Transilvania University of Braşov, Romania

Study program: Electrical Engineering and Computers

Faculty: Electrical Engineering and Computer Science
Study period: 4 years (bachelor)

1st Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mathematical Analysis	EEC101	6	3	3	-	-

Course description (Syllabus): This is a basic course in Mathematical Analysis, meant to give the student the understanding of the fundamental notions of Mathematical Analysis (sets, sequences, series, limits, continuity, differentiability and integrability) and the necessary skills when operating with them.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Linear Algebra and Analytic. Geometry	EEC102	5	2	2	-	-

Course description (Syllabus): 1. Basic notions of linear algebra (vector spaces and subspaces, examples; basis and dimension of a vector space, changes of bases; linear transformations on finite dimensional spaces). 2. Analytic geometry in plane and in space (operations with Euclidean vectors and their applications; coordinate systems and coordinate transformations in plane and in space; linear geometry -study of planes and lines- in space; quadratic geometry in plane and in space; generation of surfaces.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Applied computer science	EEC103	3	2	1	-	-

Course description (Syllabus): The aim of the course „Applied computer science is to outline the importance of using graphs theory in modeling many electrical systems. This course contains several basic graphs problems: 1. Graph searches (generic search, depth first search and breadth first search) and their applications (topological sort and determining the connected components); 2. Minimum spanning tree problem; 3.Tthe problem of determining Eulerian and Hamiltonian tours. The students are taught how to identify practical problems that can be modeled as graphs problems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
History of Technology and professional communication	EEC104	3	2	1	-	-

Course description (Syllabus): The main chapters of this course are: Communication as process, Career and professional development, Engineering and engineers - electrical engineering case study, Cultures and Civilization at the beginning of the 21st Century, The role of science and connections with technology, Developing knowledge about electricity by the 19th century, Artefacts of electricity, Developing knowledge about magnetism, Discovering and applying the electromagnetism, Electricity and magnetism in 19 – 20-th centuries, Development and evolution of electrical engineering in Romania, Development of electromagnetic converter systems in Romania, Electrification in Romania (1882-1992), Complexity of technical and technological systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Physics	EEC105	6	2	1	2	-

Course description (Syllabus): This is a basic course in Pyhiscs, meant to give the student the understanding of the fundamental notions of Physics that are necessary to understand the functioning of various applications in electrical engineering. 1. Kinematics and dynamics of the material point: References systems, vectors; kinematics, laws of motion; Dynamics, classification of forces, fundamental laws of dynamics; Conservation laws: energy, momentum and angular momentum conservation. Gravitational field and the Cavendish's experiment. 2. Dynamics of rigid bodies: Basic relations on rigid bodies rotational inertia; the principal axes of inertia, calculation examples; The fundamental equation of rotational movement of the rigid body; Conservation of the angular momentum; The energy of the rotational movement of the rigid bodies; Technical applications: the gyroscope and the flywheel. 3. Mechanical oscillations: Harmonic oscillations; General expressions, movement equations, the energy of an oscillator. Free damped and forced oscillations; The resonance phenomena; Composition of harmonic oscillations; Practical applications. 4. Thermodynamics: 0th Law of thermodynamics; temperature, state equations, thermodynamics variables; instruments; First Law of thermodynamics, thermodynamic processes, mechanical work, internal energy and heat exchanged in these processes; technical aspects; Second Law of thermodynamics; the concept of the entropy; thermal engines (Carnot, Otto, Diesel, Stirling), efficiency of a thermal engine; Third Law of thermodynamics. 5. Electric phenomena: Electrostatics laws, electric field and potential; Electrokinetics, electrical conduction, mechanism of conduction; Dielectrics, conductors, semiconductors; the energy of the electric field; capacitors; technical applications; Electromagnetism; Biot-Savart law, Ampere's circuital law; Substances in magnetic field. Technical applications; Electromagnetic induction; Waves, general characteristics; electromagnetic waves. 6. Optics: Elements of photometry; Thermal radiation; Propagation of light. Reflection and refraction of light; Interference and diffraction of light; Technical applications and optical devices.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer Programming and Programming Languages I	EEC106	5	2	-	2	-

Course description (Syllabus): Information representation. Fundamentals of programming languages C/C++; Input/output devices. Input/output functions for the console; Data types. Constants. Variables; Operators and expressions; Instructions (expressions, composed instructions, decision instructions, loop instructions); Arrays and strings; Pointers (operations with pointers, arrays and pointers, dynamic variables); Functions (datatransfer, function pointers, recursion;. Defining your own types (enumerations, structures, bit fields, unions).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Internet	EEC209	5	1	-	2	1

Course description (Syllabus): The course has three parts dedicated to work on Internet, with dynamical WebPages and databases. Building and editing HTML webpage: Headings and Comments, Paragraphs, Line break,Horizontal rule, Text Formatting, HTML Lists, Images, Hyperlinks – Links; MySQL: Running MySQL, Creating a data base, Tables, Data types, Operators, MySQL Functions, Keys, Data sort & filtering, Aggregate functions, subquery, Grouping data, Unions of tables, Elements related to database security; PHP: Introduction in PHP, Forms, Constants, variables, operators, PHP Statements, PHP Functions, "Mathematical" functions, Data display, Processing strings functions, Massive in PHP, Variables cookie; Common use of HTML, PHP and MYSQL.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer assisted graphics	EEC210	4	2	-	2	-

