# Electrical/Electronic Engineer BSc

**Economics**
Number of Credits: 3
Weekly Hours: 2 lectures, 0 seminar, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 1.
Prerequisites: -
Brief Syllabus
The course discusses several concepts of economics, some historically specific aspects and its connection to other scientific disciplines. The course highlights the motivations and decision situations of the micro players of the economy, the households and mainly enterprises. During this process the students will learn the most important concepts (management, poverty, needs, assets, production, consumption, distribution, etc.). The course presents the social position and role, the main types of operational framework, goals of internal and external stakeholders, and the characteristics of the basic operations. During the semester the students learn the types of the most important economic spaces and markets, their processes and connections, the specialities of the market decisions. The course also describes the concept of economic systems, their types, the reasons and areas of the economic role of the state, the possibilities and difficulties of the economic measurement and finally the most important specialities of an economic system (e.g. unemployment, inflation).

**Construction management 2.**
Number of Credits: 2
Weekly Hours: 1 lecture, 1 seminars, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 5.
Prerequisites: -
Brief Syllabus
The lectures and practicals of this subject introduce students to those aspects of management which can assist in a production and covers the following topics: definition and application of production management; elements of the construction process, their representations and relations; methods of production and construction management, their comparisons and potential applications; essentials of linear and progress chart scheduling, elements and contents of time schedules; methods and conditions for the sequencing of processes, calculating the demand for labour; the influence of money as a resource on construction scheduling; computer aided methods for construction management; types of management methods using flowcharts; essentials of the critical path method (CPM), its principles and preparation process; analysis of flowcharts from logical and chronological points of view.

**Construction management 3.**
Number of Credits: 4
Weekly Hours: 2 lectures, 2 seminars, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 6.
Prerequisites: -

Brief Syllabus
This course intends to provide students with the engineering and economic knowledge necessary for responsible participation in a development and investment process and covers the following topics: improvement of networks, essentials and elements of MPM (Metra Potential Method) diagrams; computer aided processes of networks; essentials and application of the continuous production management method and sequence programming; essentials, roles and elements of spatial organization; systems, types and content of organization plans; controlling the construction site, rights and duties of the site manager; technical administration on the construction site; technical supervision and the role of the design foreman in construction.

**Enterprise management**
Number of Credits: 2
Weekly Hours: 2 lectures, 0 seminar, 0 tutorial
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 7.
Prerequisites: -
Brief Syllabus
The objective of this course is to introduce the general aspects of enterprise management including legal, economic and administrative aspects. In particular the following topics are covered: theoretical concepts related to enterprise, reproduction and enterprise; definition of enterprise and management and the connections between them; economic environment of enterprise; markets and competition; definition of enterprise strategy and tactics; types of enterprises; special enterprise issues in the market of construction investments, phases of the construction implementation cycle; tendering according to FIDIC offers, tendering in EU countries, methods of tendering, types of contracts, elements of contract strategy.

**Engineering practice in EU 1.**
Number of Credits: 2
Weekly Hours: 2 lectures, 0 seminar, 0 tutorial
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 4.
Prerequisites: -
Brief Syllabus
The aim of the course is to introduce students to the system of professional engineering licences, the role and operation of the chambers of commerce and professional associations, the forms and possibilities of training and further education through examples from different countries. A brief history of the EU, the institutional system of education in the EU, training policies. Opportunities for engineering education and further education inside and outside EU countries. The dual training system in higher education. The recognition of academic qualifications and degrees. Regulation and licensure in engineering. The role and operation of the chambers of commerce, the system of traineeship, chamber membership. International Engineering Technologist Agreement. Graduate Attributes and Professional Competencies.

**Engineering management**
Number of Credits: 4
Weekly Hours: 2 lectures, 2 seminars, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.

Prerequisites: -
Brief Syllabus
The main aim of this course is to introduce the students to the fundamentals and the practical knowledge of organizations as systems and leadership activities. System approach. Organizations as systems. Reasons for establishing organizations. Elements of organizations. Objectives of organizations. Individual and organizational objectives. Necessities. Representation of organizations, descriptive models of organizations. Organizational units. Business organizations (companies, associations, state-owned companies, privately owned companies). Business environment, PEST and SWOT analyses. Planning and uncertainty. Functions in organizations. Projects. Tools of representation technique. Leadership activity. Means of the leader. Leadership functions. Forms of leadership behaviour. Leadership skills. Leadership styles. Problem solving and decision making. Problem solving methods. Creative way of thinking. Decision making models, decision making rationalism. Group decisions. Decision and risk.

