibbs energy of reaction. Standard Gibbs energy of reaction. Dependence of Gibbs energy of reaction on temperature. Chemical potential. Dependence of chemical potential on pressure. Standard condition.	
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**1**	**Specific plastic deformation processes of biomaterials** Elements of plasticity theory. Stresses and deformations. State of stress at a point of the body subjected to deformation. Tensor and tension deviator. Principal normal stresses. Octahedral stresses. State of plane stress. State of stress diagrams. Schemes of the state of deformation. Laws of plastic deformation. Law of constant volume. The law of minimum resistance. The law of the presence of elastic deformations during plastic deformation. The law of emergence and balancing of internal tensions. The law of similitude. Limit states - hypotheses of plasticity. Deformation behavior of metallic biomaterials. Classification of biomaterials according to the nature of the deformation behavior. Definition and indicators of deformation behavior. The crystal structure of deformable metallic biomaterials. Deformation of the ideal single crystal. Mechanisms of deformation of the ideal single crystal. The critical shear stress for the ideal single crystal. Deformation of the	6

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					real single crystal. Imperfections in crystals. Linear defects. Dislocations. Surface defects. Biomaterial lamination technology. General notions. Semi-finished products and rolled products. Preparation of semi-finished products for lamination. Control and cleaning of semi-finished products. Heating of semi-finished products for lamination. Cooling of rolled products. The theoretical basis of rolling with longitudinal feed. Geometrical elements of the rolling deformation zone. Forces in the rolling deformation zone. The grip condition. Lamination expansion. Lamination advance and delay. Determination of rolling force. Calculation of moment and power during lamination. Lamination cycle. Moment variation diagram. Elements of construction and operation of rolling mills. Construction and operation of the rolling mill. Classification of rolling mills. Notions of calibration. The geometric elements of a gauge. Calibration systems. Principles of gauge calculation. The technological process of lamination. General aspects regarding the manufacturing technology of laminated products. Technology of forging biomaterials. General notions. Semi-finished products intended for forging. Forgeable materials and types of semi-finished products. Reception and preparation of semi-finished products for forging. Free forging operations. Rejection. The non-uniformity of the deformation during compression. Establishing the push-out force. Choice of push-out deformation equipment. Discharge tools. Stretching by forging. Variants of stretching by forging. The degree of deformation during stretching. The bark. Establishing the number of passes. The dimensions of the semi-finished product when stretched. Deformation non-uniformity. Force and energy of deformation during stretching by forging. The choice of the machine for stretching by forging. Number of strokes and forging time. Technological recommendations for stretching by forging. Drilling by forging. State of stress and deformation during drilling. Drilling force calculation. Bending by forging. Bending stresses and deformations. The minimum bending radius. The moment of internal efforts at bending. Determination of the bending force. Forging cutting. Principles for force calculation during the cutting operation. Machines for free forging. Tools, devices and auxiliary equipment. Mold forging of biomaterials. Introductory notions. Molding principle.	

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					Molding classification. Mold structure elements. Notions of molding theory. Determining the dimensions of the burr channel threshold. Determining the molding force Resistance to deformation during forging in the mold. Molding machines and equipment. Hammers and molding presses. Special molding machines and equipment. Forms and dimensions of the molding places. Severe plastic deformation. Methods of severe plastic deformation. The influence of SPD on the structure and properties. Biomaterials extrusion technology. Notions of the theory of extrusion. The state of stresses and deformation during extrusion. Establishing the force during extrusion. Extrusion equipment and machinery. The active elements of extrusion devices. Extrusion machines. The technological process of extrusion. Hot extrusion of profiles. Obtaining parts by cold extrusion. The technology of drawing and drawing biomaterials. Drawing-drawing tools. Semi-finished products and drawn and drawn products. Drawing and drawing machines. The technological process of drawing and drawing. Defects of drawn and drawn products. Severe plastic deformation of biomaterials. Severe plastic deformation by torsion at high pressure. HPT and HSHPT processes. Extrusion through angular channel with constant section. Repeated lamination in the package	
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**1**	**Mechanisms and elements of fine mechanics** Introduction. Definitions. The structure and configuration of planar mechanisms. Kinematic element. Kinematic coupling. Kinematic chain. Mechanisms. Analysis of the configuration and kinematics of the mechanisms. Connection vector equations for configuration, velocities and accelerations. Spatial mechanisms (examples). Analysis of forces in mechanisms. Motor, resistant, external, internal, variable, inertia loads Determination of the reactions from the kinematic couplings of the mechanisms. Dynamics of mechanisms. Movement phases. Equations of motion. Energy balance. Uniformization of the angular speed with the help of the flywheel. Balancing mechanisms and machines. Balancing rotors in practice. Static balancing of planar mechanisms. Balancing polycylindrical piston machines. Optimal Balancing Synthesis of mechanisms with lower torques. Structural synthesis. Synthesis of the configuration for achieving imposed positions and for achieving an	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					imposed trajectory. Kinematic synthesis of the quadrilateral mechanism with continuous motion. Gear mechanisms. Axoids of movement. Kinematics of gear mechanisms. Planetary mechanisms. Geometry of spur gears. Concurrent shaft gears. Gears with crossed axes. Worm gears worm wheel. Cam mechanisms. Structure and classification of cam mechanisms. Laws of motion for cleats. Pressure angle and transmission angle. Structural, positional and kinematic analysis of cam mechanisms.	
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**1**	**Biochemistry** Introduction to the study of biochemistry. The molecular and macromolecular organization of the animal organism. Carbohydrates. General characterization. Structure, isomerism, properties and biochemical role. Oligosaccharides and polysaccharides. Structure and biochemical role. Lipids. General characterization. Fatty acids and alcohols. Properties and biochemical role. Sterols. Bile acids. Simple lipids. Complex lipids. Proteins. General characterization and biochemical role. Amino acids. Peptides. Protein structure. Properties of proteins. Physical properties, physico-chemical properties. Chemical properties. Biochemical properties. Nucleic acids. The structure of DNA and RNA. Enzymes. General characterization. Mechanism of enzymatic reactions. Enzyme inhibitors. Regulation of enzymatic reactions. Classification of enzymes. Vitamins - hydro and fat soluble. Water-soluble vitamins: vitamins involved in energy generation (B1, B2, biotin, lipoic acid, PP), vitamins involved in erythropoiesis (B12, folic acid), vitamin B6, ascorbic acid. Fat-soluble vitamins: vitamin A, vitamin D, vitamin E, vitamin K). Hormones. Definition, classification. Mechanism of action. Hypothalamic and pituitary hormones. Neurohypophyseal hormones. Pancreatic hormones. Thyroid hormones. Sex hormones. Adrenal hormones. Carbohydrate metabolism: digestion, absorption, glycolysis, Krebs cycle, oxidative phosphorylation, glycogen metabolism, disorders of carbohydrate metabolism. Lipid metabolism: digestion, absorption, degradation of fatty acids, cholesterol metabolism, lipoproteins. Protein metabolism: digestion, absorption, ammonia metabolism, urea biosynthesis, hemoglobin, bilirubin.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**1**	**Dynamics of polyphase fluids** Elements of kinematics and fluid dynamics. Elements of hydrodynamics. Cohesion and adhesion in liquids: surface tension and capillary action. Flow rate and its relationship to speed. Bernoulli's equation. Viscosity and laminar flow; Poiseuille's law. The motion of an object in a viscous fluid. Fluid pressures in the body. Elements of hemodynamics. Fluid dynamics in bifurcations. Fluid dynamics in large blood vessels. Analysis of blood flow in the carotid artery. Molecular transport phenomena: diffusion, osmosis and related processes.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**1**	**Unconventional techniques in medicine** Generalities. Alternative and complementary medicine. Allopathic medicine. Holistic, alternative medicine. unconventional procedures in radiation medicine. Radiology in medicine. Radiographic diagnosis of human body conditions (diascopy, radiography, angiography, bronchography). The use of radiation in human treatment. Unconventional procedures in ultrasound medicine. General notions about ultrasound. High-intensity ultrasound. The piezoelectric generator. Assembly in resonance. The magnetostrictive ultrasound generator. Medical applications of ultrasound. Non-conventional procedures in laser medicine. The principle of laser operation. The characteristics of the laser beam. Types of lasers used in medicine. Medical applications of the laser. Unconventional procedures in medicine with the 3D printer. Brief history of 3D printing. Stages in 3D printing. Types of 3D printing procedures. 3D printing in the medical field. Dental 3D printing. 3D printer for prostheses. The 3D printer for human organs. Unconventional procedures in medicine of medical robots. Basic concepts. Structure of medical robots. Minimally invasive surgery. Transluminal endoscopic surgery through natural openings (NOTES). Tele-surgery. Ethics in robotic surgery.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**1**	**Biological systems** Introduction to biological systems. Classification and characterization of biological systems. Notions of cell biology, molecular biology, macromolecules and cells. Experimental models in biological systems. Regulation and regulatory networks in biological systems. Transport phenomena in biological systems. Water in biological	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					systems. Biochemical kinetics. Enzyme kinetics. Metabolism. Metabolic networks. Introductory Bioinformatics. Basic concepts in mathematical modeling of biological systems. Modeling physiological systems: the circulatory system model. Modeling physiological systems: the respiratory system model. Modeling complex biological systems. Genomics and Proteomics	
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**1**	**Biocompatibility** Biocompatibility - Science of biomaterials. Definitions of biocompatibility of biomaterials. Economic implications and the importance of biocompatibility. Regulations and standards. Concepts regarding biocompatibility assessment. In - vitro and In - vivo. Requirements in the properties of biomaterials. The factors that influence the biological response of an implanted biomaterial. Physico-chemical characterization of materials for bomedical devices. Biocompatibility - surface phenomenon of biomaterials. Fundamental notions of the atomic and electronic structure of surfaces. Properties of surfaces. Formation of the biomaterial (implant) and tissue (biological fluid) interface in the human body. Properties of the interface implant/environment in the human body. In vitro evaluation of biocompatibility through the electrochemical behavior of biomaterials in biological fluids. Introduction to the corrosion of biomaterials. Types of corrosion of biomaterials: general, localized, pitting, tribocorrosion, biocorrosion. The impact of the contact angle and the free energy of the surface of biomaterials on biocompatibility. Biocompatibility of dental biomaterials and other implants (orthopedics, stents, etc.). Methods of in-vitro electrochemical evaluation of the behavior of biomaterials in fluids biological: linear and potentiodynamic polarization, polarization resistance, electrochemical impedance spectroscopy Strategies and potential risks in implant innovation through new biomaterials and nanomaterials.	3
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**2**	**Engineering of metallic biomaterials** Introduction to the engineering of metallic biomaterials. The choice of biomaterials. Classification of metallic biomaterials. Factors affecting the properties of biomaterials. The structure of metallic biomaterials. Crystal structures. Types of crystalline structures specific to metallic biomaterials. Structural imperfections	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					Deformation in metallic crystals. Deformation of polycrystalline aggregates. Amorphous structures. General properties of metallic biomaterials. Physical properties. The density. Thermal expansion. Melting properties. Specific heat and thermal conductivity. Diffusion. Resistivity and conductivity. Electrochemical processes. Mechanical properties of materials. Strength and plasticity. Variation of conventional stress R with specific strain e. Elongation at break. Cooking to bursting. The hardness. Metallic biomaterials from iron-based alloys. Austenitic stainless steels. Smart and nanostructured iron-based alloys. Phase diagrams. Structural transformations. Phases and constituents. Processing. Metallic biomaterials from cobalt-based alloys. Co-Cr and Co-Ni alloys. Phase diagrams. Structural transformations. Phases and constituents. Processing by. Titanium metal biomaterials and titanium-based alloys. Ti-Al, Ti-Zr, Ti-Nb, Ti-Ta alloys. Ti-Ni shape memory alloys. Gum alloys. Phase diagrams. Structural transformations. Phases and constituents. Processing. Biodegradable metallic biomaterials. Magnesium-based alloys. Copper base alloys. Zinc-based alloys. Iron-based alloys. Metal bottles. Composite systems, characterization, classification. Metal matrix composite systems. The influence of the biological environment on metallic biomaterials. Degradation of metallic biomaterials in the biological environment.	
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**2**	**Structural theory of the properties of biomaterials** Structure and properties of biomaterials. Electrical properties of biomaterials. Thermal properties of biomaterials. Magnetic properties of biomaterials. Non-destructive testing of biomaterials	4
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**2**	**Engineering of non-metallic biomaterials** Introductory notions. Classification of non-metallic biomaterials; Mechanical, optical, thermal and electrical properties characteristic of non-metallic biomaterials. Ceramic materials used for implants. Classification of ceramic biomaterials. Phase diagrams. Structural transformations. Phases and constituents. Analysis by microscopy. Oxide ceramics represented by Al2O3, MgO, ZrO2 and mixtures of various metal oxides. Phase diagrams. Structural transformations. Phases and constituents. Processing. Non-oxidic ceramics based on SiC, AlN, Si3N4.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					Phase diagrams. Structural transformations. Phases and constituents. Processing. Ceramic bottles and dental porcelain, ceramics consisting of mixtures of metal oxide powders, especially based on SiO2 and Al2O3. Processing. Carbon-based ceramics. Processing. Bioceramics based on calcium phosphates. Processing. Polymers. Polymerization reaction. Classification of polymers. Polymers used in medicine. Characterization. Polymeric materials used for implants. Polyethylene. Polypropylene. Polyamides. Processing. Polymers of acrylic and methacrylic acid. Polyesters. Polyesters. Polycarbonates. Fluorocarbon polymers. Polyurethanes. Silicones. Processing. Cements: composition, use. Plasters: composition, applications. Waxes: composition, use. Composite systems, characterization, classification. Ceramic matrix composite systems. Composite systems with polymer matrix. Metal-ceramic systems. The influence of the biological environment on non-metallic biomaterials. Degradation of non-metallic biomaterials in the biological environment. Biological testing of non-metallic biomaterials	
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**2**	**Histo-physiology and pathological anatomy** Histology - the subject of study and its history. Cell - definition, classification, characteristics. The general structure of the eukaryotic cell: the cell surface and cellular connections. The nucleus: structure: functions. Cytoplasm: general structure, cell organelles, cell inclusions. The cellular cytoskeleton. Vital cellular processes. The cell cycle. Cell differentiation and tissue development. Epithelial tissues. Definition, classification according to structure and function. Covering epithelia: classification, structure, functions. Simple epithelia: squamous, cubic, cylindrical. Stratified epithelia. Pseudostratified epithelia. Transitional epithelia. Secretory (glandular) epithelia: structure, functional (exocrine and endocrine) and morphological classification (serous, mucous, cystic acini). Sensory epithelia: general organization and localization. Connective tissues. General description, classification, functions. Histogenesis of connective tissues. Structure: amorphous component (fundamental substance), fibrillar component (collagen, elastic and reticulin fibers, collagen synthesis). Connective tissues. The cellular component (undifferentiated mesenchymal cell, reticular cell, fibroblast, mast cell, plastocyte,	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					pigment cell, adipocyte). Connective tissues. Types of connective tissue (loose, adipose, dense, embryonic) structure, function, location. Cartilaginous tissue. Articulations. Types of cartilage (hyaline, elastic, fibrous) Definition, structure, location, functions. Bone tissue. Spongy bone tissue (structure, location). Compact bone tissue (structure, location). Osteogenesis, membrane and cartilage ossification. Synarthroses, diarthroses, syndesmoses. Blood and hematopoiesis. Definition and composition of human peripheral blood. The structure, electrostructure and histophysiology of the figurative elements of the blood (red blood cells, leukocytes and platelets). Blood and hematopoiesis. Hematopoiesis (erythropoiesis, granulopoiesis, development of agranulocytes and platelets). Muscle tissue. Definition, classification, function. Smooth muscle tissue (origin, structure, location). Muscle tissue. Skeletal muscle tissue (origin, structure, location). Ultrastructure of the striated muscle fiber (myofibrils and sarcomere). The contraction mechanism. Cardiac muscle tissue (structure, function). Cardiovascular system. Blood vessels (arteries, lymphatic veins). The general structure of the vascular system (internal tunic, middle tunic, external tunic). Capillaries (definition, classification, structure). Heart (general structure – endocardium, myocardium, epicardium). The pericardium. The excito-conductive system. Nervous tissue. Definition, structure, function. Neurons (structure and classification, types of neurons). Nerve fibers (axon and dendrites). Myelin sheath. Synapse (definition, structure, types of synapses). The process of nerve degeneration and regeneration. Neuroglia	
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**2**	**Clinical medical engineering** Medical clinic. Generalities. The importance of technical medical products for medical practice and health insurance. Technical medical products in Europe nowadays. Traditional and modern raw materials used in the manufacture of products used in medical engineering. Technical medical products. Materials used in medical engineering. Modern material used in medical prostheses. Medical devices used in medical practice.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**2**	**Applied statistics in medical engineering** Statistical populations. Samples. Sampling techniques. Randomized/non-randomized samples and their importance in research. Data types. Variability, error factors. Frequency distributions. The central limit theorem. The normal (Gaussian) distribution and its importance in statistical analysis. Non-Gaussian distributions (Poisson, Bernoulli, etc.) in biomedical research. Advanced notions of descriptive statistics. Confidence intervals and their importance in medical engineering research and practice. Abnormal results and their importance in the analysis of biomedical data. Detection techniques and criteria for eliminating aberrant results from data series. The normality of the data of an experiment. Concordance tests Normality tests. Advanced protocols for parametric and non-parametric statistical analysis. Inferential statistics. The main goals of inferential statistics. Statistical hypothesis testing. Primary criteria for choosing a certain protocol/statistical test. Central tendency comparison tests (averages, medians). Parametric/non-parametric tests for comparing means/medians. Criteria for choosing the most suitable statistical test for the comparison of central tendencies. Anova analysis, its variants and applications in biomedical research. Contingency tables. The Chi-square test and its variants. Choosing the appropriate statistical protocol, depending on the desired study design. Statistical foundations of causality criteria in biomedical engineering research. Correlation and regression analysis. Linear and non-linear regressions. Multiple regressions. Criteria for choosing the appropriate statistical test, in the case of correlation and regression analysis. Statistical techniques for comparing methods in research. Bland-Altman analysis. Passing-Bablok regressions. Survival Analysis and its importance in biomedical research. Kaplan-Mayer curves. Frequent statistical analysis errors encountered in the publication of biomedical research results: case studies, using international databases. Criteria for choosing a protocol/statistical test appropriate to the research/study/experiment.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**2**	**Practice II** General training on labor protection. Clinical engineering: the design and development of facilities in the medical field (equipment, constructions, therapeutic techniques, etc.). Biomaterials: interventional medical equipment (needles, electrodes, operating instruments, etc.), anatomical prostheses (implants, dental interventions). Biomechanics: simulation of the functioning of the cardiovascular and urinary systems (laboratory analyses, specific treatments - hemodialysis) and mechanics of the solid body (study of the functioning of the locomotor system, implantation and prosthetics, osteosynthesis of fractures). Medical technologies: the design, production and use of new materials (instrumentation, drugs, etc.), the development of therapeutic technologies. Sensors: detecting physiological signals (information) and converting them into standardized "technical" signals, mostly electrical, to be quantified. Medical instrumentation: the quality and safety of medical investigations useful in diagnosis, therapeutic and surgical interventions, monitoring of the medical act, etc. Signal analysis in medicine and biology: the processing and statistical analysis of the signals recorded by different measurements in order to extract the maximum useful information in diagnosis and monitoring. Modeling, simulation and control of biological systems: the mechanisms of physiological processes and their mathematical modeling. Medical imaging: medical diagnosis (CT, MRI, ultrasound, etc.). The biological effects of the electromagnetic field: the interaction between living organisms and the electric and magnetic fields in the environment - negative influences ("electromagnetic pollution"), beneficial influences (medical therapeutics in the electromagnetic environment); dosage and exposure control. Medical informatics: data management in the records of medical institutions (personal, financial, medical files, treatment sheets, etc.); databases with medical information accessible to extended medical communities (telemedicine, radiological collection stored in images, ECG dictionary, collections of tomographic images, etc.); computerized assistance in carrying out or preparing clinical interventions - monitoring, modeling.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Applied Engineering Science	**BA**	**Medical Engineering**	**3**	**2**	**Reliability of medical equipment** Wear of medical equipment: general concepts, industrial tribosystems and types of wear. Reliability of medical equipment: general notions, theory of defects, indicators of reliability, reliability of systems. Equipment maintenance and upkeep: the activity of maintenance, operation and repair of medical equipment, elements regarding the safety in operation of medical equipment, corrective, preventive, predictive, proactive and preventive maintenance. Modern methods of organizing and planning the maintenance and repair activities of medical equipment: the critical path method; applications of graph theory in repair activity scheduling. Economic aspects of the maintenance activity.	3
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**1**	**Design of implants** Implantology - Introductory notions: definitions, history, evolution and dynamics of the development of implantable systems. Systems and types of implants used in implant-prosthetic therapy. Implants and internal prostheses of human hard tissues. Human soft tissue implants. Materials used in making implants. Characterization and their functions. Principles of biocompatibility. Degradation of materials. The body's reactions to the implant, the reactions of implants to the body. Biocompatible materials for orthopedic surgery. Biocompatible materials for oral-maxillo-facial surgery. Biofunctionalized surfaces. Mechanical behavior of biomaterials and biological materials for implants. Biomechanics of bone tissue. Bone tissue engineering. Characteristics of bone substitutes. Functional biocompatibility. Functional requirements to fulfill the objective of biofunctionality. Selection of materials based on biofunctionality. Tribological behavior of biocompatible materials used in implanto-prosthetic therapy. Physical-mechanical characteristics. Bone remodeling and mechanical evaluation of the bone-prosthesis assembly. Design principles and fundamental criteria for achieving biointegration of the implant. Geometric characteristics of the implant, shape and surface texture. Conditions for obtaining the primary stability of the implant. Analysis of the behavior of the bone-implant assembly under mechanical stress (Finite element analysis). Technologies for obtaining implants and components for implantable	6