Course description (Syllabus): General information about computer graphics; AutoCAD GUI (graphical user interface) presentation. Interactive drawing; Commands for drawing; Commands for editing; Other commands and supporting facilities; Text inserting in drawing and hatches; Structure drawings, work with layers and blocks.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mathematical fundamentals of computers	EEC211	6	2	2	-	-

Course description (Syllabus): The aims of the course „Mathematical fundamentals of computers" are to show the reasons for the binary, octal and hexadecimal number systems' association with computers, to prove the importance of finding an optimal combinatorial circuit for a given logic function and to outline the importance of using graphs theory in modeling many electrical systems. This course contains 4 chapters. The first one, „Numbers systems" deals with binary, decimal, octal, hexadecimal number systems, conversions among bases and base *b* arithmetic. In the second chapter representations of integer numbers (Sign and magnitude, One's complement, Two's complement) and real numbers (The IEEE 754 Floating Point Standard) are presented. The chapter „Basics Logic Design" is dedicated to Boolean functions, their normal forms, their minimization using Veitch-Karnaugh maps or Quine McCluskey's method and designing the corresponding optimal combinatorial circuits. The Reed-Müller expansions and the generalized Reed-Müller expansions are also presented. The last chapter contains two basic graphs problems: the shortest paths problem and the maximum flow problem. The students are taught how to identify practical problems that can be written using Boolean functions or modeled as graphs problems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer Programming and Programming Languages II	EEC 212	7	2	-	3	1

Course description (Syllabus): C++ language foundations; Functions in C++; Classes and objects. Handling objects; Friend functions and friend classes; Operators overloading.Type conversions; Inheritance. Derived classes; Virtual classes and polymorphism; Template functions. Template classes; Exception handling.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Energy Sources	EEC 213	6	2	1	2	-

Course description (Syllabus): Introduction; Conventional Energy Sources: Fossil Power Plants The operational concept and major components; Hydroelectric Power Plants The operational concept and major components; Nuclear power plants The operational concept and major components; Geothermal Power Plants The operational concept and major components. Generators and Transformers; Power Supply Networks: Conventional and Distributed Generation Ecology, Pollution and Sustainable development Renewable Energy Sources: Small and Micro Hydro Plants; Wind Generators; PV and Solar Thermal Panels; Biomass and Waste Treatment. Energy Saving. Power Electronics and Energy Conversion Conditioning Technologies.

2nd Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Special Mathematics	EEC301	5	2	2	0	0

Course description (Syllabus): Scalar field, gradient; Vector field, divergence, rotor, Hamilton operator; Integral vector, integration formulas; Particular fields: conservative, solenoid, harmonic; Complex functions of real variable; Complex functions of complex variable; holomorphic functions; Complex integrals, Cauchy formulas. Complex series: Taylor and Laurent; Residues, the residue theorem, applications; Directly integral equations. Linear equations and equations reducible to linear equations. Higher order equations; applications. Linear partial differential equations; applications. quasilinear equations; nonlinear equations; Laplace transform: Original functions. Laplace transform for derivative and for convolution product of functions; applications of Laplace transform.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer Programming and Programming Languages III	EEC302	4	2	-	2	

Course description (Syllabus): The course aims to ensure the students with the knowledge about general principles of object oriented programming. After completing successfully the course, the students will be able to: Name, explain and apply the core concepts and constructs used in object-oriented programming (Java exemplify). Develop small programs or modify existing ones, to solve clearly defined programming problems. Given a clearly described component, develop a test set and test code for the component. Run and analyze a given program, describe how well it or identify ways in which it fails.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Materials for Electrical Engineering	EEC303	4	2	-	2	-

Course description (Syllabus): Introduction in Electrical Material Science and Engineering (Tendencies in advanced material development; Discipline objectives; Atoms and bonding forces; Material properties and parameters; Classifications); Electromagnetic Theory and Material Laws (Material Laws; Electrical conduction law; Polarization law; Magnetization law); Electroconductive Materials (Electrical conduction in metals; Classical theory of conduction; Factors which influence the electric conduction in metals; Quantic theory of electrical conduction; Mathiessen law; Superconductivity: Historical view; Barden-Schrieffer-Cooper theory; Applications); Semiconductive Materials (General characteristics; Intrinsic electric conduction; Extrinsic electric conduction; Temperature and light effects; n-p junction, Applications); Dielectrics (Particularities of electrical conduction in dielectrics; Classifications; Polarization in constant and harmonic fields; Losses and equivalent schema. Dielectric breakdown; Lifetime of electroinsulating materials; Applications); Magnetic Materials (Atomic theory of magnetism; Classifications; Diamagnetism and paramagnetism of materials; Materials with magnetic order; Theory of soft and hard ferromagnetic materials; Magnetic losses; Applications); Nanomaterials (Magnetorezistive materials and ferroelectrics; Applications).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
System Theory	EEC304	5	3	2	-	-