**Basics of Environmental Engineering**
Number of Credits: 3
Weekly Hours: 2 lectures, 0 seminar, 0 tutorial
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
This course aims to give a basic knowledge of environmental processes and environmental protection to engineering student. The lectures cover the following topics: the history of environmental protection; juristical regulation and institution of environmental protection in Hungary; global problems and question of sustainable development; basic concepts; process of pollution; atmosphere and its processes; water protection; land and soil protection; waste treatment and management; noise and vibration; new fields in the environmental protection; renewable energy sources.

**Electrical Materials**
Number of Credits: 4
Weekly Hours: 2 lectures, 0 seminar, 1 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 1.
Prerequisites: -
Brief Syllabus
The main aim of this course is to introduce the students to the fundamentals and the practical knowledge of the material science. Categories and subdivision of material sciences. Evolution of knowledge on material structure, atomic models. Structure of the table of elements. Occurrence of elements in terrestrial crust, atmosphere and the universe. Main properties and usage of various materials. Properties and preparation of X-rays. Fundamentals and taxonomy of crystals, defects in crystals, single crystal growth. Destructive and non-destructive methods of structural investigation in material science. Liquids, synthetic materials and polymers.

**Mathematics a/1.**
Number of Credits: 5
Weekly Hours: 3 lectures, 2 seminars, 0 tutorial
Language of Instructions: English
Grading: Exam

Place of Subject in Curriculum: 1.
Prerequisites: -
Brief Syllabus
This lecture and practical based course aims to give engineering students a solid mathematics basis through covering the following topics: sets of numbers (natural, whole, rational and real numbers); vectors and operations with vectors, scalar and vector products and their applications; sets and operations with sets; projections; definition of functions; presentation of functions; polinoms; rational-fractional functions; algebraic functions; sequences of real numbers (definition of monotonity, limitedness, convergence and divergence); limit value and continuity of functions; types of discontinuity; definition of tangents; differential calculus of functions in one variable, differential quotients, derivative, relation between differentiability and continuity; rules of derivation, derivatives of algebraic functions; integral calculus: definition of the primitive function and indefinite integral, properties of indefinite integrals, basic integrals, integral processes, definition of the Riemann integral, its geometric and physical meaning, integral function, Newton-Leibniz theory. Students learn the basics of mathematics enabling them to interpret and understand engineer sciences and through solving elementary tasks they deepen their basic theoretical knowledge in the field of engineering. The material of the practicals matches the requirements of the different specialisations.

**Mathematics a/2.**
Number of Credits: 5
Weekly Hours: 2 lectures, 2 seminars, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 2.
Prerequisites: -
Brief Syllabus
This lecture and practical based subject aims to extend students mathematics knowledge and its application to engineering and architecture through the following topics: definition of definite and indefinite integrals, calculus of definite integrals using the Newton-Leibniz theory, application of definite integrals to engineering (architectural) problems, calculation of volume and centres of gravity, analysis of multivariable functions, interpretation and application of partial derivatives, definition, calculus and application of double integrals in authentic practical problems. Students will also learn about transcendental functions: notable limit values and their derivation, application of differential calculus, Rolle's theorem, Lagrange's mean value theorem, rule of L'Hospital, testing functions, differentials of differentiable functions and their application for fault calculation, tangency of curves, osculating circles, curvature of the plane curve at P0, Taylor-polinoms, integration with replacements, partial integration, special integrals, geometric and engineering applications of definite integrals, improprius integrals, numeric integration, examples with common differential functions, definition of differential equations, their classification and solutions, solution of differential equations of the first and second order, definition of multivariable functions, partial derivatives, gradients, extreme values of the multivariable function, definition of the double integral and its calculus in the standard range. The practical sessions are designed to meet the requirements of the different specialisations.

**Mathematics a/3.**
Number of Credits: 3
Weekly Hours: 2 lectures, 1 seminar, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.