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					systems. Modern approaches in implant design and manufacture. Innovative design and surface processing solutions to improve implant durability. Tissue engineering techniques and biomimetic implants.	
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**1**	**Applied modeling and simulation in bioengineering** Systems, models, simulation. Elements of numerical modeling technique. Fluid mechanics. Characteristics of fluids. Laminar, stationary flow, flow of viscous liquids. Viscosity measurement methods. Flow of non-Newtonian liquids. Notions of hemodynamics, blood pressure in the vascular system, factors that influence blood pressure. Biological phenomena: the transmission of the nerve impulse in the neuro-muscular synapse; Thermal phenomena. Thermodynamic system, thermodynamic processes, principles of thermodynamics, ideal gas thermodynamics. Aggregation states of the substance, state transformations. Notions of biological thermodynamics. Biomedical technologies: organ cryopreservation, artificial kidney, artificial liver. Biotechnologies: mass and heat transfer processes Functional biomechanics. History of human locomotion research. Evolution of movement recording techniques and equipment. Mechanical work, force and energy in exercises to increase muscle strength. Factors influencing the development of resistance. Graphs in biomechanics. Optimizing medical recovery. Biomechanics of muscle contractions. Isometric exercises. Plyometric exercises. Quasi-isometric exercises. Mechanical vibrations as a way of treatment. The relationship between force and speed. Biomechanics of human locomotion. Locomotion kinematics. Biomechanics of running. The factors influencing biomechanical measurements. Kinetics of running. Solutions to improve the biomechanics of walking and running. The main applications of CAD/CAM technologies. Manufacture of prostheses. The most common types of prostheses. The main objectives in the manufacture of a prosthesis. Prosthetic device manufacturing processes. Devices for measuring and scanning anatomical surfaces. Practical applications of CT scanning and 3D reconstruction	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**1**	**Medical electrical equipment** General description of the structure and mode of operation of the components of a medical electrical equipment. Elements of electrocardiography: the electrical functioning of the heart, methods of collecting the ECG signal, the basic electrical diagram of the EKG electrocardiograph, the presentation of other medical equipment, cardiac defibrillators, respectively pacemakers. Elements of electroencephalography – EEG: the functioning of the brain from an electrical point of view, methods of EEG signal collection, the structure of the electroencephalograph, operation, specific characteristics. Elements of ultrasound: the behavior of the human body to ultrasound, the principle equations of ultrasound, the choice of the parameters of the ultrasound signal used in ultrasound, the block diagram of the ultrasound. Elements of roentgenography: the physical principles of X-ray generation, structural analysis. Elements of computerized nuclear magnetic resonance tomography - NMR: physical principles of nuclear magnetic resonance, presentation of the schematic diagram of the tomograph, parameters used in NMR detection, constructive types. Structural and functional analysis of the following electrical medical equipment: Ultrasound equipment; Equipment for surgery, high frequency, radiofrequency, diathermy, bipolar, monopolar; Endoscopic equipment (video camera assembly, endoscope, lighting system, air pump); Anesthesia equipment – intensive care ventilator, anesthesia ventilator; Laser surgical instruments; Bedside monitoring equipment; Hemodialysis equipment; Incubators for newborns; Infusion pumps and syringe pumps; Intensive care equipment - active humidifier for respiratory gases; Medical freezers; Medical lighting devices: surgical lamps; Medical sterilizer; Control subsystems of medical electrical equipment. Subsystems for the automatic regulation of specific parameters of medical electrical equipment. Subsystems for automatic positioning of mobile organs of medical electrical equipment.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**1**	**Medical optics and optical equipment** Introduction to Optics: electromagnetic waves, propagation speed, refractive index, radius, beam, paraxial approximation, conjugate points, magnification. Reflection, refraction, absorption and diffusion of light, transmission factors, reflection. Notions of photometry. Radiation sources: conventional light bulb, gas discharges, LEDs, LASER devices, photopolymerization lamps, germicidal lamps. Spherical diopter and plane diopter, lenses: characteristic relations, image construction. Spherical and plane mirrors: characteristic relations, image construction. Lens and mirror systems. Light dispersion. Optical prism. Optical microscopy: principle, types, characteristic sizes. Polarization of light: phenomenology, laws, applications. Interference of light: unlocalized - Young's device; located: blade with plane-parallel faces and optical wedge. Diffraction of light: phenomenon and laws; implications and applications. Eye and sight. The biophysical mechanism of vision. Anatomy of the eye. The geometric pattern of the eye. Visual defects. Types of glasses and contact lenses. Optical instruments: magnifying glass, scope, telescope. The equipment used in medical optics.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**1**	**Programming engineering** Course content. Bibliography. Motivation, Definitions, Famous Errors, Statistics. Development models (Cascade, Spiral). Programming medical applications using Arduino development boards. Data processing using sensors dedicated to the Arduino platform. Development models. Agile, Lean, Scrum. Modeling languages, UML. UML diagrams. SCRUM methodology. Reverse Engineering. Presentation of tools necessary for project development: Github, Trello, GoogleDocs. Software Testing: Introduction, Methods, Processes Manual Testing vs Automated Testing.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**1**	**Systems with microprocessors** Introduction. History of processors, microprocessors and data acquisition. The evolution of technological systems. The usefulness of data in decision-making. Sensors, measuring systems and recording systems. Database. Interpretation of databases and decisions. Computers, process computers, PCs. pc. Architectures and work procedures. The use of computers in data acquisition. IBM7700 and IBM1800	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					systems. Structural elements. Sensor, adapter, conditioner, analog/digital conversion (A/N) and digital/analog (N/A). Specific programming languages. Processes Characterization. Variables and parameters. Definition of processes for obtaining products and services. In/out diagram. Examples. Identification of process factors, control factors, disruptive (environmental) factors. Process tracking, database development, decision making. The use of exploratory statistics regarding the evolution of processes. Correction in technological processes. Data acquisition systems and data acquisition and control systems based on microprocessors. Physical and chemical phenomena. Process/control/disturbance factors (environment), examples. Sensors, adapters, transducers, signals, Examples. Structures. Analog and numerical (digital) quantities, examples. Measuring systems. Linearity. Sensor isolation, reliability. System structures with sensors/transducers and process, Examples. Coupling (interfacing) data acquisition systems equipped with microprocessors. Coupling on ISA. Connecting to the bus. Interfacing with RS232. Interfacing with the parallel port. SAD coupling on USB. Galvanic and potential isolation. Examples. Specific programming languages. Communication lines with the process and with the PC. SAD 8bit self-contained. A/N and N/A conversion circuits. SAD characterization and performance. Microcontrollers. Access speeds. Clock. reading rate. I/O settings. Multiplexing. Conversion principles. Defining. Classification. Performance indices. Systems structure. Examples. PCL831/813 System (Advantech). The principle of operation. External features. Performance. Examples of connection to technological processes and data acquisition. Applications of SAD built with MC68HC11 (Motorola). Conversion principles. Defining. Classification. Performance indices. Systems structure. Examples. Applications of microcontrollers to processes. Examples of technological processes with data acquisition systems. Structures. Characterizations. Performances. Use of data for interpretations of the state of the system and its evolution. Analysis of systems for which data acquisition systems can be implemented. The use of SAD in research systems. For example, the acquisition of data for research on experimental models from various domains. wind turbines	