Course description (Syllabus): Mathematical modeling of dynamic systems; The Laplace transformation; Transient response analysis and steady-state error analysis; Frequency response analysis; Root-locus analysis; The state-space representation of the control systems. Design and compensation techniques; Introduction in the discrete-time systems analysis. The bilateral z-transform.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electromagnetic Field Theory	EEC305	7	3	3	1	-

Course description (Syllabus): The course and seminar teaching hours are designed to give students adequate skills that are necessary to understand and develop various applications in electrical engineering. General aspects on the theory of the electromagnetic field and on the structure of substances; Introductions of the state quantities of the electromagnetic field in vacuum; The laws of the electromagnetic field; The energy of the electromagnetic field; Electrostatics; Electrokinetics; Magnetic phenomena; Electrodynamics; Passive circuit elements. The Argand diagram. Parallel wire transmission line.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer Programming and Programming Languages III	EEC306	2		-		1

Course description (Syllabus): Develop small programs or modify existing ones, to solve clearly defined programming problems. Given a clearly described component, develop a test set and test code for the component.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Numerical Methods	EEC407	4	2	-	2	-

Course description (Syllabus): Solving of non-linear equations; Solving of linear equations systems; Interpolation and regression of functions; Numerical integration; Numerical Solving of differential equations; The computation of electrical circuits and networks by numerical methods.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Analog electronics	EEC408	5	3	2	1	-

Course description (Syllabus): Lectures presents: the principles of circuit analysis and design, the basic concepts and characteristics of the electronic devices and circuits. Tutorials develop the ability of analyzing actual electronic circuits that implements the basic circuits presented at the lectures. Laboratory work has been developed to give the students practice in the experimental setup, measurement, and analysis of basic electronic devices and circuits. The course as a whole outlines some ways of thinking about analog circuits that will help to develop intuition. By the end of this subject, students should have acquired reasonable proficiency in the analysis and design of basic electronic circuits.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer Programming and Programming Languages IV	EEC409	4	1	-	2	1

Course description (Syllabus): . The general objective of this course is developing advanced applications using Java Object Oriented Programming (OOP). The content of the course: Classes and objects, constructors and access modifiers in Java, Inheritance and interfaces in Java, Exceptions in Java , I/O streams, Graphical interface in Java.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electrical Circuits Theory	EEC410	7	3	3	-	-

Course description (Syllabus): DC circuits; AC circuits; Three phase theory & symmetrical components; Two-port networks; Analysis of non-sinusoidal waveforms.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electrical Measurements	EEC412	4	2	-	2	-

Course description (Syllabus): The course presents the main instruments and methods/techniques used in Electrical Measurements. The course contents: General aspects: The measurement as experimental operation. Electrical quantities. Measuring instruments and systems. Types of measurement errors, expressions, calculation. Deflectional measuring instruments: Moving coil instruments, ammeters, voltmeters, multimeters. Moving iron instruments. Electro-dynamic instruments, the wattmeter. Induction instruments, the single-phase electricity meter. Instrument transformers. The rectifier instrument. Applications. Bridges and potentiometers: Balanced and unbalanced DC bridges. The Wheatstone bridge. The Thomson bridge. AC bridges, balance conditions. Inductance bridges, the Maxwell-Wien bridge. Capacitance bridges, the Wien bridge. DC potentiometers. Applications. Analogue electronic instruments: DC and AC millivoltmeters and voltmeters, voltage measurement (peak, r.m.s. , average). Selective voltmeters. Electronic ammeters and ohmmeters. Electronic frequency and phase meters. Hall and magneto-resistive ammeters. The oscilloscope: Constructional and functional characteristics of the analogue dual channel oscilloscope. The cathode ray tube (CRT), other types of displays. Structure and operation of the time base. The trigger circuit. Operation modes, alternate, chopped. Special oscilloscopes, multi-channel, double time base. The digital storage oscilloscope, structure, operation, block diagram. Measurement methods: Impedance measurement. DC and AC voltage and current

measurement. Power, energy and power factor measurement. Frequency, period, time interval and phase difference measurement. Impedance measurement. DC and AC voltage and current measurement. Power, energy and power factor measurement. Frequency, period, time interval and phase difference measurement

3rd Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Switchgear equipments	EEC501	6	3	-	3	-

Course description (Syllabus): Generalities: Evolution and presentation of Switching Electrical Apparatus (SEA). General structure and characteristics of SEA. Classification: Electrical Contacts: Physical processes in the conduction state and in the switching of electric contacts; thermal problems; designing of electric contacts. Electromagnets, clasifications; calculus of attraction fortce; characterstics. Thermal calculus of electrical apparatus. Electric arc. Switching of electrical circuits – Connection and disconnection of D.C. and A.C. circuits. Quenching condition of D.C. electric arc; Disconnection of A.C. electric arc: condition of A.C. quenching arc; determination of reestablish voltage. Quenching of electric arc: quenching methods and quenching chambers. Low Voltage Apparatus. SEA: Circuit breakers, industrial plugs and sockets; electric relay, electromagnetic contactors, automatic interrupters. Static SEA. High Voltage Switching Apparatus. Circuit breakers: constructive types (oil, compresed air, vacuum, SF6). Isolators: characteristics and parameters; constructive types. Protection Apparatus. Protection relays. Electrical fuses: fusible burning theory; characteristics; constructive types. Arresters.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Static converters	EEC502	5	2		2	

