

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units				
Electrical engineering	BA	Electromechanics (EM)	I	1	Linear algebra, analytic geometry and differential	5				
					Mathematical Analysis	6				
					Physics	6				
					Computer Programming and Programming Languages I	4				
					Computer-Aided Graphics I	2				
					Applied Informatics	4				
					English language	2				
					Physical Education and Sport	1				
				2	Advanced Mathematics	5				
					Chemistry	4				
					Mechanics	4				
					Computer-Aided Graphics II	2				
					Computer Programming and Programming Languages II	5				
					Introduction to electrical engineering	5				
					English language	2				
					Physical Education and Sport	1				
					Optional 1.1	2				
					Optional - 1 semester (choose one discipline of the two disciplines of package A)					
					Package A					
					1. Communication					
2. Ethics and academic integrity										
Electrical engineering	BA	Electromechanics (EM)	II	3	Machine organs and mechanisms	3				
					Probability theory and mathematical statistics <i>Brief description:</i> Elements of probability theory; Random variables; The numerical characteristics of a random variable; Estimation of the parameters of the distribution laws; Estimation theory.	4				
					Electric Circuits Theory <i>Brief description:</i> Signals and elements of linear electrical circuits; Linear circuits of c.c. permanently; Linear circuits of c.a. permanently sinusoidal; Linear circuits in periodic non-sinusoidal permanent regime; Three-phase circuits in permanent sinusoidal and non-sinusoidal periodic regime; Linear circuits with parameters concentrated in transient regime; Non-linear circuits in permanent regime.	6				
					Analogic and Digital Electronics	4				
					Electrotechnical Materials	5				

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					Brief description: Notions of material physics; Electrical conduction; Electric polarization; Dielectric material; Conductive materials; Semiconductor materials; Magnetization; Magnetic material.	
					Numerical Methods	4
					Sources of Energy Brief description: Power and electricity; General notions about the power system; Finished energy sources; Renewable energy sources.	3
					Physical Education and Sport	1
					Electromagnetic Field Theory Brief description: Electrostatic field; electrostatic potential theory; Stationary electric field. Continuous current in massive conductors; Stationary magnetic field; vector potential theory; The quasi-stationary electromagnetic field; Non-stationary electromagnetic field. Electromagnetic waves, electromagnetic radiation.	5
					Systems Theory and Automatic Control Brief description: Fundamentals of automated systems; Mathematical modeling of signals; Functional mathematical models of smooth structural systems; Temporal analysis of SRA in functional representation; SRA stability; Analysis of the stationary regime of the SRA; Analysis of the dynamic regime of the SRA; Design of linear, monovvariable, smooth SRAs.	5
				4	Electrical Machines 1 Brief description: Introductory concepts; Constructive and functional peculiarities of electrical machines; General problems of AC machines; Mathematical modeling - in quasi-stationary / stationary regime - of electrical machines; Tracing the functional and performance characteristics of electrical machines.	4
					Static power converters Brief description: Semiconductor of power, achievements, performances and applications; Non-controlled AC converters: power diode, rectification principles, rectifier schemes, source and load interfaces; Controlled AC-DC converters: SCR thyristor, rectifier schemes, phase control, source and load interfaces, semiconrolled converters, 4 quadrant converters; Power semiconductors for switching converters: GTO, BJT, MOSFET, IGBT et al; 1, 2 and 4 dc dc-dc converters with current and voltage output. PWM command. Source and load interfaces; DC-AC converters, inverters: modulation principles, mono- and three-phase inverters, voltage and current inverters, forced-off	5

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					inverters, PWM rectifiers. Interfaces with the load and the source; Direct-to-AC converters: AC voltage inverters, cycloconverters.	
					Quality and Reliability Brief description: Product quality; Reliability indicators. Reliability in the context of systems theory; Modeling of equipment wear; Distribution laws associated with failure mechanisms; The principles of Bayesian estimation and their applications in reliability. Reliability models: global models and structural models; Renewal of equipment. Renewal processes. Renewal strategies; Structural reliability. Functional model and logical model; Methods for analyzing the reliability of equipment based on logical models; Model of Markov processes. Failure shaft model; Deterministic and probabilistic methods for generating test sequences. Procedures for conducting a test; Self-testing equipment. Control circuits used in self-test equipment; Maintenance of electrical equipment; Reliability tests.	2
					Electrical and Electronic Measurements Brief description: Introduction to metrology; Analog measuring instruments; Measurement of electrical quantities: voltages, currents, powers, energies, impedance, resistance, inductance, capacity; Signal measurement and analysis; Magnetic measurements.	4
					Physical Education and Sport	1
					Domain practice	4
Electrical engineering	BA	Electromechanics (EM)	III	5	Programmable Micro-Controllers and Regulators Brief description: Block diagrams of microprocessor and microcontroller systems; Types of microcontrollers and DSPs used for programmable automatons; Types of industrial wired communication systems, related protocols and specific extension modules; Industrial Ethernet wired network; Wireless communication systems; TCP / UDP / IP protocol used for applications through GPRS; Program packages for programmable controllers; The M2M Power programming package used for GSM modems.	5
					Electrical Equipment Brief description: Calculation of currents driven by electrical apparatus and equipment in connection processes; Thermal processes and applications in electrical apparatus; The electrodynamic forces and stresses in electrical apparatus and equipment; Processes and requests of the electric arc in the switching devices; Principles of electric arc extinguishing chambers; Constructive elements of electrical apparatus; Distribution, control, control	6

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					apparatus. Electrical Machines 2 Brief description: The dynamic regimes of the DC machine; The dynamic regimes of the asynchronous machine; Dynamic speeds of the synchronous machine; Dynamic speeds of the electric transformer; Modeling of the dynamic regimes of DC and AC machines.	6
					Transducers Interfaces and Data Acquisition Brief description: Transducers. Structure. Sensors. Adapter. Dedicated transducers; Process interface system. The structure of the interface system with the process; Subsystem of numerical inputs; The subsystem of analog inputs; Subsystem of analog outputs; Subsystem of digital outputs.	5
					Management Brief description: Management functions; General principles of management; The information system of the company management; The management decision subsystem; Management systems, methods and techniques.	3
					Modeling of electrical circuits Brief description: Modeling the circuits that c.c.; Modeling of circuits of c.a. phase; Modeling of electric circuits in transient mode; Modeling of three-phase AC circuits.	5
				6	Electric Power Generation, Transport and Delivery Brief description: Building an energy transmission network; Wiring diagrams used at high and medium voltage electrical stations; Distribution networks; Calculation of short-circuit currents; Neutral treatment; Methods of calculation and sizing of electricity transmission and distribution installations; Protection of electricity systems.	4
					Electrical Drives Brief description: Course presentation. Introduction to electric cars and adjustable drives; Basic principles; Static characteristics of working machines. Operating regimes of working mechanisms; Basic equations of motion in electrical drives; Transmission of the movement between the actuator and the working mechanism; Operating modes of the electric drive systems; Choosing electric drive systems; Electric drives with DC motors; Electric drives with three-phase asynchronous motors; Drive systems with synchronous three-phase machines.	4
					Electromagnetic Compatibility Brief description: Introductory notions of electromagnetic compatibility;	3

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					Sources of electromagnetic disturbances. Transmitter-receiver relationship; Electromagnetic disturbances in electrical networks; Biological effects; Protection against electromagnetic disturbances.	
					Hydraulic and Pneumatic Drives Brief description: General elements regarding hydraulic and pneumatic drives; Structure of a hydrostatic system; Organology of hydrostatic systems; Hydraulic pumps; hydromotors; Distribution equipment; Pressure adjustment equipment; Flow adjustment equipment; Structure of pneumatic schemes. Classification of schemes. Symbolization of pneumatic devices; Pressure valves. Distributors; Pneumatic motors. General. Classification of pneumatic cylinders.	3
					Electrical Systems in Industry Brief description: General problems of electrical installations; Electric lighting installations; Low voltage electrical installations; Dimensioning of low voltage electrical installations; Neutral treatment in low voltage installations and electric shock protection.	3+2
					Design of Electromechanical Systems Brief Description: Electromechanical systems; General notions regarding the design of electromechanical systems; Design principles of DC motors and of AC motors (Asynchronous); Design principles of electromagnets from c.c. and that.; Electromagnetic calculation of asynchronous motors with rotor in short circuit; Mechanical calculation in asynchronous motors; Thermal calculation of DC motors: The electromagnetic dimensioning of DC motors and c.a.; Sizing calculation of electromagnets of c.c. and c.a.; Thermal calculation of the electromagnets of c.c. and c.a.	2+2
					Automation of Electromechanical Systems Brief Description: DC motor cascade adjustment structures; Order in position; Classic nonlinear control techniques for DC drives; Numerical control; Synthesis of a numerical control law using methods of assigning poles and zeros; Automation with PLC (Programmable Logic Controller); Programming modes of programmable automatons; Programming using timers and counters; Presentation Step 7 Simatic Manager. Implementation. Application example; Presentation of STEP 7 Micro WIN; PLC adjusting loop configurations; Automation using smart relays.	3
					Specialty practice	4
	BA		IV	7	Exploitation and maintenance of electromechanical systems Brief description: Operation of electric transformers; Operation of rotary electric	5