Prerequisites: Mathematics a/2
Brief Syllabus
This course aims at teaching the basics of the elements of linear algebra, vector analysis and series. Linear algebra: concept of n-dimensional vector space, matrix, determinant, rank, matrix inverse. Solution of linear equation systems: Cramer's rule, Gauss-Jordan elimination, change of basis. Eigenvalues and eigenvectors. Vector analysis: Vector-scalar functions, curves in space and their tangents, curvature, torsion, arc length, surfaces as a two variable vector-scalar function, tangent plane, the area of a surface. Scalar-vector functions, gradient, directional derivatives. Vector-vector functions, line and surface integral, divergence and curl. Green' and Stokes' theorem, elements of potential theory. Numerical and function series, Taylor and Fourier series.

**Computer Science 1.**
Number of Credits: 3
Weekly Hours: 1 lecture, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 1.
Prerequisites: -
Brief Syllabus
The course starts with computer hardware and software basics with CPU's, RAM and ROM memories, drives, peripheries, etc. The software side is more relevant which starts with the common operating system features but focuses on the command interpreters. The next big theme is word processing where Office Word programs, Word and Powerpoint and LaTex will be introduced. In the end speadsheeting is trained and functions. *Learning outcomes:* At the end of the course the students will be able to use the Word, Excel, and Powerpoint software, the Latex text editing system, to create scripts.

**Computer Science 2.**
Number of Credits: 4
Weekly Hours: 2 lecture, 0 seminar, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 2.
Prerequisites: Computer Science 1.
Brief Syllabus
This course provides the students with an introduction to the core concepts in databases. It is centered around the core skills of identifying organizational information requirements, modeling them using conceptual data modeling techniques, converting the conceptual data models into relational data models and verifying its structural characteristics with normalization techniques, and implementing and utilizing a relational database using an industrial-strength database management system. Types of database management systems, Physical data storage concepts, Conceptual data model, Entity-relationship model, Object-oriented data model, Logical data model, Hierarchical data model, Network data model, Relational data model, Relations and relational structures, Relational database design, Mapping conceptual schema to a relational schema, Functional dependences, Armstrong axioms, Normalization, Database languages: SQL: DDL, DML, and DCL, Practice SQL with a lot of examples. Students will learn to understand the role of databases and database management systems in managing organizational data and information, to understand the historical development of database management systems and logical data models, to understand the basics of how data is physically stored and accessed, to use at least one conceptual data modeling technique (such as entity-relationship modeling) to capture the information requirements for an enterprise domain, to design high-quality relational databases,

to understand the purpose and principles of normalizing a relational database structure, to design a relational database so that it is at least in 3NF, to implement a relational database design using an industrial-strength database management system, including the principles of data type selection and indexing, to use the data definition, data manipulation, and data control language components of SQL in the context of one widely used implementation of the language.

**Electrical Engineering 1.**
Number of Credits: 5
Weekly Hours: 2 lectures, 2 seminars, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 1.
Prerequisites: -
Brief Syllabus
The aim of the subject is to convey fundamental knowledge on the governing relations of electrical and magnetic fields as well as characteristics, laws and computation methods of linear, time-invariant electrical circuits. Modeling of electrical networks with concentrated parameters, fundamentals of dipole theory and network topology. Computation procedures and methods of network analysis for linear, time-invariant dipole networks. Transient state analysis, phenomena accompanying switching events in direct current circuits.

**Electrical Engineering 2.**
Number of Credits: 5
Weekly Hours: 2 lectures, 3 seminars, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 2.
Prerequisites: -
Brief Syllabus
The aim of the subject is to convey knowledge on methods of alternating current network analysis. Mathematical representation of sinusoidal quantities, network analysis in case of harmonic excitation as well as general periodic excitation, computation of one- and three-phased networks. Fundamentals of AC quadrupole theory, main principles and methods of transfer function analysis, network analysis in time and frequency domain based on parametric plots and Bode diagrams.

**Computer Aided Design**
Number of Credits: 3
Weekly Hours: 0 lecture, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 7.
Prerequisites: -
Brief Syllabus
Introduction to the possibilities offered by computer aided design systems (CAD). Commands and procedures of AutoCAD program for building electrical design and track facilities. Datum level presentation of budget estimation programs. Short presentation of some electrical drawing and design codes. Starting with part design basics, sketching in 2D with simple and combined profiles, sketch modification, constraints and constraints animation. It follows Solid modelling with features and parametrization

**Electromagnetic fields**

Number of Credits: 5
Weekly Hours: 3 lectures, 2 seminars, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
Main quantities and source terms of static electric field. Electric charge, work in electric field, computation of field strength and potential, capacity, field quantities in insulators, continuity rules on boundary surfaces, energy and energy density of static electric field. Electric current.