Course description (Syllabus): Static Converters is the main chapter of Power Electronics and represents the technology for conversion and processing of electrical power and its applications. It provides the basis for new electrical circuit architecture that provides substantial improvements in performance, flexibility, and productivity. It has verity of applications in different industries such as home appliances, automotive systems, telecommunication, aerospace, industrial automation, flexible AC transmission lines (FACT), and high voltage DC transmission (HVDC). The following chapters are included:

Power electronics: enabling technologies. Power electronic switches; Advanced power static converters; Switch-mode load-side converter; Design of switching power-poles; Switch-mode dc-dc converters: switching analysis, topology selection and design; Designing feedback controllers in switch-mode dc power supplies; Soft-switching in dc-dc converters and converters for induction heating and compact fluorescent lamps; Rectification of utility input using diode rectifiers; Power-factor-correction (pfc) circuits and designing the feedback controller; Switch-mode dc power supplies; Design of high - frequency inductors and transformers.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electrical machines	EEC503	5	2		2	1

Course description (Syllabus): Aims: To introduce the students for fundamental concepts and principles of operation of various types of electromechanic converters To equip the students with basic experimental and modeling skills for handling problems associated with electromechanic converters To give the students an appreciation of design and operational problems in the electromechanic converters. Principles of Electromechanical Energy Conversion; Magnetic MEMS and Micropower Systems; Transformers; Direct-Current Generators; Direct-Current Motors; Synchronous Generators; Synchronous Motors; Polyphase Induction Motors; Single-Phase Motors; Dynamics of Electric Machines; Special-Purpose Electric Machines.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Analog Integrated Circuits	EEC504	5	2	1	1	-

Course description (Syllabus): This course is intended to provide the next level of understanding of analog circuits (after Electronic Devices and Circuits). The lecture presents: general amplifier concepts, (including frequency analysis); the ideal operational amplifiers and theirs linear applications, the non-idealities of operational amplifier, dc and ac effects and limitations; the non-linear circuits, voltage comparators and applications; function generators and oscillators; signal processing circuits, including active filters; voltage regulators, linear and switching types; SPICE simulator used for analog circuits. The main goal of the course is to develop the ability to understand, model, simulate and test low complexity electronic modules.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Database	EEC505	3	1		2	

Course description (Syllabus): This course helps students understand database concepts with the right blend of breadth and depth of information. Data is one of the most valuable assets an organisation has. Relational and hierarchical databases have been used in the industry for decades. This course teaches students the fundamentals of databases, including relational database theory, logical and physical database design, and the SQL language. Advanced topics include using functions, stored procedures and XML.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Digital Signal Processing	EEC606	4	2		2	

Course description (Syllabus): The course presents the main principles and methods used by Digital Signal Processing in order to design filters. The course contents: General aspects: Introduction to discrete-time sequences and LTI systems. Periodic sampling; Aliasing. Sampling low-pass signals. Sampling band pass signals. Fourier transform for digital signals**,** Discrete Fourier Transform (DFT). Inverse DFT. DFT Leakages. DFT of rectangular functions. Fast Fourier Transform (FFT). The radix-2 algorithm. Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters; Averaging. FIR filter structures. Convolution. Low pass FIR filter design. The Laplace transform. The Z transform. IIR filter structures. Specialized Low pass FIR filters Frequency Sampling Filters (FSF). Interpolated FIR filters (IFIR). Filters with decimation. Sample Rate conversion. The quantization process. Analogue to Digital Conversion (ADC) principles and main types of ADCs. Digital to Analogue Conversion (DAC) principles and main types of DACs.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Data Acquisition	EEC607	4	2		1	1

Course description (Syllabus): The course presents the main principles and components of Data Acquisition systems and also introduces the platforms and interfaces dedicated to building Data Acquisition (DAQ) Systems. The course contents: General aspects: Introduction to DAQ systems. Recent trends. Technologies, platforms and standards. Developing DAQ systems using specific hardware : Description of the architecture of DAQ systems. Sensors and actuators. Signal conditioning elements. Acquisition boards. DAQC system design: Designing and modelling the architecture of DAQC systems. Main architectures and platforms for acquisition and control. The OSI model. Software for DAQ applications: Introduction to Virtual Instrumentation and Graphical (G) Programming. Main LabVIEW elements used for developing DAQ systems. Configuration of DAQC systems with dedicated communication buses and interfaces: The serial interface: RS family. The parallel interface: GPIB bus. Modular instrumentation: VXI, PXI. Dedicated interfaces: USB, Ethernet, CAN. Configuration of Wireless Acquisition Systems: Smart sensors and MEMS. Description of Wireless Sensor Networks. Interfaces, standards and network topologies. The ZigBee standard.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Microcontrollers	EEC608	4	2	-	2	-