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Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units				
Electrical engineering		Electromechanics (EM)			machines. Principles; Operation of asynchronous machines; Operation of synchronous machines; Operation of DC machines; Specific defects of rotating electric machines. Particularities of the methods of remedy of the defects; Maintenance of electromechanical systems.					
					Electric traction Brief description: General structure of electric traction systems; Fixed installations specific to electric traction; The dynamics of electric motor vehicles; Transmission, support and guidance systems; Electric traction with DC machines; Non-autonomous electric vehicles with AC motors; Autonomous vehicles (electromobiles, diesel-electric locomotives, naval electric propulsion).	6				
					Optional 1.1	4				
					Optional 1.2	4				
					Optional 1.3	4				
					Optional 1.4	4				
					Business and Company Management Brief description: The role and importance of the business plan; Description of the business; Company description, products or services, business location advantages, description of the environment in which the business will evolve; Marketing plan; Operational plan and business management; The financial plan; The stages of the action program for the elaboration of the forecasted financial statements.	3				
					Optional 1.1 - 1.4 - 7 semester (4 of 8 are selected)					
					1. Security equipment and systems					
					2. Electric micromachines Brief description: Component parts of the electric drive systems with micromachines; Subassemblies of electric drive systems with micromachines. Technologies used; The electric drive subsystem: conventional electric micro-machines. Constructive and functional features; Unconventional electric machines. Innovative solutions. Specific applications; Electronic systems for supplying, controlling and controlling the chains of drives with electric machines; New classes of electric drive systems with micromachines, new technologies. Nanosystems, biosystems.					
					3. Sequential control in electromechanical systems					
					4. Electrical systems and lighting					
					5. Naval electromechanical equipment					
6. Installations on ships Brief description: Characterization of naval power plants; Electricity sources on ships;										

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					Determining the electricity consumption, choosing the number and power of the power plant generators; Excitation systems of electric generators; Automatic regulation of voltage and reactive power; Automatic adjustment of frequency and active power; Automatic synchronization of AC generators; Protection of naval power plants; Transient processes in naval power plants. Calculation of short-circuit currents; Electricity distribution; Automation of naval power plants; Measures to avoid the danger of electric shock caused by naval power plants.	
					7. Electrical and electronic equipment for motor vehicles Brief description: Automotive electrical systems within the car, specific technical conditions; Electricity supply system; Ignition system; Starter installation; Injection system; Auxiliary systems; The computer system; Modern electronic equipment used in road vehicles.	
					8. Modern electric traction systems Brief description: General elements. Classifications; Hybrid vehicles; Electric vehicles; Energy charging and storage systems on motor vehicles; Electric and hybrid vehicle control systems.	
				8	Business Law Brief description: Economic methodology and introduction in the history of economic thought; Microeconomics and Macroeconomics. Principles of business competition; Sources of commercial law. Principles of commercial law. Trader responsibility; Functions and judicial organization of commercial law courts. Comparative law; Commercial company and contracts (national and international); Patents and trademarks; Consumer protection (domestic and international); Dispute resolution and mediation; European and international trade.	2
				8	Modeling and simulation in electrical engineering Brief description: General considerations regarding modeling and simulation of electromechanical systems; Modeling and simulation of electromagnetic field equations in electromechanical converters; Modeling and simulation of the electromechanical system by the method of state variables and implementation of the control; Modeling in d-q coordinates and simulation of electromechanical systems at circuit level.	3
				8	Control of electrical drives Brief description: The concept of adjustable drive system; Design of electromechanical drive systems. Evolution of electromechanical drive control; Mathematical reference models for energy conversion systems using electromechanical drive systems; Estimators used in DC actuation systems;	5

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					Structure of analog and numerical control for electromechanical drive systems; Dynamic model in d, q coordinates of AC machines; Simulation of numerical control systems. Numerical regulators; Behavior of position, current and speed regulators integrated in an actuator system; Advanced structures of electromechanical drives Advanced control strategies, optimal control.	
					Air conditioning	4
					Optional 2.1	4
					Optional 2.2	4
					Practice for the diploma project	4
					Drawing up the diploma project	4
					Optional 2.1-2.2 - 8 semester (it choose 2 of 4)	
					1. Lifting and transporting equipment	
					2. Computer Aided Design	
					3.Power Quality Brief description: Introduction to the concept of energy quality; Variations in frequency of supply voltage; Variations in supply voltage; Voltage gaps and short-term interruptions; Overvoltages and transient phenomena; Continuity and reliability of electricity supply; Deformation regime and power factor.	
					4.Expert systems and technical diagnosis Brief description: Theoretical basis of artificial intelligence; Knowledge. Representation of knowledge through semantic networks, frameworks, production systems; Inference methods. Types of inference. Inference rules. Symbolic logic. Forward and backward chaining; Reasoning techniques used in diagnosis; Case-based systems. Causal reasoning. Model-based reasoning; Knowledge-based systems: Expert systems; Expert systems design.	
					Electrical engineering	BA
Mathematical Analysis	6					
Physics	6					
Computer Programming and Programming Languages I	4					
Computer-Aided Graphics I	2					
Applied Informatics	4					
English language	2					
Physical Education and Sport	1					
2	Advanced Mathematics	5				
	Chemistry	4				
	Mechanics	4				
	Computer-Aided Graphics II	2				

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					Computer Programming and Programming Languages II	5
					Introduction to electrical engineering	5
					English language	2
					Physical Education and Sport	1
					Optional 1.1	2
					Optional - 1 semester (choose one discipline of the two disciplines of package A)	
					Package A	
					1. Communication	
					2. Ethics and academic integrity	
					Machine organs and mechanisms	3
					Probability theory and mathematical statistics Brief description: Elements of probability theory; Random variables; The numerical characteristics of a random variable; Estimation of the parameters of the distribution laws; Estimation theory.	4
					Electric Circuits Theory Brief description: Signals and elements of linear electrical circuits; Linear circuits of c.c. permanently; Linear circuits of c.a. permanently sinusoidal; Linear circuits in periodic non-sinusoidal permanent regime; Three-phase circuits in permanent sinusoidal and non-sinusoidal periodic regime; Linear circuits with parameters concentrated in transient regime; Non-linear circuits in permanent regime.	6
				3	Analogic and Digital Electronics	4
					Electrotechnical Materials Brief description: Notions of material physics; Electrical conduction; Electric polarization; Dielectric material; Conductive materials; Semiconductor materials; Magnetization; Magnetic material.	5
					Numerical Methods	4
					Sources of Energy Brief description: Power and electricity; General notions about the power system; Finished energy sources; Renewable energy sources.	3
					Physical Education and Sport	1
				4	Electromagnetic Field Theory Brief description: Electrostatic field; electrostatic potential theory; Stationary electric field. Continuous current in massive conductors; Stationary magnetic field; vector potential theory; The quasi-stationary electromagnetic field; Non-stationary electromagnetic field. Electromagnetic waves, electromagnetic	5
Electrical engineering	BA	Power electronics and electrical drives (PEED)	II			

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					radiation.	
					Systems Theory and Automatic Control Brief description: Fundamentals of automated systems; Mathematical modeling of signals; Functional mathematical models of smooth structural systems; Temporal analysis of SRA in functional representation; SRA stability; Analysis of the stationary regime of the SRA; Analysis of the dynamic regime of the SRA; Design of linear, monovariate, smooth SRAs.	5
					Electrical Machines 1 Brief description: Introductory concepts; Constructive and functional peculiarities of electrical machines; General problems of AC machines; Mathematical modeling - in quasi-stationary / stationary regime - of electrical machines; Tracing the functional and performance characteristics of electrical machines.	4
					Static power converters Brief description: Semiconductor of power, achievements, performances and applications; Non-controlled AC converters: power diode, rectification principles, rectifier schemes, source and load interfaces; Controlled AC-DC converters: SCR thyristor, rectifier schemes, phase control, source and load interfaces, semiconverter, 4 quadrant converters; Power semiconductor switching converters: GTO, BJT, MOSFET, IGBT et al; 1, 2 and 4 dc dc-dc converters with current and voltage output. PWM command. Source and load interfaces; DC-AC converters, inverters: modulation principles, mono- and three-phase inverters, voltage and current inverters, forced-off inverters, PWM rectifiers. Interfaces with the load and the source; Direct-to-AC converters: AC voltage inverters, cycloconverters.	5
					Quality and Reliability Brief description: Product quality; Reliability indicators. Reliability in the context of systems theory; Modeling of equipment wear; Distribution laws associated with failure mechanisms; The principles of Bayesian estimation and their applications in reliability. Reliability models: global models and structural models; Renewal of equipment. Renewal processes. Renewal strategies; Structural reliability. Functional model and logical model; Methods for analyzing the reliability of equipment based on logical models; Model of Markov processes. Failure shaft model; Deterministic and probabilistic methods for generating test sequences. Procedures for conducting a test; Self-testing equipment. Control circuits used in self-test equipment; Maintenance of electrical	2