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					with horizontal and vertical axis. Research objectives. Process definition and characterization, in/out diagram, process factors, ranking factors, sensors, transducers, SAD, interfacing, principles of multiple conversion. Data acquisition. Performance indices. The structure of cogeneration/trigeneration systems. Examples.	
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**1**	**Medical electronics** Electrical phenomena. Bioelectric phenomena. Acquisition of electrophysiological signals. Instrumentation amplifiers Electrosafety in medical equipment and the electromagnetic interface. Electronic components in medical equipment. Investigation of the cardiovascular system. Investigation of the muscular system. Devices intended for physiological masseurs. Medical devices in medical imaging. Numerical processing of device signals for medical monitoring. Intelligent systems for applications in medicine.	3
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**2**	**Biosensors and instrumentation** The importance of biosensors and instrumentation in the context of medical engineering. Biosensors: definitions, concepts and principles. Analysis methods and types of biosensors. Medical applications of biosensors. Notions regarding the biomaterials used. Surface properties. Phenomena of biomaterial-tissue interactions.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**2**	**Medical instrumentation** Description of the structure and mode of operation of the components of a medical device. Instrumental general medicine. ENT instruments. Sterilization tools and products. Diagnostic tools. Instrumental Orthopedics. Urology Instrumentation. Surgical instruments. Dental instruments - office. Dental instruments - hospital. Equipment and Apparatus for cardiological investigations. Instrumentation for complex medical laboratory analyses. Quality, maintenance and safety rules for operating medical devices.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**2**	**Medical imaging** Medical imaging - medical imaging techniques; the physical principles on the basis of which the equipment is developed and the mode of operation of the instruments	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					for medical imaging. Imaging parameters and characteristics: physical quantities, signal to noise ratio (SNR), resolution, contrast, pixel, matrix. The basic principles of nuclear magnetic resonance - Fundamental notions about nuclear spin, magnetic moment, net magnetization; The basic principles of nuclear magnetic resonance: Nuclear spin interactions; External interactions (Zeeman and with the Radio Frequency field); Internal interactions (Chemical Shielding, Direct, Indirect; Quadrupolar). The basic principles of nuclear magnetic resonance - Fundamental notions about transversal and longitudinal magnetization, spin-spin and spin-lattice relaxation processes. NMR spectroscopy - Chemical shift; Dipolar interaction; The generation of the Radio Frequency (RF) pulse and the evolution of the spine system The role of the magnetic field gradient - Spatial resolution. Expanding dimensionality - Passing from 1D to 2D and then 3D, creating the image of volumes. Matrix encoding and decoding. The selection of sections, the definition of sections, the definition of the characteristic parameters of the sections, ways of changing the dimensionality of the sections; frequency versus field gradient. Techniques for brain analysis; Protocols specific to soft tissues. Techniques for chest analysis; Specific protocols for static and respective dynamic analyses. Techniques for dynamic analysis; Specific protocols for cardiological analyses. Localized spectroscopy. MRI in the context of medical imaging techniques - Advantages and disadvantages of other MRI compared to other imaging methods.	
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**2**	**Orthopedic prosthetic and rehabilitation engineering** Medical engineering and orthopedic rehabilitation: definition, purpose, objectives. Diagnosis in orthopedic rehabilitation. Preparing the patient file. Diagnosis and treatment of orthopedic conditions. Planning the treatment of orthopedic conditions. Documentation of acute phase treatment and patient discharge. Tissue engineering. Manufacturing of prostheses: types of prostheses: cosmetics, sleeves, exoskeletal devices, orthopedic implants. Technologies for the production of prosthetic components, implants and medical devices. Rapid manufacturing applications in tissue engineering. Prosthetics of the upper limb - actuation and control of prostheses. Lower limb prosthesis. Endoprostheses. Orthotics for the	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					lower limb. Denture comfort: acceptance and rejection. Recovery of the functions of human limbs. Recovery of sensory functions. Wheelchairs for disabled people. Other means for recovery of walking and assisting bipedal posture. Equipment and devices for assisting the communication function.	
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**2**	**Engineering and dental protection** Introduction to dental medical engineering: definition, purpose, objectives. Diagnosis and treatment of acute oro-dental conditions. Planning the treatment of acute oro-dental conditions. Designing the treatment plan. Establishing treatment options. Aspects of complex oral rehabilitation at the surgical level in the oro-maxillo-facial area. Principles in dental implant prosthetics. The force system developed at the level of the stomatognathic system. Modeling of the protein superstructure. Bone resorption around implants. The use of materials in dental prosthetics and rehabilitation. Tribological behavior of biocompatible materials used in implanto-prosthetic therapy. Physical-mechanical characteristics. Bone remodeling and mechanical evaluation of dental prostheses. Clinical evaluation of occlusion in patients with complex oral rehabilitation through implant-protein treatments. Dental prosthetics technologies. Equipment specific to dental rehabilitation engineering.	4
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**2**	**Final processing of biomaterials** Natural biomaterials. Classifications. Uses. Characteristics. Obtaining. Chronological development of biomaterials. Definitions. The main uses of biomaterials. Categories of medical applications of biomaterials. Conditions imposed on materials and biomaterials for medical use. General conditions. Conditions imposed on materials and biomaterials for medical use. Special conditions. Non-implantable materials. Use. Biomaterial. Obtaining technology. Materials for extracorporeal physiological attachments. Use. Biomaterial. Obtaining technology. Implantable materials. Use. Biomaterial. Obtaining technology. Implantable materials. Use. Biomaterial. Obtaining technology. Materials intended for maintaining the health and hygiene of patients. Use. Biomaterial. Obtaining technology. Material characterization attributes. Processing of biomaterials. Operations and equipment. Mixing	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
					procedures and parameters. Fiber paste mixtures. The consecutive process with premixes. Latex type mixtures. Successive mixing processes with premixes. Dry mixes. Obtaining procedures and equipment. Methods of profiling processing mixtures. Roll-Coater Process Coster Process. The process with transfer cylinders. The Reverse Roll-Coater process. Calendering process. The process of layering with the curtain. Profiling in electrostatic field. Profiling by casting and forming. Electrospinning. The main techniques and technologies for processing inorganic biomaterials. Metallic biomaterials. Structure and properties. The main types of metallic biomaterials used in biomedical applications.	
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**2**	**Practice for the diploma project** Bibliographic documentation. Experimental research in the field of the proposed theme. Visits to industrial units with the aim of collecting data and harmonizing them with the chosen research topic. Interpreting the results and reporting them to other results from the specialized literature	3
Applied Engineering Science	**BA**	**Medical Engineering**	**4**	**2**	**Elaboration of the diploma project** Bibliographic documentation. Identification and description of the materials and methods used to complete the bachelor thesis. Experimental research in the field of the proposed theme. Interpretation of the results and their reporting to other results from the specialized literature. Modeling/optimization of the technological process. Creating a synthetic presentation with the results obtained.	4
APPLIED INFORMATICS IN MATERIALS ENGINEERING - BA						
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**1**	**1**	**Mathematical Analysis** Strings and series of real numbers. Differential calculus. Integral calculus. Differential equations.	5
					Physics Classical mechanics. Elements of restricted relativity theory. Thermodynamics, Molecular Physics and Heat. Electricity and Magnetism. Optics. Introduction to Quantum Physics.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**1**	**1**	**Chemistry** Classification of chemicals. Aggregation states of matter. State transformations. The fundamental laws of chemistry. Elements of the structure of atoms. Atomic models. The periodic system of the elements. Chemical bonds. Dispersed systems. Colloidal systems. Redox reactions. Electrolysis. Hydrogen. Metals.	5
					Descriptive Geometry Projection systems. Representation of point, line and plan. Polyhedrons. Cylinder and cone. Sphere. Intersections of geometric bodies.	5
					Materials Science and Engineering Physical properties of materials. Mechanical properties of materials. Chemical stability of materials. Corrosion resistance. Interatomic Solidification of metallic materials. The diffusion. Alloy systems. Phase balance diagrams. Fe-C alloy system. Steels. Cast iron. Heat treatments. Plastic deformation. Non-ferrous alloys. Aluminum and copper. Ceramic materials. Plastic materials. Composite materials.	5
					Sports Repeat the main football procedures - boys - used in attack: driving the ball with the inside and outside of the foot, kicking the ball with the inside of the foot and with the kick on and off, the kick at the door, moving the ball with the right foot, throwing balls from the edge of the field, taking the foot from the move, etc. and defense: the opponent's possession of the ball from the front and from the side. Tactical actions in attack. Tactical actions in defense. Repeat the main procedures of volleyball - girls. Procedures used in the attack. Procedures used in defense. Settling in attack and defense game systems, organizing the 3 hits, combinations with passes between nearby areas. Bilateral games with reduced numbers: 3x3, 4x4. Structures and technical-tactical combinations in the form of „suveica", working in groups, in pairs or individually in order to consolidate the basic technical elements.	1
					English Production. Present Tenses. Research and Development. Past Tenses. Future Forms. Information Technology. Conditionals. Quality. Verb phrases. Health and Safety.	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**1**	**1**	**Communication** Communication techniques. Oral communication. Preparation and exposure of a presentation / speech / scientific papers. Types of interviews. Written communication. The experimental study. How to make a presentation on areas of professional competence. Data collection and interpretation, free discussion. Formulation of the research report. The scientific report.	2
				2	**Linear Algebra, Analytic and Differential Geometry** Vector spaces. Linear applications. Real Euclidean vector spaces. Free vectors. Line and plan in space. Conics on reduced equations. Quadrics on reduced equations. Curves in space. Surfaces.	3
					Physical Chemistry The object of physical chemistry. Chemical Kinetics. Formal kinetics of simple elementary reactions and complex reactions. The influence of temperature and pressure on the rate of reactants. Elements of electrochemistry. Transport phenomena in electrolyte solutions. Phenomena at the metal/electrolyte interface. Galvanic cells. Thermodynamics. The first and second principles of thermodynamics. Thermochemistry. Hess's law. Thermodynamic potentials. Gibbs energy. Chemical potential.	5
					Electrotechnics Introduction of electrical and magnetic quantities. Laws and theorems of the electromagnetic field. Direct current circuits. Alternating current circuits. Single-phase alternating current circuits. Three-phase alternating current circuits. Measurement of electrical and magnetic quantities. Measurement of non-electric quantities. The electrical transformer. Asynchronous machine. Synchronous machine. Elements of electric actuators.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**1**	**2**	**Technical Drawings and Infographics** Arrangement of projections. Views, sections, breaks. Dimensioning of technical drawings. Representation of threads and flanges. Indication of surface condition, marking of dimensional deviations and geometric tolerances. The assembly drawing. Non-demountable joints. Removable assemblies. Mechanical Power Transmitters. AutoCAD – overview. 2D drawing commands. 2D editing commands. Dimensioning in AutoCAD. Definition of blocks. Model-paper space and plotting drawings.	5
					Computer Programming and Programming Languages I Introduction to C Language in the Qt environment. Using widgets in Qt. Presentation of the Turbo C programming environment. Variables. Constants. Structures. Conditioning instructions. Repetitive structure for. Panels. The repetitive instruction while. Matrices. Files. Strings of characters. Functions. Pointers. Classes in C ++.	5
					Sports Applying the procedures taught in variable and difficult conditions, working with the opponent and changing the current tasks. Full bilateral games in full compliance with all notions of regulation. Improving the level of specific physical training by developing combinations of aptitudes that support physical exertion. Development of reaction speed, agility, precision, dynamic balance, flexibility, spatial-temporal orientation, explosive force, dynamic segmental force, speed of movement in coordination and resistance, power in resistance regime.	1
					English Engineering. Specialized vocabulary and discourse situations. Grammar in focus: Active vs. Passive. Relative clauses. Automotive. Specialized vocabulary and discourse situations. Grammar in focus: Causation. Chemical. Specialized vocabulary and discourse situations. Grammar in focus: Obligation and requirements. Pharmaceutical. Specialized vocabulary and discourse situations. Grammar in focus: Cause and effect. Construction. Specialized vocabulary and discourse situations. Grammar in focus: Ability and inability.	2

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**1**	**2**	**Materials Technology** The structure of materials used in engineering. The mechanical properties of materials used in industrial engineering. Manufacture of the main metals and alloys used in industry. Processing of metallic materials used in engineering. Welding of metallic materials. Glass processing. Processing of ceramic materials and cermets. Processing of plastics. Rubber processing. Processing of integrated circuits. Silicon processing. Lithography. Thermal oxidation. Chemical vapor deposition. Encapsulation of integrated circuits.	5
					Advanced Digital Skills Introduction. Hardware and software basics. Presentation of the Microsoft Office software package. Types of digital platforms. Web forums and newsgroups. Functional aspects of websites. Institutional sites. Internet search strategies.	1
			2	**1**	**Applied Informatics** General presentation. The main work menus. Modeling 3D landmarks. Creating a three-dimensional models of landmarks with complex sections. Modeling of sheet metal pieces. Generation of assemblies. Creating welded assemblies. Modeling of plastic parts. Organological design. Creating the execution drawings. Design of structures.	5
					Materials Strength Overview. Shearing forces and bending moments. Behavior of materials. Traction/Compression of beams. Cross section properties of beams. Bending of beams. Torsion of beams having circular or annular section; torsion of rectangular cross-section bars. Methodology of dimensioning and verifying beams.	4
					Numerical Methods Errors in numerical methods. Systems of linear equations. Direct methods. Iterative methods. Numerical interpolation. Numerical quadrature.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**2**	**1**	**Thermo-technics** General thermodynamics. Mechanical work, heat, entropy, enthalpy. Simple transformations of perfect gases, the Carnot cycle. Principles I and II of Thermodynamics. Reversible and irreversible processes for thermodynamic systems: closed, periodically open and in stabilized flow. The principle of operation of turbines. Piston compressors in one stage/2 stages of compression. Perfect gas mixtures: mass and volume fractions, specific heat, thermal calculation. Ideal cycles of internal combustion engines. Gas power plant (Joule cycle). Power plant with separate turbines. Humid air parameters.	4
					Technical Analysis and Characterization of Materials Structure of materials. Sampling. Types of samples. Rules for the collection of samples. Conservation and transport of samples. X-ray diffraction structural analysis. Experimental methods for studying surfaces and interfaces. Mass spectrometry. Analysis and characterization of materials through FTIR. Structural characterization of materials by Raman spectroscopy and X-ray photoelectrons. Optical microscopy in material analysis. Electron microscopy. Atomic force microscopy. Transmission electron microscopy. Thermal characterization of materials by TGA and DSC.	4
					Computer Programming and Programming Languages II Introduction to C# Language in the Visual Studio environment. Data types in C# language. Repetitive blocks in C# language. NameSpace. Arrays. Programmatic interfaces in .Net. Using delegates. Events in C#. IO operations in .Net. Collections in .Net. String operations. Encryption using Hash. Execution of executable packages for MS Windows X, Android.	6