Course description (Syllabus): Introduction to Microcontroller Architecture (structure, historical perspective, microprocessor / microcontroller comparison, embedded systems); The ISA-instruction set architecture (ISA features, instruction format, instruction types, typical addressing modes, CISC / RISC comparison); Fundamentals of the microprocessor core (data path, control path, status register, I / O configuration registers, interruptions and exceptions, stack memory, introduction to pipelining techniques); Memory system (data memory, program memory, SFR zone, cache); Timing and counting circuits (structure, configuration, precision, delays programming mode, typical applications); Digital and analogue inputs / outputs (main features, mode of use, program transfers or interruptions); Serial interfaces (UART, SCI, CAN).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Power Plants and Transport of Electrical Energy	EEC609	4	2	-	2	-

Course description (Syllabus): The teaching course presents the main issues on operating principles regarding the *Power Plants* and *Transport of Electrical Energy*. The main chapters of the course are: Introduction Conventional steam-electric power plants: steam generating plant (different fuel types, thermo-hydrodinamics, Rankine cycle analysis, steam turbine plant). Gas turbine plants (open cycle plant, closed cycle plant, combined cycle plant, cogeneration plant). Conventional hydroelectric plants (hydroelectric facilities, hydroelectric equipment, environmental impacts). Pumped hydroelectric energy storage (system description and operation, advantages and disadvantages, current state and future developments, case studies). Nuclear power plants (system description and operation, nuclear reactions, reactor with pressurized water, nuclear waste). Alternative energy sources (marine energy, biomass and synthetic fuels, earth and geothermal energy). Renewable energy sources (fuel cell plants, small scale hydro plants, solar plants, wind power plants). System structure and three phse transmission (structural features and sample diagrams, stations and substations, three phase transmission).Loading and voltage control (thermal limits, stability limits, voltage control). Protection coordination (protection and protective devices, protection zones and coordination). Systems performances (reliability, security, stability, power quality). New technologies (energy storage, distributed generation, automation, FACTS). The main goal of the course is to develop the ability to understand and to design (dimensioning and choosing) of some power systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Digital Electronics	EEC610	4	2	-	2	-

Course description (Syllabus): Digital Computers and Information; Combinational Logic Circuits - Gate Circuits and Boolean Equations; Combinational Logic Circuits - Circuit Optimization; Combinational Logic Circuits - Additional Gates and Circuits; Combinatorial Logic Design - Implementation Technology and Logic Design; Combinatorial Logic Design - Combinatorial Logic; Combinatorial Logic Design - Arithmetic Functions; Sequential Circuits – Storage Elements and Sequential Circuit Analysis; Sequential Circuits – Sequential Circuit Design; Selected Design Topics - Delay and Timing, Programmable Logic; Memory Basics .

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Industrial automation	EEC512	3	2	-	1	-

Course description (Syllabus): The main objective of this course is to provide the basic knowledge in the field of automation of industrial processes, namely the automation of hydraulic, pneumatic, and thermal processes. Also knowledge for: (1) the analysis and synthesis of the control systems for slow processes and (2) modelling and simulation of automatic control systems for industrial processes. The chapters that will be studied are: Introduction to industrial automation for continuous processes, Transducers for the industrial automation of the continuous processes,

Actuators for the industrial automation of the continuous processes, Dynamic models of the continuous-time processes, Continuous and discreet type controllers used in industrial automation systems, Industrial automation for slow processes.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Virtual instrumentation I	EEC513	3	2	-	1	-

Course description (Syllabus): Introduction; Launch LabVIEW (license activation, Getting Started with LabVIEW); Tracking a sample VI: termometer.vi (download and open an instance running example, main panel study, study block diagram of the sample); Using *Context Help;* Customizing LabVIEW's; LabVIEW programming step (programming environment, the main lines of programming, development of VI); Other instructions (Case structure, For Loop, the shift register. Feedback node, SubVIs, File writing and reading, dream Structuring While using parallel loops, text-based programming using the formula node, Text-based mathematics using MathScript, Plotting the graphs).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Microsensors and actuators	EEC514	3	2	-	1	-

Course description (Syllabus): Integrated circuit technology. Sensor materials technology; Thin films deposition techniques. Nanostructures, self-organizing nanostructures, C nanotubes and graphene. Photolithographic and nanoimprint techniques; Passive and active components obtained by IC technology; Spintronic microstructures. Modern characterisation techniques. Structural, magnetic and electric. Sensors. Classifications. Physical principles of sensing. Examples. Static and dynamic transfer functions. Interface electronic circuits. Excitation circuits; Signal conditioning circuits; C-V, Q-V circuits, etc.; Two-wire, four-wire sensing; Bridge amplifiers; Noise; Shielding; Analog-to-Digital convertors – Basic aspects; Displacement, velocity and acceleration sensors; Thermal accelerometers; Girosensors; Examples of IC microsensors; Force, strain, and tactile microsensors; Examples and circuitry; Humidity and moisture sensors; Examples and circuitry; Temperature and radiation microsensors; Examples and circuitry; Magnetic microsensors; Magnetoresistive and Hall effect sensors; Spintronic microsensors; Magnetometers, rotation sensors; current sensors; MRAM based on spintronic sensors; MEMS based actuators; Physical principles of actuation and microactuation; Integrated microactuators; Micro pumps, micromanipulators, microcalorimeters, etc.; Microsystems used for energy harvesting; microgenerators based on piezoelectric, thermoelectric and triboelectric effects; Applications for autonomous sensors.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Graphical user interfaces design	EEC515	3	2	-	1	-

Course description (Syllabus): Customizing the visual structure and behaviour of graphical user interfaces (GUIs) by employing HTML elements and HTML events, respectively.