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					equipment; Reliability tests.	
					Electrical and Electronic Measurements Brief description: Introduction to metrology; Analog measuring instruments; Measurement of electrical quantities: voltages, currents, powers, energies, impedance, resistance, inductance, capacity; Signal measurement and analysis; Magnetic measurements.	4
					Physical Education and Sport	1
					Domain practice	4
Electrical engineering	BA	Power electronics and electrical drives (PEED)	III	5	Programmable Micro-Controllers and Regulators Brief description: Block diagrams of microprocessor and microcontroller systems; Types of microcontrollers and DSPs used for programmable automaton; Types of industrial wired communication systems, related protocols and specific extension modules; Industrial Ethernet wired network; Wireless communication systems; TCP / UDP / IP protocol used for applications through GPRS; Program packages for programmable controllers; The M2M Power programming package used for GSM modems.	5
					Electrical Equipment Brief description: Calculation of currents driven by electrical apparatus and equipment in connection processes; Thermal processes and applications in electrical apparatus; The electrodynamic forces and stresses in electrical apparatus and equipment; Processes and requests of the electric arc in the switching devices; Principles of electric arc extinguishing chambers; Constructive elements of electrical apparatus; Distribution, control, control apparatus.	5
					Electrical Machines 2 Brief description: The dynamic regimes of the DC machine; The dynamic regimes of the asynchronous machine; Dynamic speeds of the synchronous machine; Dynamic speeds of the electric transformer; Modeling of the dynamic regimes of DC and AC machines.	6
					Transducers Interfaces and Data Acquisition Brief description: Transducers. Structure. Sensors. Adapter. Dedicated transducers; Process interface system. The structure of the interface system with the process; Subsystem of numerical inputs; The subsystem of analog inputs; Subsystem of analog outputs; Subsystem of digital outputs.	5
					Management Brief description: Management functions; General principles of management;	3

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					The information system of the company management; The management decision subsystem; Management systems, methods and techniques.	
					The Basics of Electric Drives Brief description: Modeling and simulation of a series and parallel RLC circuit; RLC circuit resonance; Choosing the parameters of the RLC circuit; Simulation of a single-phase line with the distributed parameters; Transformers and autotransformers; Basics of electric cars and transformers; Kinematics of electric drives; Operating modes of the electric car; Modeling of a DC machine; Modeling an asynchronous machine; Basic principles in choosing electric drive motors; Various calculations specific to electric drives.	3
					Electronic power systems Brief description: Design of non-controlled rectifiers with diodes; Designing the rectifiers ordered with thyristors; Design of c.c-c.c converters. and c.c-c.a operating in switching.	3
					Electric Power Generation, Transport and Delivery Brief description: Building an energy transmission network; Wiring diagrams used at high and medium voltage electrical stations; Distribution networks; Calculation of short-circuit currents; Neutral treatment; Methods of calculation and sizing of electricity transmission and distribution installations; Protection of electricity systems.	5
				6	Electrical Drives Brief description: Course presentation. Introduction to electric cars and adjustable drives; Basic principles; Static characteristics of working machines. Operating regimes of working mechanisms; Basic equations of motion in electrical drives; Transmission of the movement between the actuator and the working mechanism; Operating modes of the electric drive systems; Choosing electric drive systems; Electric drives with DC motors; Electric drives with three-phase asynchronous motors; Drive systems with synchronous three-phase machines.	3+2
					Electromagnetic Compatibility Brief description: Introductory notions of electromagnetic compatibility; Sources of electromagnetic disturbances. Transmitter-receiver relationship; Electromagnetic disturbances in electrical networks; Biological effects; Protection against electromagnetic disturbances.	3
					Hydraulic and Pneumatic Drives Brief description: General elements regarding hydraulic and pneumatic drives;	3

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					Structure of a hydrostatic system; Organology of hydrostatic systems; Hydraulic pumps; hydromotors; Distribution equipment; Pressure adjustment equipment; Flow adjustment equipment; Structure of pneumatic schemes. Classification of schemes. Symbolization of pneumatic devices; Pressure valves. Distributors; Pneumatic motors. General. Classification of pneumatic cylinders.	
					Applications of power electronics Brief description: General requirements for static converter control systems; Technical requirements regarding control systems; Scalar control vs. vector control; Open-loop controls with direct frequency control with voltage adjustment and direct control of voltage with frequency correction; Switching functions; PWM command.	2+2
					Modeling and simulation of electric drives Brief description: General principles of modeling of electric drive systems; Modeling of the DC machine; Modeling of AC machines: synchronous and asynchronous; Simplified models of the usual static converters; Models of transducers used in electric drive systems; Principles regarding the simulation of electric drive systems. Software instrumentation; HILS (Hardware In the Loop Simulation) method.	3
					Adjusting the speed of electric drive systems Brief description: General considerations on speed control of electric drive systems; Speed control of electric drive systems with DC motors; Speed control of electric drive systems with induction motors.	3
					Specialty practice	4
Electrical engineering	BA	Power electronics and electrical drives (PEED)	IV	7	The Control of Electrical Driving System Brief description: The concept of adjustable drive system; Design of electromechanical drive systems. Evolution of electromechanical drive control; Mathematical reference models for energy conversion systems using electromechanical drive systems; Estimators used in DC actuation systems; Structure of analog and numerical control for electromechanical drive systems; Dynamic model in d, q coordinates of AC machines; Simulation of numerical control systems. Numerical regulators; Behavior of position, current and speed regulators integrated in an actuator system; Advanced structures of electromechanical drives Advanced control strategies, optimal control.	6
					Electric traction Brief description: General structure of electric traction systems; Fixed installations specific to electric traction; The dynamics of electric motor vehicles;	4

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					Transmission, support and guidance systems; Electric traction with DC machines; Non-autonomous electric vehicles with AC motors; Autonomous vehicles (electromobiles, diesel-electric locomotives, naval electric propulsion).	
					Command of electric drives Brief description: General elements regarding the numerical control structures for electric drives; Combinational logic circuits, logic systems with memory, elementary finite automata; Numerical controls with programmable automatons; Programming languages for AP; Integrated circuits specific to AE applications; Industrial applications: modernization of control systems for AE; General notions regarding the testing, commissioning and operation of AE control systems.	5
					Business and Company Management Brief description: The role and importance of the business plan; Description of the business; Company description, products or services, business location advantages, description of the environment in which the business will evolve; Marketing plan; Operational plan and business management; The financial plan; Stages of the action program for the elaboration of the forecast financial statements.	3
					Optional 1.1	6
					Optional 1.2	6
					Optional 1.1 - 1.2 – 7 semester (it choose 2 of 9)	
					1.The basics of modeling, design and testing of electrical systems Brief description: Elements of modeling of electrical systems; The scientific basis for designing electrical systems and their manufacturing technologies; Design of technological processes; Magnetic circuit production technology; technology for the manufacture of windings for electric cars; Technology of design and assembly of electric cars; Flexible manufacturing systems; Control in manufacturing systems; Testing of electrical systems; Use of robots in the manufacture and testing of electrical systems; Management systems of technological lines with robots.	
					2.Microcontrollers and integrated systems Brief description: Common microcontroller hardware structures and integrated systems; Hardware and software aspects regarding the implementation of numerical / analog input / output variables in microcontrollers and integrated systems; Implementation of timers on microcontrollers and PLCs (specific issues); Hardware and software aspects generating the operational safety and flexibility of the integrated systems; Control applications with microcontrollers and integrated systems of common industrial processes.	

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					3.Low voltage electrical installations Brief description: General; Components of low voltage electrical installations; Electric lighting installations; Electric power supply installations; Characteristics of electrical installations; Sizing and protection of electrical installations; Accident protection installations by electric shock.	
					4. Estimators and status observers	
					5. Communications in distributed systems	
					6. Computer-Aided Design of Static Converters Brief description: CAD tools used for computer-aided design of electrical circuits: software design, modeling and simulation environments - PSPICE, OrCAD, Matlab / SIMULINK; Modeling of static switches and other passive circuit elements at low frequencies; Modeling of static power converters; Behavior of static converters in different modes of operation - simulation, functional analysis; Computer-aided design of electrical circuits and reaction and compensation circuits; Modeling, implementation and simulation of a complex structure of frequency converter for operating a DC machine.	
					7. Vector commands Brief description: The correlation of force structure in 2 levels - control system; Correlation of multilevel force structure - control system; Advanced command strategies; Implementation of mathematical models of the converter-machine assembly. Unitary approach of an electric car model in the variant of the principle of field orientation and vector control in different approaches - from classical PWM to SVM, DTC.	
					8. Design of electrical installations Brief description: General concepts regarding the design of electrical installations; Design theme; Pre-feasibility study; Feasibility study; Technical project and specifications; Details of execution; Authorizations and regulations.	
					9. Identification and modeling of systems Brief description: Signals. Identification of systems using index analysis; Nonparametric identification; Representation changes; Estimation theory; Off-line parametric identification; On-line parametric identification; Modeling of physical systems; Introduction; Laws, models and physical theories; Principles regarding the development of a model; Modeling based on material and energy balance; Material mass balance; Energy balance in a thermal system; Energy balance in an electromagnetic circuit; Physical Systems Simulation; Introduction, Classification of the domains in which the simulation techniques are used; Simulation techniques in the field of human subjects training.	
				8	Modern switching techniques in power electronics	2
					Optional 2.1	4