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**2**	**1**	**English** Production. Specialized vocabulary and discourse situations. Grammar in focus: Present tenses. Research and Development. Specialized vocabulary and discourse situations. Grammar in focus: Past tenses. Information technology. Specialized vocabulary and discourse situations. Grammar in focus: Future forms. Logistics. Specialized vocabulary and discourse situations. Grammar in focus: Conditionals. Quality. Health and Safety. Specialized vocabulary and discourse situations. Grammar in focus: Verb phrases.	2
					Sports Repeat the main football procedures - boys - used in attack: driving the ball with the inside and outside of the foot, kicking the ball with the inside of the foot and with the kick on and off, the kick at the door, moving the ball with the right foot, throwing balls from the edge of the field, taking the foot from the move, etc. and defense: the opponent's possession of the ball from the front and from the side. Tactical actions in attack: demarcation, overcoming, penetration. Tactical actions in defense: marking, tying, blocking the ball, etc. Repeat the main procedures of volleyball - girls, known from previous cycles. Procedures used in the attack: trips to specific positions, two-handed pass from the top, pass over the head, lower front service and top front service. Procedures used in defense: specific positions and movements, two-handed takeover of the service and attack, blocking the net, etc. Settling in attack and defense game systems, organizing the 3 hits, combinations with passes between nearby areas. Bilateral games with reduced numbers: 3x3, 4x4. Structures and technical-tactical combinations in the form of suveica, working in groups, in pairs or individually in order to consolidate the basic technical elements.	1
				2	**Physical Metallurgy I** Introduction to materials science. Structure and organization of materials. Real structure of crystals. Physical-chemical constitution of metallic materials. Crystallization of metals. Diffusion. Phase equilibrium diagrams. The behavior of materials under mechanical stress.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**2**	**2**	**Electronics and Automation** The signal as material support of the information. Functions of electronic circuits. Primary processing of signals. Patterns of signal in time and frequency. Transducers and systems for remote measurement of electrical and non-electric quantities (tele-measures). Negative reaction in electronic circuits. Structure of a mono-variable automatic system.	3
					Environmental Protection in Industry The implications of pollutants on environmental factors. Fundamentals of gaso-dynamics and gas circulation. Equipment and installations for capturing dust from industrial gases.	3
					Fluid Mechanics Fluid statics. Basic equations of fluid mechanics. Dimensional analysis and similarity theory. Boundary layer theory. The flow through the pipes.	3
					Properties of Materials Structure and properties of materials. Elements of crystalline structure. Electronic theories of materials. Electrical properties of materials. Thermal properties of materials. Magnetic properties of materials. Methods of analysis and control. Non-destructive control of materials.	3
					Machine Parts and Mechanisms General elements underlying the design of machine parts. Transmissions through belts and chains. Friction wheel drives. Spur Gears. Axles and shafts straight. Sliding bearings. Rolling bearings. Clutches. Removable assemblies. Non-removable assemblies by welding.	4
					Theory of Plasticity and Fracture of Material Elements of the theory of plasticity. Deformation behavior of metallic materials. Thermal regime of deformation. Fundamentals in fracture of materials.	3
					Field Practice The agglomeration sectors. The furnace sectors. The rolling mill sectors. Steelworks and technological flow at continuous casting.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**2**	**2**	**English** Engineering. Automotive. Chemical. Pharmaceutical. Construction. Specialized vocabulary and discourse situations. Grammar in focus: Active vs. Passive. Relative clauses. Causation. Obligation and requirements. Cause and effect. Ability and inability.	2
					Sports Applying the procedures taught in variable and difficult conditions, working with the opponent and changing the current tasks. Full bilateral games in full compliance with all notions of regulation. Improving the level of specific physical training by developing combinations of aptitudes that support physical exertion. Development of reaction speed, agility, precision, dynamic balance, flexibility, spatial-temporal orientation, explosive force, dynamic segmental force, speed of movement in coordination and resistance, power in resistance regime.	1
			3	**1**	**Technological Processes for Elaboration and Casting Alloys** Elaboration of cast iron for the first fusion in the furnace. Elaboration of foundry cast iron. Steel production: steel production processes (oxidation of silicon, manganese, decarburization, dephosphorization, desulfurization, deoxidation, alloying); processes and technologies of steelmaking in electric arc furnace and converter. Particularities of metallic materials casting in parts. Processing and shaping technologies of materials.	5
					Composite Materials Processing Technologies Introduction. Matrix-reinforcement load transfer in composites structures. The mechanical properties of fiber-reinforced composite materials. Manufacturing technologies and structures in metallic composites. Manufacturing technologies for obtaining polymer matrix composites. Modeling and simulation in composite materials and structures. Optimization of composite structures using software programs.	4
					Physical Metallurgy II The Fe – C equilibrium system. Phase transformations in the solid state. Alloy steels. Non-ferrous alloys.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**3**	**1**	**Manufacturing Engineering** Basic notions regarding the technological process. Methodology of designing technological processes. Drawing up flow charts. AMDE Process. Determination of the elements of technological manufacturing processes. Analysis of the execution drawing. Performance indicators of manufacturing processes.	5
					Technological Processes of Ceramic Materials Ceramic materials. Structure of ceramic materials. Traditional refracting. Advanced ceramic materials. Ceramic materials with applications in the electrical/electronic field. Ceramic materials with applications in the mechanical field. Superrefractory ceramic materials. Nanostructured ceramic materials. Ceramic materials-processing methods. Ceramic powder processing technologies. Technologies for processing raw ceramics. Drying of raw ceramic products. Sintering of ceramic products. Processing technologies of aluminum oxide ceramics. Processing of ceramic composite materials. Software used for processing ceramic materials.	4
					Technological Processes of Materials with Special Application General classification of engineering materials. Technologies for obtaining advanced and engineering metal materials. Obtaining, characterization and applications of semiconductor materials. Ceramic materials. Polymeric materials. Advanced composite materials. Smart materials.	4
					Polymeric Materials Processing Technologies Polymers structure. Processes of forming polymeric products. Compression molding. Transfer molding. Injection molding. The formation by extrusion. Blow molding. Modeling of processes for forming polymeric materials. Mould injection technologies of polymeric materials. Computer-aided design of injection molds.	4
				2	**Basics of Computer Aided Design** Sketch module. Drawing complex curves. Concepts for 3D drawing. Introducing the Features module. Quotation of drawings. Simulation of static loads. Simulation of heat transfer using the Flow Simulation mode. Obtaining 2D drawings using 3D models. Making ensembles. Relationships between pieces. Making animations. Surfaces module. Entities based on class A surfaces. Sheet Metal module.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**3**	**2**	**Thermal and Thermochemical Processing Technologies of Materials** The structural, operating and technological characteristics of metallic materials thermally, thermochemically treated. Specific heating and cooling processes and their thermal regimes for heat treatments of flat products, parts and tools. The characteristics of the chemical interaction between the heating/cooling media and the surface of metal products that are thermally treated. The technology of heat treatments applied to sheets and rolled steel strips. Thermal treatments applied to cast and forged products. The technology of thermal and thermochemical treatments applied to parts and tools. Quality control of thermally treated products.	4
					Modeling and Simulation in Materials Engineering I Modeling a system. Modeling and simulation for manufacturing. Modeling heat transfer. NVH modeling. Modeling the rolling process. Modeling the forging process. Modeling the welding process.	3
					Technological Processes for Plastic Deformation of Materials Thermal regime of deformation. Rolling of materials. Lamination technological schemes. The raw material and its preparation for rolling. Pulling and wire drawing. The peculiarities of pulling and wire drawing. Extrusion. Tensions and deformations in the extrusion process. Free forging. Free forging operations. Delivering under pressure. Stretching. Drilling. Press forming. Basic technological equipment for press forming. Press forming technology lines. Elements regarding the preparation of molds for press forming. The technological form of the press forming parts. Conditions of execution and exploitation of molds.	4
					Materials Processing Technologies and Sintered Products Obtaining powders. Properties of powders. Physical properties. Chemical properties. Technological properties. Preparation of powder mixtures. Addition components. Dosage of mixtures. Homogenization of mixtures. Formation of powder products. Cold pressing in steel molds. Hot pressing; isostatic; step by step. Lamination; extrusion of sinter powder. Molding by injection, by free pouring into molds, by vibration. Electromagnetic field formation. Sintering of powder products. Post-sintering processes applied to powder metallurgy products.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**3**	**2**	**Technological Processes of Biomaterials** Behavior on plastic deformation of biocompatible metallic materials. Design of technologies for processing metal biomaterials. Modeling of corrosion processes of metallic biomaterials. Polymeric biomaterials. Identification of methods for modeling the degradation processes of biocompatible polymers. Design of technologies for obtaining and processing ceramic biomaterials. Analysis and selection of methods for designing technologies for obtaining and processing composite biomaterials. Thermal/thermochemical/thermo-mechanical processing of bio alloys used in implantology. Biological environment influence on metallic and non-metallic biomaterials.	3
					Specialized Practice Use the driving software of the agglomeration machines. Programming of Siemens PLCs for the pressure regulation system at the furnace neck, for the temperature control system in bell ovens in Cold Roll Laminator. Calculator simulator reductions in the vertical and horizontal boxes in the thickening train. Artificial view algorithms for industrial video-inspection system - identification of 2D form defects. Image identification of metallographic structures using artificial sighting techniques. Optimization of the end-of-lamination temperature according to the chemical composition of the material, the applied reduction scheme and the required mechanical characteristics. Computer-assisted management of the rolling process. Computer aided manufacturing systems - optimization of technological parameters.	4
					Measurement Technique and Data Acquisition Introduction to Arduino. Acquisition of analog and digital data. Digital signal processing for sound. The LabVIEW environment. Data acquisition from acquisition boards. Data acquisition from distance sensors, temperature. Development of interfaces for instrumentation in RaspberyPi. Developing programs using virtual tools (VI) in LabVIEW. Industrial instrument control in LabVIEW. User interface specific controls in LabView. Signal acquisition in LabView. Developing virtual instrumentation in FactoryIO. Simulation of acquisition and automation in FactoryIO.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**4**	**1**	**Modeling and Simulation in Materials Engineering II** Statistical models. The problem of regression. Simple linear regression model. Polynomial model. Multiple regression models. Simulation issues. Simulation characteristics. Simulation based on mathematical models of systems. Building graphical user interfaces – GUI.	5
					Automation of Material Deformation Processing Technology Processes General notions. Automatic adjustment systems. The main components of the automatic adjustment systems. The operating modes of the automatic systems and their characteristics. Automatic measurement of the main technological variables: temperature, fluid flow, pressure, humidity of air and gases, chemical composition, angular position, speed of rotation, thickness of sheets and strips, carbon potential and pour point. Extreme adjustment of the parameters of metallurgical installations.	4
					Finite Element and Finite Differences Overview regarding the analysis with finite elements. The method of movements used at bars. Finite element method. Common types of finite elements. Applications in using the finite element method.	4
					Virtual Instrumentation Definitions. Simplified scheme of systems with virtual instrumentation, description, characterization. Schemes with multiple sensors. Data sketching systems, definition, characterization, examples. Sensors. Systems with sensors, data acquisition and actuators. Analog signals and digital signals, comparison. LabVIEW: front panel, characterisation, control submenu, block diagram. The LINX interface. Serial Plot. Scada (MHI).	4
					Basics of Experimental Research Theoretical research and applied research. Experimental research. Research methods. Stages of the research process. The profile of the scientific researcher. General methodology of scientific research. Planning and scheduling experimental research. Quantitative research in engineering sciences. The ethics of scientific research. Bibliographic references, methods of use and citation.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**4**	**1**	**Computer-Aided Manufacturing and Prototyping** The stages of obtaining a model through rapid prototyping. Realization of models by stereolithography (SLA). Obtaining models through the LOM process. Obtaining models through the process of digital exposure to light (DLP). Integration of the CAD model in the CAM system. Manufacturing and application technological problems.	4
					Advanced Materials Processing Technologies New trends in the advanced processing of metallic materials. Unconventional technologies for obtaining cast parts/landmarks with special properties. Unconventional plastic processing procedures. Thermomechanical processing of flat rolled products from low-alloyed and microalloyed steels. Unconventional thermal and thermochemical treatment procedures. Advanced processing technologies in surface engineering. Computer simulation and optimization of technological processes of advanced material processing. Mathematical modeling in the field of advanced material processing. Optimization techniques specific to advanced material processing processes.	4
				2	**Technological Processes Optimization of Materials Elaboration and Processing** The object and importance of mathematical modeling in industrial processes. Classification of types of mathematical models. Parameters of industrial processes. Methodology of analytical mathematical modeling. Functional characterization of systems. Function and transfer matrix. Experimental mathematical modeling (identification). Use of the MATLAB software package in modeling. The mathematical model of optimization problems. Optimizations on open sets. Optimizations with equality restrictions. Elements of convex analysis. Optimal conditions. Numerical methods for solving unrestricted optimization problems.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**4**	**2**	**Nanomaterials and Nanotechnologies** Organization of nanotechnology. Nanostructured materials. Analysis and control tools. Functional nanodevices. Nanostructured materials. Nanomaterials: nanocrystalline materials; fullerenes; nanotubes; nanofibers and nanofibers; semiconductor quantum particles; organic hybrid architectures; functional nanostructures. Dispersions and coatings. Materials with large surface area. Massive nanostructured materials. Manufacturing techniques. Physical methods. Gaseous phase synthesis. Methods of wet chemistry. Modeling processes for obtaining nanomaterials. Design of technologies for the manufacture of nanomaterials. Applications of nanostructured materials. Optical. Magnetic. Thermal. Mechanical. Energy. Biomedical. Environmental protection.	4
					Elaboration of Diploma Project	4
					Practice for the Diploma project	4
					Quality Engineering Introduction. Quality-concepts and developments. Definition of quality. Dimensions of quality. - Total quality management. Quality engineering. Quality engineering procedures. "On-line" procedures. "Off-line" procedures. Function of quality drops. Engineering tolerances. Noise factors, causes of quality drops. Exploitation of non-linearities. Experiment matrices using orthogonal matrices. Estimating the effect of factors, selecting the optimal level of factors. The additive model of the effect of factors. ANOVA analysis of variance.	3
					Shape Design and Shape Acquisition Devices Prototype piece. The concept of Rapid Prototyping. Cad Model. 3D scanning techniques. Models. Classification. Stages of obtaining a model by rapid prototyping. Building models by stereolithography (SLA). Designs development through LOM process. Building models by selective sintering process with laser (SLS). Building models by the process of deposition in molten state (DFD). Building models through polijet learning process with photopolymers (PJP). Models obtained by treatment of the base layer (BGS). Obtaining patterns by inkjet printing (3DP). Manufacturing technology problems and applications.	3