Course outline: HTML elements for constructing the visual composition of GUIs (forms, frames/iframes, images, video, links, lists, formatting elements, styles, client-side scripts); HTML events for designing the GUIs behaviour (window events, form events, drag events, clipboard events, keyboard and mouse events, respectively).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer Architecture	EEC616	3	2	0	1	0

Course description (Syllabus): Introduction to computer architecture: Historical perspective of Computer architecture: ISA, organization, implementation, architecture classification, computer system; System buses: bus structure, multiple bus hierarchies, arbitration, timings; Measuring performance: Evaluation of computer performance, CPU execution time, response time, throughput, latency, comparison between different machines, CPI, Other metrics: MIPS, MFLOPS, different benchmarks, Amdahl's Law for compute the performance improvement; Memory system: Memory hierarchy, main characteristics; Main memory: ROM, static RAM, dynamic RAM - standard and advanced DRAM organization-,

memory address map, memory connection to CPU; Associative memory, hardware organization, match logic, read operation, write operation; Cache memory , mapping types, writing into cache; Memory management: static and dynamic allocation, segmentation, paging and page translation, memory protection; Virtual memory , address space and memory space, address mapping using pages, associative memory page table, page replacement; Input-Output organization: Input-Output Interface, isolated versus memory-mapped IO; Asynchronous data transfer, strobe control, handshaking; Modes of Transfer (programmed, by interrupts, by DMA); Introduction in parallel processing architectures: advanced pipelining; Branch prediction, out-of-order execution, predicated execution, speculative execution, data speculation; VLIW Architectures, organization, advantages and limitations; Vector processor architecture, vector processing and vector operations; Introduction to multiprocessor architecture, characteristics of multiprocessors, multithreading, classification of architectures for parallel processing.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Virtual instrumentation II	EEC617	3	2	-	1	-

Course description (Syllabus): Introduction (reminder of notions previously used); Connecting models and SubVI; Transfer functions of model state in module Control and Simulation; Mesh models; MathScript window**;** MathScript node (in LabVIEW block diagram); Modules for data acquisition.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electrical equipment monitoring and diagnosis	EEC618	3	2	0	1	0

Course description (Syllabus): The general course objective is providing basic theoretical and practical knowledge for the design, measurement, diagnosis and use of automotive electronic components, as well as for the study of acoustical and vibrational behaviour.. The content of the course: Engineering study – digital signal processing, sampling, Fourier transform, conversion from time to frequency domain; Data acquisition systems; Modal analysis and structural testing; Acoustic and vibration testing and analysis; Sensors and microphones used for measurements and diagnosis; Study of an electrical machine and of the noise sources; Reading and interpreting the results from acoustic measurements and harmonic analysis; On-Board Diagnostic (OBD II) - Diagnostic System, Components, Structure of a DTC; Measurement and recording procedures; Diagnosis of the measurements over a vehicle in standstill conditions or run-up condition; Building up diagnosis reports; Electric and hybrid vehicle.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electrical and electronic equipment for automotive I	EEC619	3	2	0	1	0

Course description (Syllabus): The general course objective is to provide basic theoretical and practical knowledge for the design, diagnosis and use of automotive electronic components. The content of the course: Specific electrical systems in automobile construction; Power supply system; Starting system of vehicle construction; Charging installation; Information system: Components - basic structure of a central control unit (ECU), CAN auto network; Sensors and actuators used in vehicle construction; The ignition system; Operation of the vehicle lighting system; On-Board Diagnostic (OBD II) - Diagnostic System, Components, Structure of a DTC; ABS system operation; Airbag system operation; Vehicle management; Electric and hybrid vehicle.

4th Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electrical Drives	EEC701	4	2	-	2	-

Course description (Syllabus): Basic principles for the electrical drives analysis; The reference-frame theory; The direct-current machine's dynamic behavior; The direct-current machine converter supply and control; The field-oriented control of the induction machine; The synchronous machine dynamic and static operation; Theory of the brushless-dc machines; Controlled 3-phase bridge converters for the rotating-field electric machines supply; Stepper-motor drives.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer interfaces and peripherals	EEC702	4	2	-	2	-

Course description (Syllabus): The objectives of the course are: understand and use of the Input/Output system of a computer system, aquire knowledge related to the common computer interfaces, use of programmable interface circuits. Introduction to I/O Communication in Computer Systems. Serial Asynchronous Interface RS-232 (RS-422). Parallel Interface (IEEE-1284Standard). Special purpose interface chips (programmable interface circuits, Timers, Interrupt controller, DMA controller) Serial interfaces SPI, I2C. Universal Serial Bus (USB). JTAG.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electrical Installations	EEC703	5	2	-	1	1

Course description (Syllabus): Generalities; Producing, transport and distribution of electric energy; High, medium and low voltage electric networks; Low voltage electric networks at the consumer; Designing of low voltage electric networks; Lighting and socket installations; Increasing quality of electric energy; Electro-security in electrical installations; Electric equipment.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electromagnetic compatibility	EEC704	4	2	0	3	0