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					Optional 2.2	4
					Optional 2.3	6
					Optional 2.4	6
					Practice for the diploma project	4
					Drawing up the diploma project	4
					Optional 2.1-2.4 - 8 semester (two disciplines are chosen each of the 3 sub package with the same structure (courses, applications))	
					Sub package 1	
					1.Power Quality Brief description: Introduction to the concept of energy quality; Variations in frequency of supply voltage; Variations in supply voltage; Voltage gaps and short-term interruptions; Overvoltages and transient phenomena; Continuity and reliability of electricity supply; Deformation regime and power factor.	
					2.Computer-Aided Design of Electrical Drives Brief description: Modern design of electric drive systems and future developments; The problem of choosing the frequency converters for an electric drive system; The load capacity of the frequency converter; Operation of an electric drive system in the constant power area; Types of load torques and their relation to the motor shaft; Variable torque of the working machine; Constant torque of the working machine; Speed variation limits; The moment of inertia of the working machine; Requirements for starting an electric drive system with the induction machine; The requirements of a variable speed electric drive system for the braking - stopping regime; Braking by direct current injection into the intermediate circuit of the converter; Dynamic braking; Sizing of electric drives. Calculation methods.	
					3. CAD for electrical installations (AutoCAD, Cadelec)	
					Sub package 2	
					1. Mechanisms	
					2.Servomotors and intelligent motion control Brief description: The problem of optimal adjustment. Formulation of the optimization problem; Necessary and sufficient conditions of optimality; Simulation of the control law; Methods of implementing the control law.	
					3.Optimization algorithms in electrical engineering Brief description: The problem of optimal adjustment. Formulation of the optimization problem; Necessary and sufficient conditions of optimality; Dynamic optimization of systems; Optimization techniques used in electric drives; Optimal electric drive systems with DC machines.	
Electrical engineering	BA	Electrical	I	1	Linear algebra, analytic geometry and differential	5

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Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units				
		engineering and computers (EEC)			Mathematical Analysis	5				
					Physics	5				
					Computer Programming and Programming Languages I	5				
					Computer-Aided Graphics	3				
					Applied Informatics	4				
					English language	2				
					Physical Education and Sport	1				
				2	Advanced Mathematics	5				
					Chemistry	4				
					Mechanics	4				
					Computer Programming and Programming Languages II	4				
					Probability theory and mathematical statistics	4				
					Introduction to electrical engineering	4				
					English language	2				
					Physical Education and Sport	1				
					Optional 1.1	2				
					Optional - 1 semester (choose one discipline of the two disciplines of package A)					
					Package A					
					1. Communication					
2. Ethics and academic integrity										
Electrical engineering	BA	Electrical engineering and computers (EEC)	II	3	Operating systems Brief description: The conceptual model of a computing system. The role and functions of the operating system. Concepts underlying the elaboration of operating systems; Types of operating systems and their characteristics. Classification of operating systems; Process management. Multiprogramming. Process planning. Internal memory management. Resource management; File information management. User account management; UNIX operating system; Interfaces for communication with the operating system. UNIX command interpreter; Windows operating system.	3				
					Object Oriented Programming Brief description: Structured data types; Dynamic data structures; sub; Recursive subprograms; The principles of object-oriented programming.	4				
					Electric Circuits Theory Brief description: Signals and elements of linear electrical circuits; Linear circuits of c.c. permanently; Linear circuits of c.a. permanently sinusoidal; Linear circuits in periodic non-sinusoidal permanent regime; Three-phase circuits in	6				

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					permanent sinusoidal and non-sinusoidal periodic regime; Linear circuits with parameters concentrated in transient regime; Non-linear circuits in permanent regime.	
					Analogic and Digital Electronics	4
					Electrotechnical Materials Brief description: Notions of material physics; Electrical conduction; Electric polarization; Dielectric material; Conductive materials; Semiconductor materials; Magnetization; Magnetic material.	4
					Numerical Methods	4
					System theory Brief description: Fundamentals of automated systems; Mathematical modeling of signals; Functional mathematical models of smooth structural systems; Temporal analysis of SRA in functional representation; SRA stability; Analysis of the stationary regime of the SRA; Analysis of the dynamic regime of the SRA; Design of linear, monovariale, smooth SRAs.	4
					Physical Education and Sport	1
				4	Electromagnetic Field Theory Brief description: Electrostatic field; electrostatic potential theory; Stationary electric field. Continuous current in massive conductors; Stationary magnetic field; vector potential theory; The quasi-stationary electromagnetic field; Non-stationary electromagnetic field. Electromagnetic waves, electromagnetic radiation.	5
				4	Electrical Machines 1 Brief description: Introductory concepts; Constructive and functional peculiarities of electrical machines; General problems of AC machines; Mathematical modeling - in quasi-stationary / stationary regime - of electrical machines; Tracing the functional and performance characteristics of electrical machines.	4
				4	Static power converters Brief description: Semiconductor of power, achievements, performances and applications; Non-controlled AC converters: power diode, rectification principles, rectifier schemes, source and load interfaces; Controlled AC-DC converters: SCR thyristor, rectifier schemes, phase control, source and load interfaces, semiconrolled converters, 4 quadrant converters; Power semiconductors for switching converters: GTO, BJT, MOSFET, IGBT et al; 1, 2 and 4 dc dc-dc converters with current and voltage output. PWM command.	5

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					Source and load interfaces; DC-AC converters, inverters: modulation principles, mono- and three-phase inverters, voltage and current inverters, forced-off inverters, PWM rectifiers. Interfaces with the load and the source; Direct-to-AC converters: AC voltage inverters, cycloconverters.	
					Electrical and Electronic Measurements Brief description: Introduction to metrology; Analog measuring instruments; Measurement of electrical quantities: voltages, currents, powers, energies, impedance, resistance, inductance, capacity; Signal measurement and analysis; Magnetic measurements.	4
					Database Brief description: Getting started with databases; Databases and database management systems: Definition of the database. Properties. Definition of DBMS. Functions. Classification; Data models. The relational model; Language for relational databases. SQL commands; Designing relational databases: Data dependence. Normalization. Examples; Other database objects; Data protection.	2
					Computer architecture Brief description: The arithmetic basis of the computer; Structure of the numerical computer; The arithmetic and logical unit; Command and control unit; buses; Memory unit; Pipeline systems; CISC and RISC architectures; Multithreading, Superthreading and Hyperthreading; Multiprocessor systems.	5
					Physical Education and Sport	1
					Domain practice	4
Electrical engineering	BA	Electrical engineering and computers (EEC)	III	5	Programmable Micro-Controllers and Regulators Brief description: Block diagrams of microprocessor and microcontroller systems; Types of microcontrollers and DSPs used for programmable automatons; Types of industrial wired communication systems, related protocols and specific extension modules; Industrial Ethernet wired network; Wireless communication systems; TCP / UDP / IP protocol used for applications through GPRS; Program packages for programmable controllers; The M2M Power programming package used for GSM modems.	5
					Electrical Equipment Brief description: Calculation of currents driven by electrical apparatus and equipment in connection processes; Thermal processes and applications in electrical apparatus; The electrodynamic forces and stresses in electrical apparatus and equipment; Processes and requests of the electric arc in the switching devices; Principles of electric arc extinguishing chambers;	6

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					Constructive elements of electrical apparatus; Distribution, control, control apparatus.	
					Electrical Machines 2 Brief description: The dynamic regimes of the DC machine; The dynamic regimes of the asynchronous machine; Dynamic speeds of the synchronous machine; Dynamic speeds of the electric transformer; Modeling of the dynamic regimes of DC and AC machines.	5
					Transducers Interfaces and Data Acquisition Brief description: Transducers. Structure. Sensors. Adapter. Dedicated transducers; Process interface system. The structure of the interface system with the process; Subsystem of numerical inputs; The subsystem of analog inputs; Subsystem of analog outputs; Subsystem of digital outputs.	5
					Systems with microprocessors Brief description: The general structure of a microprocessor regarded as a "computer on a chip"; Basic architectures; Input / output ports: logic scheme, control of data transfer direction, electrical characteristics, galvanic isolation solutions of digital inputs and outputs, programming examples; Common and current families of microprocessors; The problem of designing microprocessor systems; Solving the problems of synchronization and sharing of tasks between the components of a system with microprocessors.	4+2
					Web Programming Brief description: Fundamental aspects of the discipline. Introduction. The objectives of the discipline and the way of working. History of JavaScript. A prime example. Functional aspects. Closures. Callbacks. Module; JavaScript specific data structures. Regular expressions. Comparators. Pictures. Maps and sets. Notions of object-oriented programming; Object-oriented programming in JavaScript. Classes and instances. Prototypes and features. Inheritance. Get / set methods. Unit testing and troubleshooting. ECMAScript 6 specific syntax; The DOM document template. Events and event chain. Handling DOM. Events generated by the browser. The jQuery package. JavaScript as a programming language for server applications; Programming templates. Creative, structural and behavioral templates; Programming templates. Functional, reactive templates. MVC Model - Model, View, Controller for programming Web applications; Communication templates. Microservices. Templates for testing. Dependency injection and aspect-oriented programming.	3
				6	Electric Power Generation, Transport and Delivery	4