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**BA**	**Applied Informatics in Materials Engineering**	**4**	**2**	**Computer-Aided Manufacturing and Prototyping** CNC automatic machining machines. CNC programming language. Use of CAD model for manufacturing. Process planning. CAM software systems. Use of the CAD model for the realization of the CNC program. Building models through the process of deposition in the molten state (FDM). Building models by laser sintering of metals (SLM). Models obtained by treating the base layer (SGC). 3D printer parameters optimisation.	4
					Graphical Interface Programming Introduction to the issue of human/machine interface design. Designing the human/machine interface interaction. Generic input controls. Generic output controls. Programs for obtaining graphic elements. Libraries dedicated to creating graphic interfaces. Controls in Qt vs Visual Studio vs Android Studio. The winCC environment for industrial graphical interfaces. Qt 3D environment for automotive interfaces. The Unreal environment for creating haptic interfaces. Augmented reality interfaces. Code optimization for graphical interfaces.	4
MODELING AND SIMULATION IN MECHANICAL ENGINEERING - MA						
Mechanical Engineering	**MA**	**Modeling and Simulation in Mechanical Engineering**	**1**	**1**	**Advanced Methods of Finite Element Analysis** Recapitulation. Linear-elastic calculation. Non-linear geometric calculation. Non-linear physical calculation. Dynamic calculation. Structural optimization.	5
					Solid Modeling Introduction. 3D modeling of castings. 3D modeling of sheet metal parts. 3D modeling of assemblies. Development of 3D models of welded assemblies. 3D design of mechanical structures from profiles. Specific procedures for 3D modeling of plastic parts.	4
					Modeling and simulation in thermodynamics and hydrodynamics Fundamental equations of the dynamics of mechanical systems. Elements of continuous environment mechanics. Elements of thermoelasticity. Calculation of thermal loads in machines and installations. Calculation of gas temperature and instantaneous coefficient of heat transfer from gases to walls. Thermal stress in turbines and boilers.	6

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**MA**	**Modeling and Simulation in Mechanical Engineering**	**1**	**1**	**Modeling Using CATIA** Introduction to CATIA assisted design. Generation of sketch - Sketcher module. Three-dimensional generation of solids - Part Design module. Generation of execution drawings - Drafting module. The assembly drawing - the Assembly Design module.	4
					Ethics and Academic Integrity Academic responsibilities and rights. Intellectual property and copyright. Lack of academic integrity. Plagiarism. Forms of plagiarism. Other forms of lack of academic honesty. Identification of plagiarism. Consequences and sanctions. The social effects of the lack of academic integrity.	1
					Research and Design Practice Choosing the research topic. Bibliographic documentation. Presentation of the current state of knowledge in the field of theoretical modeling, in the technological field and in the field of experimental modeling of the research topic. Establishing scientific research directions. Report of research and design practice.	10
				2	**Complex Modeling in Vibration Mechanics** Mechanical vibration - general considerations. The vibrations of the elastic linear systems with a degree of freedom. Vibrations of elastic linear systems with finite number of degrees of freedom. Vibrations of continuous systems. Approximate methods in vibration study. Vibration analysis of linear gyroscopic systems. Vibration analysis of branched shaft systems using specific finite element method. Small oscillations of a rigid on elastic suspension having a built-in rotor. Small oscillations of a mechanical system with respect to a landmark in uniform rotation. Analysis of the behavior of metallic structures in the dynamic action produced by earthquakes.	4
					Simulation in CATIA CATIA Generative Sheetmetal Design module. CATIA Weld Design module. CATIA Generative Structural Analysis module. CATIA Knowledge Advisor module. The CATIA DMU Kinematics module.	6

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**MA**	**Modeling and Simulation in Mechanical Engineering**	**1**	**2**	**Elements of Standardization** General notions. Guiding principles in standardization. International standardization organizations. The Standardization Association of Romania (ASRO). The European standardization system. Standardization strategy as a factor of economic growth. New fields of standardization in mechanical engineering. Infrastructure for a global market. Application and verification of application of standards. Quality audit. Ethics in the development and use of standards.	6
					Modeling in Solid Edge Solid Edge Overview: User Interface, Solid Edge Modules. Commands for making sketches and profiles. Commands for modeling curves and surfaces. Generation of solid models; editing solids. Drawing with Solid Edge: creating technical product documentation. Obtaining assemblies.	4
					Research and Design Practice Analysis and selection of theoretical study methods, technological research methods and experimental modeling methods applicable in the area of the research topic. Analysis of the capabilities of numerical investigation, technological research capabilities and experimental investigation capabilities at the „Dunarea de Jos" University in Galati, in the field of research topic. Report of research and design practice.	10
			2	**1**	**Simulation of Mechanical Systems** Summary notions. Modeling 3D landmarks. Introducing the Assembly menu. Particularities and specific orders. Realization of dynamic simulations. Interpretation of experimental data. Introducing the Tube and Pipe menu. Modeling of pipeline routes. Using the Frame Generator menu to generate metal structures. Finite element analysis. Introducing the Freeform menu. Modeling complex surfaces.	6

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**MA**	**Modeling and Simulation in Mechanical Engineering**	**2**	**1**	**Advanced Methods of Designing Mechanical Systems** Introductory notions specific to parametric design. Terminology and principles of parametric design. Parametric families of parts. Defining the parameters and the relationships between them. Realization of the model and the parametric family. Introduction to finite element analysis with applications in mechanical engineering. Static analysis. Material assignment; definition of loads and constraints; view the results. Static analysis of assemblies using the finite element method. Assignment of materials; definition of loads and constraints; results analysis. The study of parametric design. Defining the parameters. Material assignment; definition of loads and constraints; Running the simulation; View results. Parametric analysis of design constraints in order to improve the functional characteristics of the components of an assembly. Methods of optimization and testing of model and assembly functional parameters. iCopy technology. Automating the process of copying and positioning similar components in an assembly. iLogic technology. Methods of automating repetitive tasks through logical rules; determining the valid combinations of the parameters that define the geometry of the model. Using logical relationships between design parameters to create parts and assemblies that define multiple product configurations. Bi-directional interaction with Excel spreadsheets. iDrop technology. Internet transfer of models or subassemblies with the ability to be downloaded directly to the Inventor screen by any user. Dynamic simulation of the assembly. Calculation of the dynamic behavior of component parts. Trajectory analysis of the various component parts of the assembly. Realization of diagrams of physical parameters. The method of making the exploded presentation of an assembly and the animation of the assembly of the component parts.	4
					CAM Basics in CATIA CATIA Prismatic Machining module. CATIA Lathe Machining module. Module interface. Setting working parameters. Specific working tools. Generation of the numeric control machine program code. Program verification and simulation.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Mechanical Engineering	**MA**	**Modeling and Simulation in Mechanical Engineering**	**2**	**2**	**Simulation in Solid Edge** Sheet Metal Module. The module interface. Establishing the modeling parameters of sheet metal parts. Specific work tools. Obtaining execution drawings for sheet metal parts. Weldment Module. Specific work tools. Obtaining drawings of welded assemblies. Frame Design Module. Specific work tools. Obtaining frames from standardized profiles. Simulation Module. Establishing parameters for finite element analysis. Toolbars for finite element analysis. Engineering Reference Module. Making shafts, cams, gears, chain and belt transmissions. Motion Module. Notions of structural analysis of mechanisms. The module interface. Creation of common kinematic couples and their simulation.	6
					Research and Design Practice Theoretical modeling of the research topic. Realization of the theoretical model. Theoretical results. Numerical modeling of the research topic. Realization of the numerical model. Numerical results. Making experimental determinations. Analysis and comparison of theoretical and experimental results. Report of research and design practice.	10
					Completion of the Dissertation Paper The dissertation paper will include the following main chapters: formulation of the research theme; presentation of the current state of knowledge in the field of research; presentation of the theoretical, numerical, experimental, technological study methods applied for the development of the research theme; realization of the theoretical, numerical, experimental, technological model within the research theme; case studies corresponding to the dissertation theme; the conclusions of research; bibliographical references.	20
					Methodology of Scientific Research Comparison of theoretical, numerical and / or experimental results. Highlighting the innovative solutions applied in theoretical, numerical, technological and / or experimental modeling. Highlighting the optimal solutions applied in solving the research topic. The conclusions of theoretical, numerical, technological and / or experimental research. Report of research and design practice.	10

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
QUALITY MANAGEMENT IN INDUSTRIAL ENGINEERING - MA						
Industrial Engineering	**MA**	**Quality Management in Industrial Engineering**	**1**	**1**	**Quality Policies and Strategies** The concept of quality. Quality tools. Strategic management. Human resources management. Carrying out the quality function. International quality standards: ISO 9000, ISO 9001, ISO TR 10013: 2003.	5
					Total Quality Management Quality in the traditional model. Total quality. Tools and techniques for improving quality. Quality audit. Quality certification. Quality management documents.	5
					Computerized Measuring Systems Reverse engineering methods and techniques. Data collection and surface identification. Devices and programs for computer-assisted measurement. Choosing the optimal computerized measurement system. Coordinate measuring machines. Measuring devices of the profile projector type. Video measuring devices. Optical measurement systems.	4
					Environmental Audit Audit concept. Environmental audit. The main environmental audit groups. The process of environmental audit. General notions regarding environmental pollution. The European System of Environmental Management and Audit - EMAS. Audit of environmental management systems. Audit of environmental impact assessment. Pollution prevention audit. Case studies on pollution prevention.	5
					Research Project I The design activities are partially supervised. These are carried out in the teaching and research laboratories of the department, under the guidance of a senior lecturer in the master's degree program.	10
					Ethics and Academic Integrity Academic responsibilities and rights. Intellectual property and copyright. Lack of academic integrity. Plagiarism. Forms of plagiarism. Other forms of lack of academic honesty. Identification of plagiarism. Consequences and sanctions. The social effects of the lack of academic integrity.	1

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**MA**	**Quality Management in Industrial Engineering**	**1**	**2**	**Innovation Management** Basics of management knowledge. Research-Development and Innovation. The innovation processes. Quality Function Deployment (QFD). Innovation in Romania and the European Union. Innovation management systems. Intellectual property. Copyright. The technology transfer system and tools. Creativity in the context of innovation management. Sources of innovation.	5
					Quality Systems Assurance and Certification Development of standards regarding quality management systems according to ISO 9001. Certification of quality management systems according to ISO 9001. The context of the organization. Leadership and commitment. Planning. Support. Operation. Performance evaluation. Continuous improvement of the effectiveness of the quality management system. The stages of the certification of the quality management system.	5
					Benchmarking Introduction. Benefits of benchmarking. Presentation of the AHP and ANP methods. Identification of comparison companies. Methods of data collection. Determining the current competitive difference. Design of future levels of performance. Communicating Benchmarking findings. Establishing functional goals. Development of action plans. Implementation of specific actions and monitoring progress. Recalibration. Beyond Benchmarking.	5
					Sustainable Development Evolution of the concept of sustainable development. The challenges. Sustainable development in the context of the European Union. Current sustainable development practices. Sustainable development in developing countries. Use of market mechanisms to stimulate sustainable development.	5
					Research Project II The design activities are partially supervised. These are carried out in the teaching and research laboratories of the department, under the guidance of a senior lecturer in the master's degree program.	10

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**MA**	**Quality Management in Industrial Engineering**	**2**	**1**	**Interactive Design and Processing of Experimental Data** Introduction to statistics in engineering. Processing of statistical data specific to engineering. Error assessment. Notions of probability theory. Laws of distribution. Statistical hypotheses. Verification of statistical hypotheses. Statistical control of processes. Experiment planning. Taguchi method. Signal-to-noise analysis.	5
					Optimization of Manufacturing Processes Optimization concept. Optimization stages. Construction of the optimization processing model. Sources of error in using the model for the decision factor. Basic concepts in model construction. The general mathematical model of an optimization problem. Types of optimization problems. The dimension of optimization problems. Methods for solving optimization problems.	5
					Research Project III The design activities are partially supervised. These are carried out in the teaching and research laboratories of the department.	10
					Product Development Management Purpose and objectives of the course in product development management. Development stages of a product. The Product Lifecycle Management (PLM) concept. PLM implementation models. PLM components that underlying the development of a new product. Benefits of PLM adoption.	5
					Non-Destructive Control Methods Defects and control methods. Control methods specific to welded joints. Control with penetrating liquids. Magnetic control. Ultrasonic control. Control with penetrating radiation. Tightness control.	5
				2	**Research-Design Practice** Specific researches on modeling, simulation design and optimization of material and information flows. Specific researches to evaluate the performances of the industrial flow of production from an economic point of view. Researches regarding the use of the necessary tools to ensure the quality of the production processes in the field of industrial engineering.	15
					Elaboration of Dissertation Thesis	15

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
DESIGN AND SIMULATION IN WELDING ENGINEERING - MA						
Industrial Engineering	**MA**	**Design and Simulation in Welding Engineering**	**1**	**1**	**Statistical Methods Applied in Engineering** Introductory statistics in engineering. Processing of statistical data specific to engineering. Descriptive statistics. Typical selection sizes. Notions of probability theory. Elements of probability theory. Design of Experiments-DoE. Multidimensional optimization of process parameters in engineering experiences. Methods of organizational diagnosis of data obtained during welding processes.	4
					CAD Simulation in Welding Engineering The AutoCAD interfaces. 2D drawing, editing and simulation tools. Dimensioning of 2D drawings. Technological dimensions specific to welding engineering. Parametric dimensioning. Printing, exporting, publishing AutoCAD projects. Drawing primitive objects and manipulating them in 3D space. Automatically obtain projections / sections from the 3D model. Adaptive design and simulation of welded structures.	5
					Welded Ship Structures Component elements of some types of ships. Notions about the shape of the ship. Types of ships. Ship construction. Loads acting on the ship. Maneuvering and lifting systems. Tools and equipment used to assemble the ship. Assembly and welding of prefabricated elements. The technology of assembly and welding of the block sections and the body of the ship. Methods of assembling and welding the body of the ship on the dock.	4
					Design and Certification of Welding Procedures Specification Coordination of welding and welding operations according to standard EN 719. Qualification of welders and welding operators according to current European standards. Specification and qualification of welding procedures according to SR EN ISO 15614. Welding procedures in industry. Technical requirements regarding the authorization of the welders and the approval of the welding procedures used for the execution of the works at the mechanical installations under pressure, at the lifting installations and in the naval field.	6