**Technical Physics I.**
Number of Credits: 4
Weekly Hours: 2 lectures, 2 seminars, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 1.
Prerequisites: -
Brief Syllabus
Mechanics: basic principles and definitions, position, displacement, velocity, motion along a line, uniform motion, velocity, acceleration, free fall, circular motion, projectiles motion, Newton's laws, work done, power, work-kinetic energy theorem, conservation of energy, gravitational force, simple harmonic motion, pendulum, damped oscillations, sound waves, the speed of sound waves, ultrasound, surface tension of liquids, capillarity. Electrodynamics: electric charge, electric field, field lines, electric potential energy, electric potential, electric current, electric current density, direct current, alternating current, thermo-electricity, electrolysis, magnetic fields. Optics: speed of light, the laws of reflection and refraction, optical fibers, optical imaging, plane mirrors, spherical mirrors, lenses, aberrations, optical instruments, cameras, microscopes, telescopes, the human eye, seeing, color sensitivities, interference of light, multilayered (antireflection) coatings, diffraction, polarization, dichroism, lasers, the main types of lasers, holography. Electromagnetic radiations: types of luminescence, black body radiation, light sources, fundamentals of photometry, Beer-Lambert law, light filters, x-rays, x-ray diagnostics, natural and iduced radioactivity, radioactive isotopes, dosimetry, detectors. Our main goals are to present the basic concept of physics that students need to know for later courses, and to emphasize that physics is a tool for understanding the real world, and to teach transferable problem-solving skills that students can use throughout their lives.

**Technical Physics 2.**
Number of Credits: 4
Weekly Hours: 2 lectures, 1 seminar, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 2.
Prerequisites: Technical Physics 1.
Brief Syllabus
Concept of thermodynamic system, parameters, extensive and intensive quantities, zeroth law, state indicators, the concept of temperature, gas laws, state equation. Concept of quasistatic process. State equations, internal energy, expansion work, heat, material transfer work. The first law of thermodynamics. Concept of Kelvin and Clausius machine. The Carnot cycle, efficiency, reduced heat. The entropy law. The second law of thermodynamics. The Gibbs fundamental equation, enthalpy, free-energy, free-enthalpy. Thermodynamic

potentials, Maxwell relations. The Gibbs-Durham relation. The third law of thermodynamics. First order phase transitions, the Clausius-Clapeyron equation. Continuous phase transitions. The thermal modes of energy transport. Introduction to optics: subdivisions of optics. Main laws of geometric and wave optics.

**Electric Power Conversion 1.**
Number of Credits: 4
Weekly Hours: 3 lectures, 1 seminar, 1 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 4.
Prerequisites: Electrical Engineering 2.
Brief Syllabus
Students learn the working principle, operational properties, selection and operation conditions of electrical machines applied in engineering practice along with fundamentals of electric drives. Students learn the structure and operation of direct-current machines, transformers, synchronous and asynchronous machines.

**Electric Power Conversion 2.**
Number of Credits: 5
Weekly Hours: 2 lectures, 1 seminar, 1 tutorial
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 5.
Prerequisites: Electrical Power Conversion 1.
Brief Syllabus
The main aim of this course is to introduce students to learn the working principle, operational properties, selection and operation conditions of electrical machines applied in engineering practice along with the fundamentals of electric drives. Kinetics of electrical drives: gears and their role, calculation of drive properties at the shaft. Torque, equation of motion of electrical drives, rotation speed versus time. Electrical motor selection criteria: construction, vibration and noise level, protection class, heating, cooling solutions, operation types**.**

**Electric Power Conversion 3.**
Number of Credits: 5
Weekly Hours: 2 lectures, 0 seminar, 1 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 6.
Brief Syllabus
Direct-current (DC) drives: Static and dynamic test of DC motors with independent excitation. DC power units. Drives based on current converters. Closed-loop control methods and possibilities. Alternating-current (AC) drives: Test of synchronous and asynchronous motors. Operational conditions of AC power units and drives.

**Operation of Electrical Installations 2.**
Number of Credits: 6
Weekly Hours: 3 lectures, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 6.
Prerequisites: -

Brief Syllabus
Kilowatt-hour metering, power factor correction, voltage and current transformers. Electric energy storage, batteries and chargers, uninterruptible power sources. Auxiliary equipment. Fundamentals, types, automatics and settings of protective devices. Operational automatics. Dimensioning of bus-bars. Electric heat generation. Fundamentals of lightning protection, risk assessment, dimensioning of primary and secondary lightning protection.