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Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					<p>Brief description: Building an energy transmission network; Wiring diagrams used at high and medium voltage electrical stations; Distribution networks; Calculation of short-circuit currents; Neutral treatment; Methods of calculation and sizing of electricity transmission and distribution installations; Protection of electricity systems.</p>	
					<p>Electrical Drives Brief description: Course presentation. Introduction to electric cars and adjustable drives; Basic principles; Static characteristics of working machines. Operating regimes of working mechanisms; Basic equations of motion in electrical drives; Transmission of the movement between the actuator and the working mechanism; Operating modes of the electric drive systems; Choosing electric drive systems; Electric drives with DC motors; Electric drives with three-phase asynchronous motors; Drive systems with synchronous three-phase machines.</p>	3+2
					<p>Electromagnetic Compatibility Brief description: Introductory notions of electromagnetic compatibility; Sources of electromagnetic disturbances. Transmitter-receiver relationship; Electromagnetic disturbances in electrical networks; Biological effects; Protection against electromagnetic disturbances.</p>	3
					<p>Hydraulic and Pneumatic Drives Brief description: General elements regarding hydraulic and pneumatic drives; Structure of a hydrostatic system; Organology of hydrostatic systems; Hydraulic pumps; hydromotors; Distribution equipment; Pressure adjustment equipment; Flow adjustment equipment; Structure of pneumatic schemes. Classification of schemes. Symbolization of pneumatic devices; Pressure valves. distributors; Pneumatic motors. General. Classification of pneumatic cylinders.</p>	3
					<p>Electrical installations Brief description: General problems of electrical installations; Electric lighting installations; Low voltage electrical installations; Dimensioning of low voltage electrical installations; Neutral treatment in low voltage installations and electric shock protection.</p>	3
					<p>Computer networks Brief description: Introductory concepts in the field of computer networks and data communications. Characteristics. Classification criteria. Standardization and protocols; Standardization and reference models. ISO-OSI and TCP / IP; Physical level. Types of transmission media and their characteristics; Data link</p>	4

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
Electrical engineering	BA	Electrical engineering and computers (EEC)	IV	7	level. Structure. Addressing. Services and protocols. Control of access to the environment. Ethernet technologies; Network level. Short presentation. Interconnection of computer networks. Internet network level: IPv4 and IPv6, ARP and RARP, ICMP; General aspects of packet routing in TCP / IP networks. Static routing and dynamic routing: Routing protocols: RIP, OSPF, BGP; Transport level. Basic elements of Transport level protocols. Transport level Internet protocols: TCP and UDP; OSI levels support for applications: Session, Presentation and Application; Application Level on the Internet (TCP / IP protocol suite).	
					Designing user interfaces and graphics Brief description: Introduction to user interface design. Java Graphic Components; Presentation medium of visual design for interfaces; Basic principles for creating interactive interfaces; Psychological notions about interfaces. User expectations; Options, accessibilities and metaphors; Consistency; Simplify user interfaces; User-centered design; Software architecture for user interfaces; The process of designing a product.	4
					Specialty practice	4
					Software engineering	6
					Monitoring and diagnosis of electrotechnical equipment Brief description: Basic principles used in electromechanical energy conversion; Defectoscopy / diagnosis of electrotechnical equipment by the current fingerprint method; Defectoscopy / diagnosis of electrotechnical equipment by frequency analysis; Defectoscopy / diagnosis of electrotechnical equipment by vibrational analysis; Defectoscopy / diagnosis of electrotechnical equipment by thermography; Principles of monitoring of electrotechnical equipment; Principles of maintenance of electrotechnical equipment.	5
					Management Brief description: Management functions; General principles of management; The information system of the company management; The management decision subsystem; Management systems, methods and techniques.	3
					Optional 1.1	4
					Optional 1.2	4
					Optional 1.3	4
					Optional 1.4	4
Optional 1.1 - 1.4 – 7 semester (it choose 4 of 8)						
Lighting technique						

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					<p>Microsensors and actuators Brief description: The structure of an industrial measuring circuit (sensor, adapter, transmission system). Methods used to transmit the transmission of the measured size; Sensors of modulator type (thermistor resistance, tensometric mark, inductive sensor capacitive sensor). Adapters for modulator type sensors; Generator type sensors (thermocouple, piezoelectric sensor, etc.). Adapters for generator type sensors; Hall sensor, applications: Proportional Hall sensor, Switch type Hall sensor, Current Hall sensor Power Hall sensor; Transducers for electrical quantities (voltage, current, phase, power); Optical sensors. Optical transmission slot, reflection optical slot, modulated light optical slot, presence optical sensor, ambient light sensor.</p>	
					<p>Command of electric drives Brief description: General elements regarding the numerical control structures for electric drives; Combinational logic circuits, logic systems with memory, elementary finite automata; Numerical controls with programmable automatons; Programming languages for AP; Integrated circuits specific to AE applications; Industrial applications: modernization of control systems for AE; General notions regarding the testing, commissioning and operation of AE control systems.</p>	
					Robotics	
					Naval radio and electronic equipment	
					<p>Automation on board ships Brief description: Automatic systems for ship steering; Automatic systems for naval auxiliary mechanisms; Automation of the systems of anchoring, maneuvering, binding and towing; Electric automation of naval lifting mechanisms; Automatic power management system on a ship.</p>	
					<p>Electrical and electronic equipment for vehicles Brief description: Automotive electrical systems within the car, specific technical conditions; Electricity supply system; Ignition system; Starter installation; Injection system; Auxiliary systems; The computer system; Modern electronic equipment used in road vehicles.</p>	
					Mechatronic systems for vehicles	
				8	<p>Business Law Brief description: Economic methodology and introduction in the history of economic thought; Microeconomics and Macroeconomics. Principles of business competition; Sources of commercial law. Principles of commercial law. Trader</p>	2

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					responsibility; Functions and judicial organization of commercial law courts. Comparative law; Commercial company and contracts (national and international); Patents and trademarks; Consumer protection (domestic and international); Dispute resolution and mediation; European and international trade.	
					Optimization techniques in electrical engineering Brief description: The problem of optimal adjustment. Formulation of the optimization problem; Necessary and sufficient conditions of optimality; Dynamic optimization of systems; Optimization techniques used in electric drives; Optimal electric drive systems with DC machines.	3
					Control of electric drives Brief description: The concept of adjustable drive system; Design of electromechanical drive systems. Evolution of electromechanical drive control; Mathematical reference models for energy conversion systems using electromechanical drive systems; Estimators used in DC actuation systems; Structure of analog and numerical control for electromechanical drive systems; Dynamic model in d, q coordinates of AC machines; Simulation of numerical control systems. Numerical regulators; Behavior of position, current and speed regulators integrated in an actuator system; Advanced structures of electromechanical drives Advanced control strategies, optimal control.	5
					Artificial intelligence Brief description: Introduction to artificial intelligence. Intelligence, knowledge, reasoning; Introduction to mathematical logic. First-order languages in mathematical logic. The language of propositional calculus; The language of calculus with first-order predicates; Elementary reasoning; Cognitive systems, knowledge representation through production rules.	4
					Practice for the diploma project	4
					Drawing up the diploma project	4
					Optional 2.1	4
					Optional 2.2	4
					Optional 2.1 - 2.4 – 8 semester (it choose 2 of 4)	
					Assisted design of electronic modules	
					Assisted design of electrical installations	
					Quality of electricity Brief description: Introduction to the concept of energy quality; Variations in frequency of supply voltage; Variations in supply voltage; Voltage gaps and	

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units	
					short-term interruptions; Overvoltages and transient phenomena; Continuity and reliability of electricity supply; Deformation regime and power factor.		
					Virtual instrumentation in electrical engineering Brief description: Introduction to virtual instrumentation: the structure of a virtual instrument; functions of virtual instruments; virtual instrument applications; Introductory elements in the LabVIEW programming environment; Data types represented in LabVIEW; Creation of a Sub-VI: achievement; the use of a VI as a Sub-VI; Programming structures: while loop; structure of houses; sequential structure; travel registers; for loop; node of formulas; Array data type: definition; operations; clusters; Graphic representations: elements for representation (Waveform Chart, Waveform Graph, XY Graph), elements of type Picture; ListBox, Table and Ring elements; Applications in the field of electrical engineering: DC generator, DC machine with separate excitation; Applications in the field of electrical engineering: induction machine; Applications in the field of electrical engineering: synchronous machine with permanent magnets.		
Systems engineering	BA	Automation and Applied Informatics (AAI)	I	1	Mathematical Analysis	4	
					Linear algebra, analytic geometry and differential	4	
					Computer Programming and Programming Languages I	5	
					Applied Informatics I	5	
					Computer-Aided Graphics	4	
					Physics	5	
					Optional 1.1	2	
					Optional 1.2	1	
					Optional 1.1 - 1.2 – 1 semester (choosing one discipline of the 2 of each package)		
					Package A		
				1. English language			
				2. French language			
				Package B			
				1. Physical Education			
				2. Team sport			
				2	Advanced Mathematics	5	
					Computer Programming and Programming Languages II	5	
Electrotechnics	4						
Numerical methods	5						
Mechanics	4						
					Mechatronics	4	