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**MA**	**Design and Simulation in Welding Engineering**	**1**	**1**	**Research Project I** Elaboration of a research topic in welding engineering, customized for each student, according to the topic of the dissertation work and the coordinating didactic framework: elaboration of a bibliographic study oriented to the approached topic; carrying out a bibliographic synthesis, highlighting the characteristic elements of the theme addressed; designing an experimental program within the theme elaborated with the highlighting of the personal contributions obtained from the research activity; elaboration of the conclusions resulting from the research activity undertaken; writing a scientific report.	10
					Ethics and Academic Integrity Academic responsibilities and rights. Intellectual property and copyright. Lack of academic integrity. Plagiarism. Forms of plagiarism. Other forms of lack of academic honesty. Identification of plagiarism. Consequences and sanctions. The social effects of the lack of academic integrity.	1
				2	**Visualization and Monitoring Systems of Welding Processes** Modern welding procedures in a protective gas environment. Dynamic characteristics of modern welding sources. Solutions and systems for visualizing the electric arc. Sensors and methods for monitoring welding. Acquisition and processing of signals from the welding arc. Virtual instrumentation. Data acquisition systems and virtual programming in LabView. Systems for measuring, visualizing and dimensional control of welded structures, using systems based on 3D digitization. Techniques and methods of artificial intelligence.	4
					Design of Robotic Welding Systems Types of robots and industrial applications. Current trends and perspectives in robotic welding. Electric arc welding systems. Kinematics of industrial robots for welding. Dynamics of industrial robots for welding. Drive systems of industrial robots for welding. The integrated system. Functions of the management system. Programming languages. Elements of programming and simulation of industrial robots in integrated industrial applications. Adaptive programming of industrial robots for welding.	6

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**MA**	**Design and Simulation in Welding Engineering**	**1**	**2**	**Research Project II** Elaboration of a research topic in welding engineering, customized for each student, according to the topic of the dissertation work and the coordinating didactic framework: elaboration of a bibliographic study oriented to the approached topic; carrying out a bibliographic synthesis, highlighting the characteristic elements of the theme addressed; designing an experimental program within the theme elaborated with the highlighting of the personal contributions obtained from the research activity; elaboration of the conclusions resulting from the research activity undertaken; writing a scientific report.	10
					Advanced digital skills Office suite: **MS Word**: General features, Page layout settings, Character and paragraph formatting, Charts and drawings, Tables, References, Mailings, Fields. **MS Excel**: General features, Tables, Illustrations, Charts, Tables and cell formatting, Page layout, Formulas and functions, Data (sorting and filtering): Queries and connections. **MS Powerpoint**: General features, Slides, Presentations, Font and paragraph formatting, Drawings, Transitions and animations	2
					Unconventional Pressure Welding Technologies Embossed welding. Welding in line. Electrical welding between surfaces. Welding with capacitors. Welding in high frequency currents. Electric arc welding. Welding with turning electric arc. Friction welding. Cold welding. Ultrasonic welding. Explosion welding. Diffusion welding. Process parameters. Industrial applications.	4
					Characterization of Welded Joints Identification of methods and techniques for mechanical and metallurgical characterization of welded joints. The thermal effects generated by the welding process and their influence on the behavior of the materials. Estimation of the chemical composition of welds. Estimating the structure of welded joints. Mechanical and metallurgical characterization of welded joints. Case studies: characterization of welded joints in the shipping industry and gas transportation.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**MA**	**Design and Simulation in Welding Engineering**	**2**	**1**	**Modelling and Simulation of Welding Processes** The analytical model of the thermal transfer by conduction, by convection and by radiation in the welding processes. General equations for thermal field analysis. The mathematical model for estimating the areas of participation in the welding of the basic materials. The mathematical model to estimate the chemical composition of the weld at the joining of materials used in welded constructions. Numerical modeling and temperature distribution analysis. Simulation of the welding process of the materials used in welded constructions.	6
					Design of Complex Welded Structures Steel metal constructions and fields of use. Jointing and clamping techniques according to EUROCODE 3 rules. Calculation elements in the design of welded structures. Elements of fatigue calculation of welded structures. Calculation of stresses and strains in welded structures caused by the welding process. Design and calculation of elements of welded structures. Design of the metal columns and calculation of the buckling. Design and calculation of master pipelines.	6
					Research Project III Elaboration of a research topic in welding engineering, according to the topic of the dissertation work: elaboration of a bibliographic study oriented to the approached topic; carrying out a bibliographic synthesis, highlighting the characteristic elements of the theme addressed; designing an experimental program within the theme elaborated with the highlighting of the personal contributions obtained from the research activity; elaboration of the conclusions resulting from the research activity undertaken; writing a scientific report.	10
					Ecotechnologies of Welding The potential for risk at welding. Gases resulting from welding operations. The metallic constituents of the smoke resulting from welding. Elaboration of tubular wires with low smoke emissions. Determination of pollutants at mechanized welding MAG. SEM and EDX analyzes of the microparticles resulted in the MAG mechanized welding. MAG welding with ordinary and environmentally friendly tubular wires on flat ceramic support.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**MA**	**Design and Simulation in Welding Engineering**	**2**	**1**	**Management of Research, Development and Innovation** Terms and definitions specific to the field of Research-Development-Innovation (RDI). Research policies and strategies. Human resources management from research. Evaluation of performance in research. Management of the implementation of the RDI project. Quality management of RDI projects. Financial management of Research-Development-Innovation projects. Risk management.	4
				2	**Research-Design Practice** Elaboration of a research topic in welding engineering, according to the topic of the dissertation work: elaboration of a bibliographic study oriented to the approached topic; carrying out a bibliographic synthesis, highlighting the characteristic elements of the theme addressed; designing an experimental program within the theme elaborated with the highlighting of the personal contributions obtained from the research activity; elaboration of the conclusions resulting from the research activity undertaken; writing a scientific report.	15
					Elaboration of Dissertation Thesis Establishing the content of the dissertation paper specific to the master's degree program. Planning of activities. Elaboration of the current state of research. Research proposed in the activity plan. Processing of data / results obtained in the research plan. Analysis and interpretation of the results obtained in the research plan. Writing the dissertation thesis. Elaboration of the presentation of the dissertation thesis.	15
DIGITAL DESIGN AND MANUFACTURING - MA						
Industrial Engineering	**MA**	**Digital Design and Manufacturing**	**1**	**1**	**3D CAD** General concepts and introductions. Two-dimensional modelling. Modelling solids. Operations performed on the volume of solids. Operations on edges and faces. Incorporation of intelligence in design. Synchronous modelling. General notions of curve and surface modelling. Modeling of assemblies. Different 3D models of the product considered will be made in a specialised drawing program.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**MA**	**Digital Design and Manufacturing**	**1**	**1**	**CNC Machining** Cutting tools and fixturing devices used for CNC cutting machines. CNC machines. Choosing of cutting tools. Machining cylces programming on CNC machines. CNC 3 axis-machines programming. CNC 5 axis-machines programming.	5
					Digital dimensional control Reverse Engineering. Specific reverse engineering methods in manufacturing. Inspection of parts using CMM coordinate measuring machines. Inspection of parts using laser scanning equipments. Robotic 3D measurement systems. Reverse Engineering Applications for assuring the parts quality. Measurement of deformations and displacements, in real time, with the help of the ARAMIS system.	4
					The design of robotic welding systems Overview of industrial robots. Generalities, classification, components, tasks, conception and symbolization of mechanical structures, applications of industrial robots, the use of robots in robotic manufacturing systems. Transmission systems of industrial robots. The mechanical structure of industrial robots used in welding. Gripping devices and industrial applications. Actuation systems of industrial robots. Sensorial systems of industrial robots for welding. Programming and simulation of industrial robots for welding processes.	5
					Ethics and Academic Integrity Academic responsibilities and rights. Intellectual property and copyright. Lack of academic integrity. Plagiarism. Forms of plagiarism. Other forms of lack of academic honesty. Identification of plagiarism. Consequences and sanctions. The social effects of the lack of academic integrity.	1
				2	**Digital design and modelling** Advanced Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM). Aspects of computer-aided design with CATIA. Sketcher module. Part Design module. Generative Shape Design module. Assembly Design module. Mock-up Kinematics module. Machining Module	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**MA**	**Digital Design and Manufacturing**	**1**	**2**	**Additive Manufacturing** Basic principles of additive manufacturing. History and evolution of additive manufacturing technologies. Additive Manufacturing Materials. Generalized additive manufacturing process chain. Thermo-rheological phenomena in additive manufacturing. Additive manufacturing by thermoplastic extrusion. Additive manufacturing by photopolymerization. Additive manufacturing of metals. Additive manufacturing post-processing treatments. Business models with additive manufacturing: opportunities and challenges.	5
					Manufacturing Intelligent Control Manufacturing. Manufacturing activity. Manufacturing activity control. Attributes of intelligent control. AI in activity control. Architecture of intelligent control systems: structure of intelligent control systems; operation of intelligent control systems. Implementation of intelligent management of manufacturing activity.	5
					Manufacturing of structures by thermal assembly Steel metal constructions and fields of use. Jointing and clamping techniques according to EUROCODE 3 rules. Calculation elements in the design of welded structures. Elements of fatigue calculation of welded structures. Calculation of stresses and strains in welded structures caused by the welding process. Design and calculation of elements of welded structures. Design of the metal columns and calculation of the buckling. Design and calculation of master pipelines.	
					Manufacturing of structures by thermo-mechanical assembly Pressure Welding Technologies: Welding in line, Welding in high frequency currents, Rotary arc welding, Friction welding, Cold pressure welding, Ultrasonic welding, Explosion welding, Diffusion welding.	5
			2	**1**	**3D printing of plastic and composite materials** Introduction to 3D printing technologies. History of 3D printing technologies. 3D printing steps. Stereolithography. Selective Laser Sintering. Fused Deposition Modeling. Selective Laser Melting. Laminated Object Manufacturing. Digital Light Processing. Three-Dimensional Printing. PolyJet Printing. Binder Jetting. Solid Ground Curing. Direct Ceramic Jet Printing.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**MA**	**Digital Design and Manufacturing**	**2**	**1**	**Modelling and Simulation of Manufacturing Process by Fusion Joining** Analytic models of conductive, convective and radiation heat transfer. Analytical modelling of temperature field developed by spot thermal source. Goldak model used for simulation of 2D and 3D mobile thermal sources. Mathematical modelling and calculus of metals participation coefficients and chemical composition of weld. Modelling and simulation of fusion joining using stationary thermal source. Analysis of temperature, stress and strain fields. Modelling and simulation of fusion joining using mobile thermal source. Analysis of temperature, stress and strain fields. Modelling and simulation of fusion joining using multiple arc system. Analysis of temperature stress and strain fields.	5
					Industry 4.0 Introduction to Industry 4.0. Data standardization. Industrial communication technologies, sensors, IoT, IIoT and mobile devices with simulation software. Big data, Cloud Computing - concepts and use. Virtual Reality applied in Industry 4.0. Augmented Reality applied in Industry 4.0. Maintenance systems 4.0. Automation and software technologies. The architecture of intelligent manufacturing systems. Artificial intelligence software. Systems with artificial vision. Digital twins. Functional models. Data security. Future trends and challenges for Industry 4.0.	**5**
					Digital Factory Traditional Factory vs. Digital Factory. Digital factory and simulation software. The digital factory and its role in manufacturing. New technologies applied in product development. Cyber-Physical Systems in Industry and Simulation Software. Virtual Reality, Augmented Reality and Mixed Reality applied in the digital factory. The digital factory in manufacturing process control. Industrial communication technologies, sensors, IoT, IIoT and mobile devices with simulation software. Integrated Enterprise Resource Planning platforms for the digital factory. Business Intelligence tools. Analysis and processing of information in a digital factory. Ways to make the decision-making process more efficient. Digitization methods and the main technologies used: applications and selection of systems for reverse engineering. Industry 4.0 vs. Industry 5.0.	**5**

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Industrial Engineering	**MA**	**Digital Design and Manufacturing**	**2**	**1**	**Entrepreneurship** Introduction to entrepreneurship. Market and business environment: customers and competitors. Foundation of a business model: Financial resources, material resources and human resources. Business planning. Business plan structure. Frequent errors in making and presenting the business plan. Marketing strategies. The main financial statements of a company and the relationships between them. Costs and prices. Profit.	5
					Risk management Introduction. Classification of risks. External sources and internal sources of risk. The risk management process. Risk planning. Risk analysis. Establishing risk management strategies. Risk monitoring and control. Risk management within projects. Identifying risks. Risk assessment. Reaction to Risk. Probability-impact matrix technique. Risk modeling. Risk response – risk control.	5
ADVANCED MATERIALS AND INNOVATIVE TECHNOLOGIES - MA						
Materials Engineering	**MA**	**Advanced Materials and Innovative Technologies**	**1**	**1**	**Advanced Methods of Material Investigation** General classification of methods of material investigation. Choice of investigation methods. Scanning Electron Microscopy (SEM). Transmission electron microscopy (TEM). Scanning Auger Microscopy (SAM). X-ray photoelectron spectroscopy (XPS). Ultraviolet photoelectron spectroscopy (UPS). Mass spectrometry. Rutherford reflection spectroscopy (RBS). Elastic Recoil Detection Analysis (ERDA). Proton-induced X-ray emission (PIXE). Morphological analysis of surfaces. Thermal analysis. Analysis of very thin films.	4
					Structural Transformations in Crystalline Materials Structural transformations that occur at the crystallization of materials. Diffusion in crystalline materials. Solid state transformations when heating and cooling steels. Structural transformations and modification of properties in plastic deformation and recrystallization processes. Structural transformations in alloy steels. Hardening by dispersion with hard, thermostable and / or thermoreactive phases. Thermodynamics of mass transfer processes at the dispersed phase / matrix interface. Structural transformations to materials with shape memory.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Technologies**	**1**	**1**	**Materials for Renewable Energy Sources** Materials for the conversion of solar energy into electricity. Materials for solar thermal panels. Materials for combustion cells and for electric batteries. Dielectric and ferroelectric materials. Magnetic materials. Conductive and superconducting materials. Energetic materials with applications in the military field.	4
					Design, Modeling and Simulation of Processing Technologies of Advanced Materials The purpose and importance of mathematical modeling in industrial processes. Classification of types of mathematical models. Parameters of industrial processes. Methodology of analytical mathematical modeling. Methods of characterization of systems (processes). Function and transfer matrix. Experimental mathematical modeling (identification). Creating interactive graphical interfaces. Simulation of industrial processes.	7
					Research-Design Practice Choosing the research topic. Bibliographic documentation. Presentation of the current state of knowledge in the field of theoretical modeling of the research topic. Presentation of the current state of knowledge in the technological field of the research topic. Presentation of the current state of knowledge in the field of experimental modeling of the research topic. Establishing scientific research directions in the research topic. Report of research and design practice.	10
					Ethics and Academic Integrity Plagiarism. Ethical issues of research and publication. Forms of plagiarism. Corruption - concept, prevention, combating. Professional ethical codes. Vulnerability and risk in school and university. Ethical issues and the internet.	1
				2	**Research and Design Practice** Analysis and selection of theoretical study, technological research and experimental modeling methods applicable in the area of the research topic. Analysis of the capabilities of numerical investigation, technological research and experimental research at the „Dunarea de Jos" University of Galati, in the field of research topic. Report of research and design practice.	10