Course description (Syllabus): Introduction in ElectroMagnetic Compatibility (EMC); Sources of Electromagnetic interference and disturbances; Interference coupling mechanisms; EMC Requirements; Electromagnetic radiation and health.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer networks	EEC705	3	2		2	

Course description (Syllabus): The materials presented in classes and seminars are designed to give students basic training in the main principles, basic components and TCP/IP layers necessary in order to understand the operation of computer networks. Specific objectives: Description of the main network protocols used in computer networks; Synthesis of the typical network layers (TCP/IP stack); Description of the structural and operational characteristics of various (wired and wireless) network architectures and configuration of the related networks/sub-networks; Application of computer networks principles in different technical fields through related distributed applications; Interpretation of numerical data obtained by monitoring the packets sent in the computer network and network performance evaluation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Management	EEC806	3	2	1	-	1

Course description (Syllabus): The purpose of this course is to introduce students to the study of management principles: Introduction to General Management Business History Entrepreneurship Financial Management General Marketing; Leveraging the Power of Marketing Setting; Competitive and Corporate Strategy; Organizational Management; Technology Management; Environmental and Economic Development; Developing Leaders.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Industrial Control	EEC807	6	3		3	

Course description (Syllabus): Introduction to industrial control systems; Methods for describing a sequential automation application; Programmable Logic Controllers: Introduction; Programming Languages; Ladder Diagram; Function Block Diagram; Instruction List; Structured Text; Sequential Function Chart. Structured design of PLC applications: Method of synchronuous activation and deactivation; Method based on latch circuits. Example applications; Human machine interface.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Data transmissions and protocols	EEC808	4	2		2	

Course description (Syllabus): Among the course's main topics are the following: Data communications models and the evolution from service-centered telecommunications networks to service independent, all-over IP data networks; The main elements of a protocol and key concepts regarding the design of protocols; The TCP/IP protocol stack and the OSI reference models; The application layer: client - server and peer-to-peer architectures, the HTTP and DNS protocols; The transport layer: general rules for designing a reliable data transfer protocol, UDP vs TCP protocol analysis, developing networked applications using socket programming; The network layer: datagram protocols vs virtual circuit protocols, IPv4 and IPv6, designing and configuring an IPv4 network (subnetting), routing; The data link layer: link layer services, main types of MAC protocols, Ethernet and link layer addressing, switching; Wireless communication technologies and protocols: WiFi, WiMAX, Bluetooth, ZigBee; Industrial communication technologies and protocols: Fieldbus industrial networks vs Ethernet-based industrial networks.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Analysis of nonlinear systems in electrical engineering	EEC809	4	2	1	1	

Course description (Syllabus): The general objective of the course: Perceiving the manner in which the set of differential equations and algebraic correlations, describing the dynamics of an electrical system, has to undergo symbolic manipulation, through deductive reasoning, in order to allow the synthesis of various state-space/process models, described by nonlinear systems of differential equations. The content of the course: 1. Mathematical modelling. System model. Characteristic quantities and parameters. I/O quantities. Ordinary differential equations and algebraic correlations between characteristic quantities. The generalized mathematical model of synchronous generator. 2. Dynamic modelling. Process model synthesis. Ways of selecting the state variables based on the algebraic correlations between the characteristic quantities of the system. State-space models described by systems of ordinary differential equations in normal form. State-space models described by systems of equations in differential-algebraic form. Numerical analysis applied upon systems of equations in differential-algebraic form (overview). Development of high-order *Adams-Bashforth* predictor methods (at least eight-order) for online contingency analysis and adaptive modelling. 3. Synchronous generator. The synchronous generator orthogonal (*d-q*) axis generalized model. Parameters of the orthogonal axis generalized model. Ways of selecting the state variables (currents and/or flux linkages) based on the algebraic correlations between the *d-q* axis flux linkages and the *d-q* axis currents. The winding flux linkage state-space model. The winding current state-space model. Incorporating the effects of main flux path saturation. 4. Induction machine. The induction machine orthogonal axis generalized model. State-space equations. The parameters of the orthogonal axis generalized model. The winding flux linkage state-space model. Incorporating the effects of main flux path saturation. 5. Initial value problems (Cauchy problems) for the more complex case of salient-pole synchronous generator under dynamic conditions (short circuits, switching-in). Nonlinearities arisen as an effect of accounting for angular velocity time-related variation and main flux path saturation, respectively. 6. Procedures of assessing transients in electrical systems with a view to approximating the relative extrema (minima and maxima) of the characterisitc quantities. The more complex case of assessing transients in synchronous generators.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Power electronic circuits simulation	EEC 711	5	1	-	2	1

Course description (Syllabus): The general discipline objective is the achieving the ability of using Simulink for simulating power electronic converters. The main issues are: Introduction to MATLAB & Simulink; SimPowerSystem Library presentation; Creating and simulating a simple circuit using Simulink; Simulation basics; Subsystems; Interpretation and further use of the simulation results; Accelerating Simulink Models; Creating S-Functions; Modelling and simulation of power electronic converters for renewable energy integration; Modelling and simulation of power electronic converters for electrical machines and drives.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
CAD for electrical engineering I	EEC 712	5	1	-	2	1