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Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					Optional 2.1	2
					Optional 2.2	1
					Optional 2.1 - 2.2 - 2 semester - is the continuation of disciplines in each particular package choosing in 1 semester	
Systems engineering	BA	Automation and Applied Informatics (AAI)	II	3	Assembly languages Brief description: Getting started with assembly languages. Representation and coding of information. Elements of the assembly language. The stages of developing a program in assembly language; Z80 microprocessor architecture. Z80 microprocessor central processing and processing unit. Z80 microprocessor registers. Control circuit signals. Z80 microprocessor cycles; Addressing modes of the Z80 microprocessor. Directive. Tags. The general structure of a program in the assembly language of the Z80. Types of instructions of the Z80 microprocessor; Study of bus applications, interruptions and Halt status. 0, 1 and 2. Maskable Switches Unmountable Switches; Direct memory access (DMA). LSI 8257 circuit for DMA access. Registers LSI8257; Programmable parallel interface Z80-PIO. Control and interrupt signals. Z80-PIO circuit operating modes. The interrupt control block. Programming of the Z80-PIO circuit; Z80-CTC (Counter / Timer Circuit). Control and interrupt signals. The working modes of the Z80-CTC circuit. Interrupt control block; Digital signal processors (DSP). Getting started. Generations of DSPs from Texas Instruments.	4
					Operating systems Brief description: The conceptual model of a computing system. The role and functions of the operating system. Concepts underlying the elaboration of operating systems; Types of operating systems and their characteristics. Classification of operating systems; Process management. Multiprogramming. Process planning. Internal memory management. Resource management; File information management. User account management; UNIX operating system; Interfaces for communication with the operating system. UNIX command interpreter; Windows operating system.	4
					Linear electronic circuits	4
					Applied Informatics II Brief description: Java language features; Introduction to object-oriented programming; Java lexical units; Primitive data types and type declarations; Fundamental control structures; Classes, fields, methods; Paintings (one-dimensional; multidimensional); Characteristics of objects and classes; interfaces; Nested classes and interior classes; Graphical user interfaces; Event-	4

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Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					oriented programming; Input / output flows; Process concept; Execution threads. Digital Electronics Brief description: Introduction. Numbering systems. Boolean algebra; Binary functions. Modes of representation. Minimization techniques; Binary function systems. Combinational structures; Standard structures: decoder, demultiplexer, multiplexer; Specialized structures: summator, comparator, priority encoder, logic-arithmetic unit. Descriptions Verilog HDL; Latch type circuits. Bistable circuits; Registers. Counting; Finished automatons. Definitions. Classifications. Transformations. Reduction and coding of states; Finished automatons. Design examples. Descriptions Verilog HDL; Programmable structures. ROM memory. RAM memory; Programmable structures. PLD and FPGA circuits; CMOS logical families; Astable and monostable circuits; Microprogrammed systems.	4+2
					Data processing Brief description: Signals: Continuous signals, Random signals and processes, Sampling and restoration of continuous signals; Fourier analysis: continuous and discrete; Signal filtering; 2D signal processing; Processing of data used in pattern recognition; Supervised theoretical - theoretical methods; Unsupervised classification methods.	5
					Optional 1.1	2
					Optional 1.2	1
					Optional 1.1 - 1.2 – 1 semester (choosing one discipline of the 2 of each package)	
					Package A	
					1. English language	
					2. French language	
					Package B	
					1. Physical Education	
					2. Team sport	
				4	Computer architecture Brief description: The arithmetic basis of the computer; Structure of the numerical computer; The arithmetic and logical unit; Command and control unit; buses; Memory unit; Pipeline systems; CISC and RISC architectures; Multithreading, Superthreading and Hyperthreading; Multiprocessor systems.	4
				4	Computer Networks Brief description: Introductory concepts in the field of computer networks and data communications. Characteristics. Classification criteria. Standardization and protocols; Standardization and reference models. ISO-OSI and TCP / IP;	4

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Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					Physical level. Types of transmission media and their characteristics; Data link level. Structure. Addressing. Services and protocols. Control of access to the environment. Ethernet technologies; Network level. Short presentation. Interconnection of computer networks. Internet network level: IPv4 and IPv6, ARP and RARP, ICMP; General aspects of packet routing in TCP / IP networks. Static routing and dynamic routing: Routing protocols: RIP, OSPF, BGP; Transport level. Basic elements of Transport level protocols. Transport level Internet protocols: TCP and UDP; OSI levels support for applications: Session, Presentation and Application; Application Level on the Internet (TCP / IP protocol suite).	
					Algorithm Designing Brief description: Fundamental aspects of the discipline. Introduction. The objectives of the discipline and the way of working. Define algorithms; Data structures. Data structures II. Data structures III; Algorithms I. Algorithms II; Trees I. Trees II; Algorithms III; Graphs I. Graphs II; Programming techniques I. Programming techniques II.	3
					Database Brief description: Getting started with databases; Databases and database management systems: Definition of the database. Properties. Definition of DBMS. Functions. Classification; Data models. The relational model; Language for relational databases. SQL commands; Designing relational databases: Data dependence. Normalization. Examples; Other database objects; Data protection.	3
					Measurements and transducers Brief Description: The notion of information. Signal types, unified signals. Measuring systems. The notion of sensor and translator. The notion of electronic measuring and control device. The concept of measuring and control equipment. The place of EMCs in automatic systems; Translating classifications. Static characteristics. Dynamic features. Energy characteristics. Constructive features. Reliability features; Protection of input circuits in SAD against disturbances. Metrology of A / D and D / A converters. Functional model of the A / D converter. Quantization by rounding. Quantization by truncation. The quantization noise. Common codes in A / N and N / A conversions; Direct CNAs: R / 2R resistor networks, binary weighted resistive networks. Direct CNA: Indirect DAC with preset numerator, Indirect DAC with numerator and numerical comparator; The sampling and storage circuit. Classification criteria for A / D converters. CAN of parallel type. CAN parallel-series type. CAN with	4

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Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units				
					reaction. CAN with integration. Sigma-Delta modulation. Sigma-Delta converter. Problems solved; Translators for physical sizes. Light radiation sensors. Translators for measuring the speed of rotation. Temperature transducers. Pressure transducers.					
					Introduction to automatic Brief description: Fundamentals of automated systems; Mathematical modeling of smooth continuous signals and systems; Functional mathematical models of smooth structural systems; Temporal and frequency analysis of automatic control systems (SRA) in input-output representation; SRA stability; Analysis of the stationary regime of the SRA; Analysis of the dynamic regime of the SRA; Methods for designing linear, continuous and smooth SRAs.	5				
					Domain practice	4				
					Optional 2.1	2				
					Optional 2.2	1				
					Optional 2.1 - 2.2 – 2 semester (choosing one discipline of the 2 or 3 of each package)					
					Package A					
					1. English language					
					2. French language					
					Package B					
					1. Physical Education					
					2. Team sport					
3. Ethics and academic integrity										
Systems engineering	BA	Automation and Applied Informatics (AAI)	III	5	Systems theory I Brief description: Obtaining the structural model of a physical process; Structural properties of systems; Synthesis of systems in structural representation; Stabilization of systems by dynamic compensation; The problem of stable internal management of systems in structural representation; Robust synthesis methods in structural approach; The problem of stable structurally stable systems management in structural representation.	5				
					Microprocessor Systems Brief description: The general structure of a microprocessor regarded as a "computer on a chip"; Basic architectures; Input / output ports: logic scheme, control of data transfer direction, electrical characteristics, galvanic isolation solutions of digital inputs and outputs, programming examples; Usual and current families of microprocessors; The problem of designing microprocessor systems; Solving the problems of synchronization and sharing of tasks between	3+2				