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Technologies**	**1**	**2**	**Nanostructured Materials** Introduction. Classification of nanomaterials. Synthesis of nanomaterials. Theoretical considerations on the advanced finishing of the structure of the metallic materials by severe plastic deformation. Severe plastic deformation by HPT method. Theoretical principles of granulation finishing by pressing through a constant section angular channel - ECAP. Theoretical principles of granulation finishing by severe plastic deformation using repeated lamination in the package - ARB. Severe plastic deformation of hard deformable materials. HSHPT method.	4
					Thin Films Multifunctional thin films. Methods of manufacturing thin films: physical methods of vapor phase deposition, chemical methods of vapor phase deposition, chemical methods of solution deposition. Methods for characterizing thin films. Types of multifunctional thin films.	6
					Advanced Composites and Sintered Materials Advanced methods for obtaining metallic powders. Powder sizing. Properties of superfine powders. Advanced processes for forming powder products. Sintering of powder products. Processes for obtaining advanced composite materials by powder metallurgy. Characterization of sintered products.	6
					Advanced Materials for Machine Manufacturing and Aeronautics Ferrous alloys used in the automotive and aerospace industry. Alloys based on aluminum, copper, titanium or magnesium with special properties used in the automotive and aerospace industry. Composite materials used in the automotive and aerospace industry. Polymer materials used in the automotive and aeronautical construction industry.	4
			2	**1**	**Expertise of Metallic Materials** Advanced metallic materials and key generic technologies. The science of obtaining and advanced processing of ferrous and non-ferrous metallic materials. Metal glass, metal foam, metal nano powder. Optimal selection and design of advanced metal materials. Assessing the impact of new metallic materials and advanced processing technologies on the environment.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Technologies**	**2**	**1**	**Biomaterials** Biomaterials - definition, characterization. Metal materials used for implants. Polymer materials used for implants. Ceramic materials used for implants. New biocompatible materials for custom implants manufactured by Selective Laser Sintering (SLS) and by Selective Laser Melting (SLM). New biocompatible materials manufactured by Fused Deposition Modeling (FDM).	7
					Functional Polymeric Materials Types of polymeric materials. Processes for obtaining polymers. Structure of polymers. Mechanical behavior of polymers. Mechanisms of deformation and increase of polymer resistance. Crystallization, melting and glass transition. Processes for moulding polymer products. Polymer processing equipment.	4
					Innovative Technologies for Surface Modification and Protection Metals and metal surfaces. Metal-solution interfaces. Kinetics and mechanism of electrodeposition. Nucleus and layer growth models in electro crystallization processes. Effect of additives in the kinetics and electro crystallization mechanism. Structure and morphology of nano- and micro-composite surfaces. Influence factors in the process of functionalization of surfaces by electrochemical methods. Corrosion and tribocorrosion behavior of functional surfaces.	4
					Research and Design Practice Theoretical modeling of the research topic. Realization of the theoretical model. Theoretical results. Numerical modeling of the research topic. Realization of the numerical model. Numerical results. Technological modeling of the research topic. Realization of the technological model. Technological results. Experimental modeling of the research topic. Realization of the experimental model. Results on experimental model. Transposition of experimental results from model to nature. Report of research and design practice.	10

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Technologies**	**2**	**2**	**Research and Design Practice** Comparison of theoretical, numerical, technological and/or experimental results. Highlighting the innovative solutions applied in theoretical, numerical, technological and/or experimental modeling. Highlighting the optimal solutions applied in solving the research topic. The conclusions of theoretical, numerical, technological and/or experimental research. Future directions applicable in solving the research topic. Report of research and design practice.	10
					Elaboration of Dissertation Thesis	20
ENVIRONMENTAL QUALITY AND SUSTAINABLE DEVELOPMENT - MA						
Environmental Engineering	**MA**	**Environmental Quality and Sustainable Development**	**1**	**1**	**Soil Chemistry, Pollution and Preservation** General notions about soil. Soil chemistry. Soil pollution and degradation. Methods of soil depollution. Ecological soil conservation and restoration.	5
					Generation, Prevention and Processing of Polluting Emissions Powdered materials involved in air and gas currents. Persistent organic pollutants. Dioxins and furans. Prevention, reduction, and control of persistent organic pollutants. The emissions of oxides of sulfur, nitrogen and carbon. Heavy metals.	5
					Sustainable Development and Product Life Cycle Concept of sustainable development. Sustainable development in the context of the E.U. Current sustainable development practices. Use of market mechanisms to stimulate sustainable development. Life cycle impact assessment. Information management in life cycle analysis. Introducing life cycle assessment in companies. Life cycle analysis of systems. Management tools for the product life cycle.	4
					Research and Design Practice Choosing the research topic. Bibliographic documentation. Presentation of the current state of knowledge in the field of theoretical modeling, in the technological field and in the field of experimental modeling of the research topic. Establishing scientific research directions in the research topic. Report of research and design practice.	10

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**MA**	**Environmental Quality and Sustainable Development**	**1**	**1**	**Ethics and Academic Integrity** Plagiarism. Ethical issues of research and publication. Forms of plagiarism. Corruption - concept, prevention, combating. Professional ethical codes. Vulnerability and risk in school and university. Ethical issues and the internet.	1
					Water Management Water management. Water quality. Processes used to treat wastewater. General principles of water management. The impact of wastewater on the environment.	5
				2	**Waste Monitoring and Management** Types of waste. Collection and transport, monitoring, and management procedures. Waste treatment and analysis methods. Waste avoidance and disposal methods. Dangerous waste. End-of-life vehicles. Waste from electrical and electronic equipment. Integrated waste management.	5
					Integrated Management of Environment, Quality and Safety Total quality management. ISO model for integrated management. ISO 14001 model for environmental management. ISO 45001 model for Occupational health and safety management systems. Integrated system of management of the environment, quality, and safety of work. Audit and certification of the system of management of the environment, quality, health, and occupational safety.	5
					Research and Design Practice Analysis and selection of theoretical study, technological research, and experimental modeling methods applicable in the research topic. Analysis of the capabilities of numerical investigation, technological research and experimental research at the „Dunarea de Jos” University of Galati, in the field of research topic.	10
					Environmental Technology Concept of "Cleaner Production". Government policies and strategies for adopting "cleaner" practices in industry. Technological innovation and "Cleaner production". Prevention of pollution by eco-design of technological processes. Ecotechnological analysis of the technological process. “Clean” process technologies for limiting environmental pollution. Treatment, recovery and ecological disposal of waste, including hazardous waste. Renewable energy sources.	5

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Environmental Engineering	**MA**	**Environmental Quality and Sustainable Development**	**1**	**2**	**Political, Social and Cultural Aspects in Environmental Engineering** Politico-social and cultural aspects in environmental engineering. Environmental policy in the EU. Environmental policy in Romania. The current situation of the socio-economic system and the natural capital of Romania. National objective.	5
ADVANCED MATERIALS AND INNOVATIVE MEDICAL TECHNOLOGIES - MA						
Materials Engineering	**MA**	**Advanced Materials and Innovative Medical Technologies**	**1**	**1**	**Advanced materials investigation methods** General classification of materials investigation methods. Choice of investigation methods. Scanning Electron Microscopy (SEM). SEM under environmental conditions (ESEM). X-ray energy dispersive spectroscopy (EDS). Transmission electron microscopy (TEM). Bright and dark field images. High Resolution Transmission Electron Microscopy (HRTEM). Morphological analysis of surfaces. Scanning probe microscopy (SPM). Atomic force microscopy (AFM). Thermal analysis. Thermogravimetric analysis (TGA). Differential scanning calorimetric analysis (DSC). Analysis of thin films. UV-VIS spectroscopy. Electrical analyses	4
					Structural transformations in crystalline materials Structural transformations that occur during the crystallization of materials. The thermodynamic conditions of crystallization. The mechanism of crystallization, Phenomena related to crystallization. Diffusion in crystalline materials. Solid state transformations during heating and cooling of steels. Structural transformations and the modification of properties in the processes of plastic deformation and recrystallization. Mechanisms of plastic deformation. Plastic deformation of single crystals. The mechanism of plastic deformation of polycrystalline metallic materials. Ecru and anisotropy. The influence of temperature on the structure and properties of cold plastic deformed metallic materials. Cold and hot plastic deformation. Structural transformations in alloy steels. The influence of alloying elements on the critical points of iron. The interaction of alloying elements with carbon. The influence of alloying elements on the structural transformations in the solid state of steels. Dispersion hardening with hard, thermostable and/or thermoreactive phases. Thermodynamics of mass transfer processes at the dispersed phase/matrix interface. Structural transformations in materials with shape memory.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Medical Technologies**	**1**	**1**	**Visualization techniques for medical imaging** Visualization and processing of medical images. Introductory notions. Fields of application. Examples of applications for viewing medical images. The mathematical model of the image. Sampling and quantization of medical imageS. Image file types. Graphic formats for medical imaging. Image enhancement techniques. Binarization. Negation. Cropping images. Image histogram. The histogram equalization algorithm. Basic geometric transformations: translation, rotation, mirroring. Noise in images: uniform distribution, Gaussian distribution, salt and pepper, other types of noise. Image filtering. Linear and non-linear filters. Morphological operations. Basic morphological algorithms. Contour extraction. Filling regions. Segmentation of medical images. Region-based segmentation. Contour-oriented segmentation. Neural techniques regarding digital image processing. Applications and methods used in the diagnosis of medical conditions by viewing, analyzing and extracting information from medical images.	4
					Modeling and simulation of technologies in the biomaterials industry Modeling and Simulation, introductory concepts. The importance of modeling and simulation in biomaterial processing technologies. Advantages of simulation. Linear or non-linear models for carrying out the simulation. Deterministic or probabilistic models for carrying out the simulation. Dynamic models for carrying out the simulation. Functional characterization of systems for modeling and simulation of biomaterials processing technologies. Input-output models. Input - state - output models. Basic notions regarding the use of the MATLAB program package in the modeling and simulation of biomaterials processing technologies. Presentation of the MATLAB interface. Instructions and control functions in MATLAB. Numerical calculation with MATLAB. Graphics in MATLAB. Creation of interactive graphic interfaces in MATLAB for simulating the processing of metallic biomaterials, used in medicine, by predicting specific properties. Creation of a mathematical model in order to simulate, with the help of MATLAB, the processing technologies of polymeric biomaterials, used in medicine, by predicting specific properties.	6

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Medical Technologies**	**1**	**1**	**Research-design practice** Choosing a research topic. Theoretical documentation on the current state at national and international level, consulting recent bibliography in the field (last 10 years), calling on information from different sources (libraries, different databases, etc.). Analysis of ethical and copyright issues within the proposed research theme. Development of a research direction based on the scientific conclusions drawn. Identification and description of materials and methods used. Visits to industrial units with the aim of collecting data and harmonizing them with the chosen research topic Establishing the type of measurements, developing the experimental model. Preparation of measurements. Making measurements. The processing of experimental data, the interpretation of the results and their reporting to other results from the specialized literature. Modeling/optimization of the technological process. Creating a synthetic presentation with the results obtained.	10
					Ethics and academic integrity Scientific research. Standardization. University ethics. Academic integrity. Plagiarism. Identification of plagiarism. Programs for identifying plagiarism.	2
				2	**Research-design practice** Choosing a research topic. Theoretical documentation on the current state at national and international level, consulting recent bibliography in the field (last 10 years), calling on information from different sources (libraries, different databases, etc.). Analysis of ethical and copyright issues within the proposed research theme. Development of a research direction based on the scientific conclusions drawn. Identification and description of materials and methods used. Visits to industrial units with the aim of collecting data and harmonizing them with the chosen research topic Establishing the type of measurements, developing the experimental model. Preparation of measurements. Making measurements. The processing of experimental data, the interpretation of the results and their reporting to other results from the specialized literature. Modeling/optimization of the technological process. Creating a synthetic presentation with the results obtained.	10

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Medical Technologies**	**1**	**2**	**Nanostructured materials** Introduction. Classification of technologies. Definition of nanotechnologies and nanomaterials. Applications of nanomaterials. Nanomaterials and nanostructures with functional properties. Techniques for obtaining nanostructured materials. Sol-gel techniques, PVD technique, Chemical methods from solution. Techniques for obtaining nanostructured materials. Theoretical considerations on the advanced finishing of the structure of metallic materials by severe plastic deformation. Granulation fragmentation by severe plastic deformation. Severe plastic deformation techniques. The method of obtaining joints with ultrafine structure by severe plastic deformation. Methods of severe plastic deformation by chipping. SPD by ECAP with rotary tools. Severe plastic deformation by reversible rolling. Severe plastic deformation by transverse-radial lamination between rolls. Severe plastic deformation of cylindrical parts and those. Severe plastic deformation by the HPT method. Calculation of the degree of deformation in the HPT process. Variation of homogeneity on a disc processed by the HPT method. The influence of the applied pressure on the microstructure. The influence of the number of rotations and implicitly the imposed deformation. The influence of deformation on ecruization. Theoretical principles of granulation finishing by pressing through an angular channel with constant section – ECAP. ECAP dies. Plastic deformation paths in the ECAP process. Calculation of the degree of deformation in the ECAP process. Granulation refinement mechanism in case of ECAP. Obtaining nanostructures by the ECAP process. Theoretical principles of granulation finishing by severe plastic deformation using repeated lamination in pacher-ARB. Calculation of the parameters of the ARB process. Calculation of the number of layers and the thickness of the layers. Calculation of the degree of deformation. The influence of the number of ARB passes on the structure of metallic layers. Severe plastic deformation of hard-to-deform materials. HSHPT method. Severe plastic deformation of copper-based shape memory alloys, of iron-based shape memory alloys, of magnesium-based shape memory alloys, and of hard-to-deform magnetic alloys.	6