Course description (Syllabus): Introduction: The object of the course, Electrical technical documentation, Classification of technical documentation, Structure of technical documentation, Content of written documents, Items that must be entered in the electrical installations projects. Making highlighting the field and drawing scale: Methods of measurement and estimation of size, containing the situation plan, Representation of existing installations, Measurement scale used to represent the plans. List of electrical equipment that is used frequently and their symbols in drawings: Symbols used in wiring diagrams for different types of devices (lights, sockets, etc), Symbolizing electric cars, Symbolizing complex aggregates (lathes, mills, crane, etc.) Niches and paintings, single line diagram: Components of cubicles and panels (bar systems, fuses, measurement systems, Realization of single line diagrams according to electrical wiring diagram in plan Types of cables and their symbolization drawings: Recognize the main types of cables commonly used in electrical, Technical data should be considered when choosing the types of cables, Symbols in the drawings of cables Facilities provided by the programming environment Caddy Electric: Program Overview, Facilities offered by the program, Existing databases symbols, Establishing measurement scale, Creating connection points, Connecting cable Generate reports on conductor size and apparatus used: Editing drawings of Electric Caddy, Fixing the types of cables used, Generating reports using programming environment Caddy Electric

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Operating systems	EEC 713	5	1	-	2	1

Course description (Syllabus): Introduction: What is an operating system: History of operating systems. Basic concepts. Processes. Files. System call. Shell. Operating system structure. Monolithic systems. Multi-layers systems. Process implementation: Inter-process Communications (IPC). Race conditions. Critical Section. Mutual exclusion. Semaphores. Event counters. Monitors. Classic IPC problems. Process scheduling. Scheduling policies and mechanism. Threads. Memory management; File systems; I/O device management; Operating systems security.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Java Programming	EEC 714	5	1	-	2	1

Course description (Syllabus): The course aims to know Java technologies, to understand the use of Java technologies depending on the problem to be solved and to learn the methodology of developing Java applications specifical to each particlar technology. The course content is the following: Generic data types; Familiarize students with the notion of "event"; Design templates;Working with MysSQL database; Java applets; AWT and Java2D; About JSP technology.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer network administration	EEC 815	2	2	-	2	-

Course description (Syllabus): Introduction to computer networks administration. Fundamental concepts; Workstation administration. Case study: Linux Installation; Web server administration. Case study: Apache server installation and

configuration; FTP Server and mail server administration; PHP stack administration. Case study: Drupal Installation and configuration; Distributed File Systems; Monitoring Tools. Case study: Nagios; SNMP; Managing changes in IT Infrastructures; Managing backup, restore and remote access services.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Software engineering	EEC 816	2	2	-	2	-

Course description (Syllabus): Introduction: The phases of a software project. Developing process monitoring. Software life-cycle models. Structured analysis and structured designing. Capability and Maturity Model Integration: (CMMI) What is? Why SMMI? Improvements in CMMI; Immature process and organizations; Building process Capability; How is a model used? Process improvement; CMMI performance results; CMMI available disciplines; Benefits of using CMMI Verification, Testing and maintenance: Verification of designing correctness. Process stability. Capability and optimization. Taguchi methods. System's maintenance. Availability and efficiency. Distributed applications: Architectures types for connecting to a server. Overview of distributed applications. Models. Reliability aspects: Mission critical type applications; Error types and their debugging; SCADA – system for control and data acquisition. Software security aspects: Support for advanced security. Data encryption. Digital signature. Keys exchanging. Encryption keys management. Databases security, Risk assessment. Security accomplishment in Java technology: Java Applet Signing; Client-server communication in secured mode; Software tools.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
CAD for electrical engineering II	EEC 817	2	2	-	2	-

Course description (Syllabus): Introduction in EPLAN work environment, basic functions; Project management: Editing a graphic - Creating cover page and a page schematic; Basic Functions - Menu Bar, copy and modify pages; Graphics core functions - Inserting and autobinding symbols, symbolization Black boxes for complex electronics (rectifiers, frequency converters, etc.); Block editing. Macros / Selection and referencing contactors: Managing a parameter; Schematic Macros; cross referencing; Select Contacts. Clasps, strings of terminals / cables and ratings: Clamps and connectors; Cables. Database, the mounting. Settings / Parameters; Create and modify database; Selection, award and modification of components in electrical circuits; Automatic generation of material lists and control lists; Printing forms. Import and export databases; Panel mounting (mounting plate); Generating plate components; Sizing (quoting dynamics) - Methods for quotation; Import / export of DXF / DWG.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electrical and electronic equipment for automotive II	EEC 818	2	2	-	2	-

Course description (Syllabus): The lectures presented and the practical works during the lab activity are designed to give students knowledge of physics phenomena that are necessary to understand the functioning of various applications in automotive engineering. The content of the course is: Today design of electric automotive, State of the art electric motors, Electric energy storage: state of the art batteries vs. super-capacitors, Regenerative brakes, Additional on-board energy sources: thermoelectric materials and photovoltaic cells.