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					the components of a system with microprocessors.	
					Automatic systems Brief description: Sample signals; Functional mathematical models of numerical systems; Temporal analysis of SRA in functional representation; Analysis of the stationary regime of the SRA; Designing linear, monovvariable, numerical SRAs.	4
					Dynamic systems with discrete event Brief description: Introduction to the problem of dynamic systems with discrete events (definitions, classifications, typical examples); Modeling some classes of dynamic systems with discrete events with languages and automatics, with Petri nets; Petri nets for modeling discrete event systems. Structural properties. Classification. Types of Petri nets; Qualitative analysis and performance analysis of dynamic systems with discrete events modeled through Petri nets; Languages and automated models for solving problems driving dynamic systems with discrete events.	4
					Electric machines and drives Brief description: Basic principles. Definitions of electric drives: classic and modern. Electric drive systems - energy conversion; Static characteristics of working machines. Operating regimes of working mechanisms; Basic equations of motion in electrical drives; Mechanical characteristics of electric cars; Transmission of the movement between the actuator and the working mechanism; Operating modes of the electric drive systems; Choosing electric drive systems; Electric drives with DC motors; Electric drives with three-phase asynchronous motors; Drive systems with synchronous three-phase machines.	3
					WEB technologies Brief description: Fundamental aspects of the discipline. Introduction. The objectives of the discipline and the way of working. History of JavaScript. A prime example. Functional aspects. Closures. Callbacks. Module; JavaScript specific data structures. Regular expressions. Comparators. Pictures. Maps and sets. Notions of object-oriented programming; Object-oriented programming in Javascript. Classes and instances. Prototypes and features. Inheritance. Get / set methods. Unit testing and troubleshooting. ECMAScript 6 specific syntax; The DOM document template. Events and event chain. Handling DOM. Events generated by the browser. The jQuery package. Javascript as a programming language for server applications; Programming templates. Creative, structural and behavioral templates; Programming templates. Functional, reactive templates. MVC Model - Model, View, Controller for programming Web	4

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Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					applications; Communication templates. Microservicii. Templates for testing. Dependency injection and aspect-oriented programming.	
					Optional 1.1	5
					Optional - 1 semester (choose one discipline of the two disciplines of package A)	
					Package A	
					1.Planning and control strategies for mobile robots Brief description: Robots overview; Direct and inverse analytical models used in management structures; Motion control structures; Planning the movement path; Sensory system: Translators; sensors; Robot programming.	
					2.Driving industrial robots Brief description: Robots overview; Mechanical elements of industrial robots; The drive system; Transmission system; The sensory system; Robot programming; Applications of industrial robots.	
				6	Acquisition systems and process interfaces Brief description: Process interface system. The structure of the interface system with the process; Subsystem of numerical inputs (SIN); Analog Inputs Subsystem (SIA); Analog Output Subsystem (SOA); Subsystem of digital outputs.	3
				6	Modeling, identification and simulation Brief description: Signals; Identification of systems using index analysis; Nonparametric identification; Representation changes; Estimation theory; Off-line parametric identification; On-line parametric identification; Modeling of physical systems; Introduction; Laws, models and physical theories; Principles regarding the development of a model; Modeling based on material and energy balance: Material mass balance; Energy balance in a thermal system. Energy balance in an electromagnetic circuit; Physical Systems Simulation; Introduction; Classification of the domains in which the simulation techniques are used; Simulation techniques in the field of training of human subjects.	4
				6	Optimizations Brief description: Introduction. Formulate an optimization problem. Types of extremes. Concave and convex functions; Unidimensional optimization methods without restrictions. Search methods. Approximation methods. Mixed methods; Unrestricted multidimensional optimization methods. Direct method. Indirect methods; Optimization methods with restrictions. Problems with nonlinear constraints; Case study. Optimization functions in Matlab; Applications of optimization methods. Approximation of functions by regression and	3

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Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					interpolation.	
					Automated and microprogramming Brief description: Common hardware structures of microcontrollers and PLCs; Hardware and software aspects regarding the implementation of numerical / analog input / output variables on microcontrollers and programmable automatons; Implementation of timers on microcontrollers and PLCs; Hardware and software aspects generating the operational safety and flexibility of PLC systems; Control applications with microcontrollers and PLCs of common industrial processes.	3
					Systems theory II Brief description: Definition of functional spaces RL_2 , RL_∞ , RH_2 , RH_∞ ; Definition and significance of H_2 and H_∞ norms for mono and multivariable systems; Formulate the problem of robust frequency management, in terms H_2 and H_∞ ; Qualitative considerations regarding robust frequency synthesis. Stability and performance analysis. Sensitivity functions, templates and weights; Robustness of performance and stability in the presence of unstructured uncertainties for SISO systems; Fundamental results of robust frequency synthesis. Granted processes and fractional linear transformations; Robust frequency synthesis methods.	4
					Designing user interfaces and graphics Brief Description: Introduction to user interface design. Java Graphic Components; Presentation medium of visual design for interfaces; Basic principles for creating interactive interfaces; Psychological notions about interfaces. User expectations; Options, accessibilities and metaphors; Consistency; Simplify user interfaces; User-centered design; Software architecture for user interfaces; The process of designing a product.	2+2
					Specialty practice	4
					Optional 2.1	5
					Optional - 2 semester (choose one discipline of the two disciplines of package B)	
					Package B	
					1.Nonlinear systems Brief description: Nonlinear phenomena encountered in various fields. Nonlinearities encountered in continuous processes. Types of nonlinearities encountered in mechanical and electrical processes. Non-linearities due to hardware and software implementations; Multimodel systems. Structures of multimodel systems. Multimodel systems management techniques; Nonlinearity compensation systems. Internal and reverse model structures. Control	

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					solutions based on static feature inversion. Compensation of hysteresis nonlinearities; Case studies. 2.Fuzzy driving systems Brief description: Elements of the theory of vague sets; Treatment of vague information (Fuzzification of crisp information. Vague inferences. Defuzzification of vague information); Fuzzy regulators. The basic structure. Processing input information into the fuzzy controller. The basis of rules. Inference mechanisms. Defuzzification methods. Measures to change the static characteristics of the fuzzy regulators; Typical fuzzy regulators and special fuzzy regulators. Fuzzy controllers without dynamics. Dynamic fuzzy controllers. Fuzzy regulators after Sugeno and Takagi. Fuzzy regulators with variable structure. Conventional regulators with fuzzy parameter adaptation; Adjustable structures with fuzzy regulators. Design aspects. Applications of fuzzy driving; Aspects of modeling nonlinear functions with fuzzy blocks.	
Systems engineering	BA	Automation and Applied Informatics (AAI)	IV	7	Control Engineering Brief description: Functional characterization of SRA and performance criteria; PID adjustment; Conventional synthesis of linear and continuous SRA; Design of complex adjustment structures; Design of numerical control systems based on input-output models; Designing the regulators according to the estimated state; Model-based predictive adjustment.	4+2
					Reliability and diagnosis Brief description: Reliability in the context of systems theory. Reliability indicators; Modeling of system wear; Distribution laws associated with the mechanisms of failure; The principles of Bayesian estimation and their applications in reliability; Renewal of systems; Structural reliability; Methods for analyzing the reliability of systems based on logical models; Model of Markov processes. Failure shaft model; Deterministic and probabilistic methods for generating test sequences; Self-testing systems; Evolutionary renewal systems based on diagnostic and prediction techniques; Use of neural networks for real-time estimation of the parameters of the Markov model of reliability; Estimating the state of the equipment using fuzzy methods and methods based on neural networks; Reliability of computing equipment.	4
					Adaptive and robust systems Brief description: Adaptive systems, definitions, classifications, block schemes, adaptive management issues; Adaptive systems, with variable structure and compound with reference model, definitions, properties; Adaptive management, with variable structure and composed with reference model of the processes with excess poly-zeros unitary, and superunitary, hypotheses, generalization, the order	4

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					synthesis algorithm, properties; Adaptive systems with self-tuning. Stochastic processes. The optimal predictor over one step, the optimal predictor over two steps. The optimal predictor over k steps; Synthesis of adaptive self - tuning control by minimal variance strategy, block diagram. Order synthesis for modified minimum variance strategies; Adaptive process management with nonlinear affine models.	
					Management Brief description: Introduction to the concept of management; Management functions; Management research; Managers and leaders; The organizational structure of the company; The firm's decision-making system; The information system of the company management; Management methods and techniques; Management strategy in the field of IT units.	4
					Real time systems Brief description: Process interaction with real-time operating systems; Concurrent languages; Use of competing languages for real-time programming; Real-time operating systems; Execution planning algorithms in SOTR. <i>Rate monotonic and Earliest deadline first.</i>	4
					Optional 1.1	4
					Optional 1.2	4
					Optional 1.1 - 1.2 – 1 semester - (choose one discipline of the two disciplines from each sub package of package A)	
					Package A	
					Sub package 1	
					1.Applications with programmable machines Brief Description: Usual hardware structures of PLCs; Hardware and software aspects regarding the implementation of the numerical / analog input / output variables in the programmable automatons; Implementation of PLC timers; Hardware and software aspects generating the operational safety and flexibility of PLC systems; Applications of PLC control of common industrial processes; Approaching the elements specific to the programming language Step 7 TIA13 for Simatic 1200; Addressing elements specific to the WinCC TIA14 programming language for the HMI KTP600.	
					2.Multi-agent systems Brief description: Introduction to the field of multi-agent systems; Concepts. Passive agents. Active agents; Behavior of agents in the virtual environment, in the discrete environment or in the continuous environment; Use of multi-agent systems in the real world; Main features of multi-agent systems; Autonomy, decentralization, self-organization; The main paradigms	