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Medical Technologies**	**1**	**2**	**Implantology and intelligent prosthesis** Introduction to oral implantology. Anatomical notions of the dento-maxillary apparatus correlated with the prosthetic field receiving implants. Anatomy of the dentate and edentate jaw, anatomy of the dentate and edentate mandible. Biomechanics of the dento-maxillary apparatus. Diagnosis, indications and contraindications in oral implantology. Bone supply in implantology. Biomaterials used in oral implantology. Classification of oral implants. Tissue integration of oral implants. Endoosseous implant screw. Mini-implants and their indications. Tissue healing and integration of implants. Bone reconstruction of deficient alveolar ridges. The indications of bone reconstruction and the methods of its realization. Prosthetic reconstruction on implants.	6
					Controlled release systems of bioactive principles Fundamental concepts in controlled release. Controlled release systems for oral drugs. Nasal drug delivery systems. Ocular drug delivery systems. Oral drug release systems. Transdermal drug delivery systems. Parenteral drug delivery systems. Intravaginal and intrauterine drug release systems. Dispersed controlled drug release systems. Systems activated by feed-back mechanisms. Release systems activated by physical processes. Preprogrammed active principle release systems. Systems with controlled diffusion of active principles. Osmotic drug release systems. Controlled release polymer systems.	4
					Medical biotechnologies Biotechnology – definitions, evolution, applications. The stages of developing biotechnological processes. Microorganisms used in biotechnology. Formulation of culture media. Design and optimization of culture environments. Sterilization processes. Installations for continuous sterilization of culture media. Sterilization of equipment and machinery. Sterile transfusion systems. Air sterilization. Fermentation processes. Growth curve of microorganisms. Thermodynamic aspects of fermentation processes. Kinetics of batch fermentation processes. Kinetic models for the rate of product formation. Kinetic models for the growth rate of cell mass.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Medical Technologies**	**2**	**1**	**Smart biomaterials** Biomaterials – general notions. Smart biomaterials. History, classification. The structure of biomaterials. Microstructure of materials. Evaluation methods. Properties of biomaterials. Physical properties: electrical, magnetic, optical and thermal. Mechanical properties. Interaction properties. Biocompatibility of materials. Polymeric biomaterials. Methods of obtaining. Features and peculiarities. Specific properties. Biomedical applications of polymeric biomaterials. Metallic biomaterials. Methods of obtaining. Features and peculiarities. Specific properties. Biomedical applications of metallic biomaterials. Ceramic and composite biomaterials. Methods of obtaining. Features and peculiarities. Specific properties. Biomedical applications of ceramic and composite biomaterials. Smart biomaterials. Materials with shape memory. Piezoelectric materials. Electro and magnetostrictive materials. Electro and magnetorheological materials. Biomimetic materials. Nanomaterials. Characteristics. Methods of obtaining nanomaterials. Biomedical applications.	5
					Artificial intelligence and machine learning The basics of artificial intelligence. The difference between artificial intelligence and machine learning. Concepts and methods of artificial intelligence. The structure and technology of artificial intelligence-based systems (structural elements, development methodology) and knowledge representation models (requirements, characteristics, facts, rules, semantic networks, frameworks, logic-based representation). Computational Sustainability: Artificial Intelligence in engineering, applications, implications and limitations. Current Applications of Artificial Intelligence. Imaging and validation of technologies based on artificial intelligence. Systems, algorithms and methods for diagnostics in medical engineering (cardiology, endocrinology, nephrology, gastroenterology, neurology, computational cancer diagnosis in histopathology). Artificial intelligence systems to personalize treatment and design the right treatment plan for the patient. Ethical implications of applying artificial intelligence in engineering.	7

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Medical Technologies**	**2**	**1**	**Innovative surface modification and protection technologies** The importance of knowing corrosion phenomena. Metals and metal surfaces. The structure of metals in bulk. Processes on the surface of metals. Wetting capacity of surfaces. Biocompatibility surface phenomenon for biomaterials. The impact of contact angle on bicompatibility. General notions of electrochemistry. Electrode reactions. Electrolysis cell. Laws of electrolysis. Electrical parameters useful in electrochemistry. Electrode potentials. Surface processes and electrochemistry of implants. Formation of the metal-solution interface. Electrochemical corrosion. Mechanism of electrochemical corrosion. Anodic processes. Cathodic processes. Corrosion cells and reactions. Thermodynamics of corrosion. Corrosion kinetics. General concept on implant corrosion. Methods of determining and expressing the corrosion speed. Electrodeposition kinetics and mechanism. Current – potential relationship. The Butler Volmer equation. The influence of mass transport on electrode kinetics. Study techniques of electrodeposition processes. Models of nucleation and layer growth in electrocrystallization processes. Nucleation. Formation of monolayers. Formation of multilayers. Laws and mechanisms of layer growth. Characterization of calcium phosphate thin coating. IN VITRO and IN VIVO evaluation of calcium phosphate thin coatings. Pulsed laser deposition of calcium phosphate thin coatings. Ion beam techniques for thin calcium phosphate deposition. Coating with calcium phosphate by spraying. Advanced processes of surface functionalization through nano and micro structured composite layers obtained by electrodeposition. Influence factors in the process of surface functionalization by electrochemical methods. Current density. Concentration of dispersed phases. The type of metal matrix. Mathematical modeling of influence parameters – co-deposition equations. Functionalization of the surface of materials and biomaterials through the controlled growth of nanoporous oxide layers. Anodizing. Specific parameters. Specific electrolytes for the formation of nanoporous oxides. Corrosion, biocorrosion and tribocorrosion behavior of functional surfaces. Comparison of the corrosion resistance of nanocomposite layers Polarization curves.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Medical Technologies**	**2**	**1**	**Advanced technologies for processing biomaterials** Biomaterial nanostructuring technologies to improve the properties of implantable systems. Nanostructured materials. Definition of nanotechnologies and nanomaterials. Applications of nanomaterials. Nanomaterials and nanostructures for biomedical applications. Nanomaterials and nanostructures with functional properties. Nanopores (in membranes). Nanocomposites; Nanostructures (nanotubes). Nanoparticles (nanopowders). Nanostructured (photonic crystals). Magnetic nanomaterials. Nanostructured polymers. Obtaining fine and ultrafine structures in volume. Technologies of severe plastic deformation of biomaterials. ECAE technology - Equal Channel Angular Pressing. Theoretical principles of granulation finishing by pressing through an angular channel with constant section – ECAP. ECAP dies. Plastic deformation paths in the ECAE process. Calculation of the degree of deformation in the ECAP process. Granulation refinement mechanism in case of ECAP. Obtaining nanostructures by the ECAP process. Severe plastic deformation by the High Pressure Torsion method. The principle of the HPT method. Calculation of the degree of deformation in the HPT process. Variation of homogeneity on a disc processed by the HPT method. The influence of the applied pressure on the microstructure. The influence of the number of rotations and implicitly of the imposed deformation. The influence of strain on roughening. HSHPT Technology Applied to Biocompatible Alloys - High Speed High Pressure Torsion. Presentation of the method. Deformation of biocompatible copper-based shape memory alloys. Severe plastic deformation of biodegradable magnesium-based alloys. Severe plastic deformation of biocompatible titanium-based alloys. Advanced technologies of additive processing of biomaterials. Extrusion of biomaterials for 3D printing of soft and rigid anatomical models (FDM technology). DED- Direct Energy Deposition technologies. Material Jetting Technologies (Polyjet) Additive technologies with powders. Additive technologies based on liquid materials (SLA, DLP Technologies) Technologies for the processing of biomaterials intended for bone tissue engineering. SL-Selective Laser technology – for melting and sintering. Electron Beam technology for melting metallic biomaterials.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Medical Technologies**	**2**	**1**	**Research-design practice I** Choosing a research topic. Theoretical documentation on the current state at national and international level, consulting recent bibliography in the field (last 10 years), calling on information from different sources (libraries, different databases, etc.). Analysis of ethical and copyright issues within the proposed research theme. Development of a research direction based on the scientific conclusions drawn. Identification and description of materials and methods used. Visits to industrial units with the aim of collecting data and harmonizing them with the chosen research topic. Establishing the type of measurements, developing the experimental model. Preparation of measurements. Making measurements. The processing of experimental data, the interpretation of the results and their reporting to other results from the specialized literature. Modeling/optimization of the technological process. Creating a synthetic presentation with the results obtained	10
				2	**Research-design practice II** Choosing a research topic. Theoretical documentation on the current state at national and international level, consulting recent bibliography in the field (last 10 years), calling on information from different sources (libraries, different databases, etc.). Analysis of ethical and copyright issues within the proposed research theme. Development of a research direction based on the scientific conclusions drawn. Identification and description of materials and methods used. Visits to industrial units with the aim of collecting data and harmonizing them with the chosen research topic. Establishing the type of measurements, developing the experimental model. Preparation of measurements. Making measurements. The processing of experimental data, the interpretation of the results and their reporting to other results from the specialized literature. Modeling/optimization of the technological process. Creating a synthetic presentation with the results obtained	20

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Materials Engineering	**MA**	**Advanced Materials and Innovative Medical Technologies**	**2**	**2**	**Elaboration of dissertation work** Choosing a research topic. Theoretical documentation on the current state at national and international level, consulting recent bibliography in the field (last 10 years), calling on information from different sources. Analysis of ethical and copyright issues within the proposed research theme. Development of a research direction based on the scientific conclusions drawn. Identification and description of materials and methods used. Visits to industrial units with the aim of collecting data and harmonizing them with the chosen research topic. Establishing the type of measurements, developing the experimental model. Preparation of measurements. Making measurements. The processing of experimental data, the interpretation of the results and their reporting to other results from the specialized literature. Modeling/optimization of the technological process. Creating a synthetic presentation with the results obtained.	10
CONCEPTS IN DESIGN AND OPERATION OF VEHICLES - MA						
Automotive Engineering	**MA**	**Concepts in Design and Operation of Vehicles**	**1**	**1**	**CAD/CAM** CATIA Generative Sheetmetal Design module. CATIA Weld Design module. CATIA Generative Structural Analysis module. CATIA Knowledge Advisor module. The CATIA DMU Kinematics module. CATIA Prismatic Machining module.	6
					Basics of experimental research of road vehicles Measurement of displacements and speeds. Measuring temperatures. Measurement of unit efforts and deformations. Pressure and flow measurement. Measurement of forces. Measurement of rotation moments. Techniques for measuring and evaluating emissions. Measurement errors.	4
					Special road transport Transport logistics. Management of transport fleets. International road transport legislation. The classification of dangerous goods according to Agreement concerning the International Carriage of Dangerous Goods by Road (ADR). Refrigeration installations for road transport. Road transport for cryogenic fluids. Heavy and oversized transport.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**MA**	**Concepts in Design and Operation of Vehicles**	**1**	**1**	**Electrical and electronic systems for vehicles** Fundamental physics concepts. Electric Motors (DC and AC moors). DC to DC converter and DC to AC inverters. 48-Volt Mild Hybrid system. Batteries for electric vehicles. Battery management system (BMS). Vehicle wiring harness. Communication networks for automotive and industry (CAN Bus, LIN Bus, and Modbus RS485).	4
					Ethics and Academic Integrity Academic responsibilities and rights. Intellectual property and copyright. Lack of academic integrity. Plagiarism. Forms of plagiarism. Other forms of lack of academic honesty. Identification of plagiarism. Consequences and sanctions. The social effects of the lack of academic integrity.	2
				2	**Comfort systems for vehicles** Thermal comfort systems. Bizonal and trizonal heating. Heat pumps for vehicles. High-performance refrigeration systems. Car heating systems in the seats. Driving assistance systems	5
					Current automotive diagnostic methods and technologies Diagnostic parameters. Main features and aspects. Diagnostics of the motor mechanism and the distribution mechanism. Diagnosing the lubrication system Diagnostics of the power supply system. Diagnostics of the fuel injection system Diagnostics of the steering system and the cooling system. Diagnostics of the braking and running system	5
					Energy conservation in transportation Implementing energy efficiency measures and shifting to alternative fuels and electric drive vehicles. Attributes of the main alternative fuels applicable to transportation. Types of electric drive vehicles. Primary energy efficiency strategies associated with freight transport, mass transit systems, and passenger cars and light trucks: improving engine and vehicle designs; increasing the load factor for a given transport mode; ensuring traffic and usage patterns are optimal; shifting from less to more efficient transportation modes; reducing the need for transport; and implementing electric drive systems an duse of alternative fuels.	4

Study domain	Level (BA/MA)	Study programme	Study year	Semester	Course title and brief description	Credit units
Automotive Engineering	**MA**	**Concepts in Design and Operation of Vehicles**	**1**	**2**	**Advanced digital skills** Office suite: **MS Word**: General features, Page layout settings, Character and paragraph formatting, Charts and drawings, Tables, References, Mailings, Fields. **MS Excel**: General features, Tables, Illustrations, Charts, Tables and cell formatting, Page layout, Formulas and functions, Data (sorting and filtering): Queries and connections. **MS Powerpoint**: General features, Slides, Presentations, Font and paragraph formatting, Drawings, Transitions and animations	2
			2	**1**	**Hybrid and electric vehicles** Vehicles with electric and hybrid propulsion, the solution for reducing pollution and fuel consumption. General objectives and design specifications for electric and hybrid vehicles. Accumulators used on electric and hybrid vehicles. Command and control of hybrid electric vehicles. Electric motors used for the propulsion of electric and hybrid electric vehicles.	5
					Modeling and simulation of a vehicle system *iPart Concept*. Create an iPart configuration (define the parameters and properties that must change for each part). *iFeature Concept*. Create an iFeature from an iPart or from a set of features and specify the geometry that is used to position it on a part. *iAssembly Concept*. Create assembly families that differ by size, the number of components, or other variables. *iCopy*. Automate the process of copying and positioning similar components in the main assembly.*iLogic.* Use iLogic to standardize and automate design processes and configure virtual products. *Dynamic Simulation*. Dynamic simulation adds to that functional mechanism the dynamic, real-world influences of various kinds of loads to create a true kinematic chain.	5
					Welding Technologies applied in Automotive Industry Advances and perspectives in welding processes development. Activation energy methods. Models of fusion and pressure welding. Gas Metal Arc Welding (GTAW). Tungsten Inert Gas (TIG). Plasma welding and cutting. Laser and hybrid laser welding. Cold welding. Pressure welding. Friction Stir Welding (FSW). Soldering and Brazing.	5

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Automotive Engineering	**MA**	**Concepts in Design and Operation of Vehicles**	**1**	**2**	**Navigation systems for motorvehicles** Intelligent navigation systems architecture, examples, classification; Hardware and software components of navigation systems; Navigation systems with artificial vision; Terrestrial and satellite communication systems. Wireless Mesh Network. Cloud, Big data; Aspects regarding data encryption and security; Navigation systems based on GPS/Glonass/Galileo/GSM/GPRS communications; Dedicated navigation equipment and software based on GPS; Smart markers and roads. Lidar scanners and 360 cameras; ADAS systems. Side & Lane Assist. Navigation systems using V2V, vehicle-to-vehicle communications. Navigation systems assisted by telematics systems; Car fleet management. Tracking platforms. Intelligent navigation systems used at night "night vision"; Navigation systems developed for self-driving vehicles; Intelligent driverless vehicles.	4