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					specific to multiagent systems; The characteristics of multiagent systems implemented hardware; Multiagent systems implemented with programmable automatons; Multiagent systems implemented with modules and elements of the SCADA system.	
					Sub package 2	
					1.Information systems in ecology Brief description: Introductory concepts of ecology and environmental protection; Systemic approach to ecological processes and environmental protection. Classification of the input, state and output sizes; Structural-functional modeling of ecological processes and environmental protection through dynamic balance equations; Classical models in ecology (eg logistic and exponential population growth models); Modeling of biological wastewater treatment processes (oxidation of organic pollutants, biological removal of nitrogen and phosphorus); Modeling of anaerobic digestion processes; Modeling of biological air treatment processes, bio-mitigation of carbon dioxide with microalgae; Control strategies in wastewater treatment and bio-filtration processes.	
					2.Bioengineering Brief description: Introductory notions: classification of biotechnological processes, phases of biotechnological processes, types of bioreactors; Systemic approach to biotechnological processes. Classification of the input, state and output sizes; Structural-functional modeling of biotechnological processes through dynamic balance equations; Processes discontinuous. Kinetic modeling of biotechnological processes; Semicontinuous processes. Continuous processes; Structural-functional modeling of biotechnological processes based on reaction schemes; Modeling of aerobic biological oxidation processes; Modeling of nitrification and denitrification processes; Modeling of anaerobic fermentation and oxidation processes; Modeling photosynthetic growth processes; Control strategies in biotechnological processes (chemostat, auxostat, lumostat, etc.).	
				8	Optimal control Brief description: Complementary parametric optimizations: unrestricted optimization; optimization with restrictions; Procedures for numerically solving optimal driving problems.	4
					Continuous process management systems	5
					Robot management systems Brief description: Getting started; Introduction to dynamic systems; Trajectory tracking; Control systems (adjustment); Leadership based on the inverse dynamic model; Basic concepts regarding the management of nonlinear processes. Applications for driving mobile robots and robotic manipulators.	5
					Leading Flexible Manufacturing Structures	4

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units				
					Brief description: Introduction to the problem of manufacturing systems (concepts, definitions, classifications); Production planning, structuring of production systems, scheduling, control, sizing of production capacities. Just-in-time (JIT) techniques, kanban, bucket brigades; Optimization criteria. Balancing production lines, sizing flows and stocks. Addressing demand uncertainties; Techniques of analysis, modeling and simulation of manufacturing systems. Modeling specifications for logistics systems; Advanced manufacturing systems. Agile manufacturing, flexible systems, logistics chain management; Flexible systems management: problematic, techniques, implementation; Industrial robots management: problematic, techniques, implementation.					
					Practice for the diploma project	4				
					Drawing up the diploma project	4				
					Optional 2.1	4				
					Optional - 2 semester (choose one discipline of the two disciplines of package B)					
					Package B					
					1. Artificial intelligence					
Brief description: Introduction to artificial intelligence. Intelligence, knowledge, reasoning; Introduction to mathematical logic. First-order languages in mathematical logic. The language of propositional calculus; The language of calculus with first-order predicates; Elementary reasoning; Cognitive systems, knowledge representation through production rules.										
2. Intelligent control systems										
Brief description: Introduction to artificial intelligence. Expert systems. Definitions. Features of expert systems with real-time applications; Mathematical methods in artificial intelligence. Formal languages. The language of the propositional and first-order predicates; Expert systems architectures; Representation of knowledge; Resolution systems in expert systems.										
Electronic Engineering, Telecommunication and Information Technologies	BA	Applied Electronics (AE)	I	1	Mathematical Analysis <i>Differential calculus, integral calculus, differential equations</i>	5				
					Linear algebra, analytic and differential geometry <i>Matrices, determinants, vector spaces, analytical geometry</i>	5				
					Computer Programming and Programming Languages I <i>C language, data structures, structured programming, files</i>	4				
					Physics <i>Thermodynamics, statistical physics, quantum physics, solid body physics</i>	4				
					Electronic Technology <i>Technologies for components and wiring</i>	4				
					Computer-Aided Graphics	4				

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					<i>AutoCAD, drawing and 2D and 3D editing</i>	2
					Physical Education and Sport <i>Improving physical development and general and specific driving capacity</i>	
					English language <i>Understanding and translating a specialized text</i>	
				2	Advanced Mathematics <i>Complex functions, Fourier transform, differential equations with partial derivatives</i>	4
					Electrotechnique – I <i>Circuit theory in DC and AC regimes.</i>	4
					Passive components and circuits <i>Resistors, coils, capacitors and related circuits</i>	4
					Computer Programming and Algorithms II <i>Object Oriented Programming, C ++</i>	4
					Chemistry <i>Chemical bonds, chemical kinetics, electrochemistry, liquid crystals</i>	4
					Electronic devices <i>Junction pn, Diode, Bipolar transistors, Unipolar transistors.</i>	4
					Communication <i>Drawing up and presenting a scientific paper, a CV, Teamwork.</i>	2
					English language <i>Understanding and translating a specialized text</i>	2
					Physical Education and Sport <i>Improving physical development and general and specific driving capacity</i>	2
					Total credit units =	60
				Electronic Engineering, Telecommunication and Information Technologies	BA	Applied Electronics (AE)
Numerical Methods Approximation of functions by regression, Parameter optimization, numerical integration, interpolation.	4					
Digital Integrated Circuits Combined Structures, Automated Terminals, Memories, TTL and CMOS Logic Families..	5					
Signal and Systems I Analysis of periodic and non-periodic signals, modulated signal analysis,	5					

Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
					sampling	
					Electrotechnique II Electric field, magnetic field, electromagnetic field, stationary and quasi-stationary regimes	4
					CAD techniques for electronic modules design Wiring Design, Module Design, Circuit Simulation.	4
					English language Oral communication on different topics	2
					Physical Education and Sport Fundamental concepts to compensate for intellectual activity, sedentary, stress and fatigue.	2
				4	Signal and Systems II Systems theory with applications in electronic engineering	4
					Analysis and synthesis of circuits Design and analysis of passive and active filters	4
					Fundamental electronic circuits Amplifiers, Oscillators, Rectifiers, Stabilizers, Negative feedback.	4
					Architecture of microprocessors Processing structures, microprocessor programming languages	4
					Digital integrated circuits – Project Synthesis of the electrical scheme of a finite automaton	3
					Measurements in electronics and telecommunications Measurement of electrical quantities, basic instruments in measurements	3
					Training (Practice) in Industry Knowledge and understanding of manufacturing and design technologies in applied electronics	4
					English language Oral communication on different topics	2
					Physical Education and Sport Fundamental concepts to compensate for intellectual activity, sedentary, stress and fatigue	2
					Total credit units =	60
Electronic Engineering, Telecommunication and	BA	Applied Electronics (AE)	III	5	Analogic integrated circuits Operational Amplifiers, Linear and Nonlinear Applications	5
					Analogic circuits – Project Synthesis of the circuit diagram of a circuit that processes analog signals	3

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Domain of study	Level (BA/MA)	Study programme	Year of study	Semester	Course title Brief description	Credit units
Information Technologies					Transmission theory of information Basics of information transmission systems, source encoding, channel encoding	5
					Microwaves Propagation Lines, Adaptation, Smith Diagram, Microwave Circuits	3
					Data acquisition systems Analog inputs, outputs, digital inputs, AN and NA converters	3
					Microcontrollers Structure, Program Execution, Ports, Communications, Applications	4
					Decision and estimation in information processing Random processes, Detection theory, Theory of estimation with practical applications	3
					General economy Basic Principles of Economic Sciences	4
Automation in electronic and telecommunications Automatic systems with applications in electronics	4					
Digital Signal processing Numeric representation of information, numerical filters, numerical filtering of signals	4					
Power electronics Electronic power devices and related circuits	3					
Electronic instrumentation for measurements Instrumentation Amplifiers, Circuits for electronic devices	4					
Data communication and interfaces Data Communications, Line Codes, Serial Interfaces, Communication Channels	4					
Architecture of computing systems Buses, Memories, Central Units	4					
Specialty practice Understanding and assimilating the design, testing, and maintenance processes specific to the applied electronics	4					
Total credit units =	60					
Electronic Engineering, Telecommunication and	BA	Applied Electronics (AE)				
					Reliability of electronic systems Basic concepts regarding the reliability of electronic systems	4

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Information Technologies			IV	7	Management General principles of organization and monitoring of the management of economic processes	4
					Power supplies Linear and switching stabilizers, Converters, Inverters	5
					Electric machines Knowledge of the operation and use of electric machines	4
					Industrial electronics Electronic equipment and circuits for industrial applications	4
					Sensors and transducers Circuits and devices for measuring electrical and non-electrical quantities	4
					Construction and technology of electronic equipment General principles and solutions for the construction of electronic equipment	3
				8	Elaboration of the diploma project Practical activity for drawing up the diploma project	4
					Business law Business law, legal report, legislation, contracts, legal rules, revenues, expenses, taxes, taxes.	3
					Electric drives Knowledge of the operation and use of electric drives	4
					Car electronics Circuits and systems for motor vehicles	4
					Medical electronics Electronic equipment for data acquisition and processing in medicine	4
					Alternative energy sources Methods and equipment for generating electricity from alternative sources	4
					Practice for the diploma project Training of experimental validation skills and presentation of an applied electronics project	4
					Total credit units =	60