**Building Management Systems 1.**
Number of Credits: 4
Weekly Hours: 2 lectures, 0 seminar, 1 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 6.
Brief Syllabus
The main aim of this course is to introduce the modern building installations, the comparative analysis of the different systems. Practising the planning and the installation of the most common systems in laboratory practices. Tasks, functions, sensors and actors of building supervisory systems in energy saving and intelligent buildings. Management of heating, air cooling, ventilating and lighting systems. Dimensioning and management of household sized photovoltaic systems. Energy management, smart metering. Up to date electricity installation. Structure and supervision of smart networks, virtual power plants, micro-grids. Access management systems, room control.

**Building Management Systems 2.**
Number of Credits: 3
Weekly Hours: 2 lectures, 0 seminar, 1 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 6.
Prerequisites: Building Management Systems 1.
Brief Syllabus
The main aim of this course is to introduce the modern building installations, the comparative analysis of the different systems. Practising the planning and the installation of the most common systems in laboratory practices. Bus systems and Building Surveillance Systems. Network topologies. Communication model. Binary encoding. Transfer fitting units. Network hierarchies, field bus standards. Control system communication buses and IT systems. General structure of surveillance systems. Networks used by surveillance systems. Conditions of information and data transfer safety. Environment and network disturbance. Design and implementation principles. Design of complex building IT network, parameter setting, post-commissioning testing. The format of the message HDLC protocol, UART, Profibusz standard, HART protocol, Token wire. Communication standards, RS232, RS422, RS485, visualization of binary information: RZ, NRZ, NRZI, AFB, AMI, Manchester coding.

**Computer Programming I.**
Number of Credits: 3
Weekly Hours: 1 lecture, 0 seminar, 1 tutorial
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 1.
Prerequisites: -

Brief Syllabus
This course provides an introduction to all of the fundamental aspects of the C programming language, including elementary data types; arithmetic, logical and bitwise operators; control-flow statements; functions; structures; pointers; program scope rules; good program design practices; and C debugging techniques. Emphasis is on the ANSI-standard C. Variables and data types, operators. Control flow. Functions and modular programming. Variable scope. Static and global variables. Pointers and memory addressing. Arrays and pointer arithmetic. Strings. Searching and sorting algorithms. User-defined data types, structures, unions, bitfields. Memory allocation. Linked lists, binary trees. Pointers to pointers, pointer and string arrays, multidimensional arrays. Stacks and queues. I/O, using files. C standard library: stdio.h, ctype.h, stdlib.h, assert.h, stdarg.h, time.h. Students will learn the basic concepts of program design and data structures. They will learn fundamental C concepts such as algorithmic thinking, problem solving, control structures (if, if…else, switch, while, do…while, for), data types, operators, input/output, functions (user-defined and library) and arrays.

**Computer Programming II.**
Number of Credits: 3
Weekly Hours: 0 lecture, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 2.
Prerequisites: Computer Programming I.
Brief Syllabus
The purpose of this course is to introduce the students to the fundamental concepts of object-oriented programming and appreciate the complexity of application development. Students will learn the basic concepts of program design, problem solving, and fundamental design techniques for object-oriented and event-driven programs. Program development will incorporate the implementing a solution in a programming language C# .NET, and testing the completed application. Fundamentals of object-oriented theory. The concept of Class and object. Creating properties, methods, creating classes and objects. Constructors. Passing parameters to constructors, overloading constructors. Inheritance. Passing parameters to methods. Polymorphism. Creating and using interfaces. Delegates. Exception handling. Arrays. Collections. Generics. Files and Streams. GUI applications. Using Controls. Event handling. Menus. Threads. Students will learn to understand the architecture of .NET Framework, to understand the concepts and technics of object-oriented programming, to create console applications, to create GUI (Windows Form) applications, to use data-streams, files, collections in their applications, to understand the fundamental concepts of event-driven programming, to create multi-forms, menu driven applications.

**Computer Programming III.**
Number of Credits: 5
Weekly Hours: 3 lectures, 0 seminar, 1 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 5.
Prerequisites: Computer Programming II.
Brief Syllabus
The primary goal of this course is to introduce advanced object-oriented programming and the Java Programming Language. The course emphasizes an in-depth study of object-oriented

programming paradigm including advanced topics in: inheritance: abstract classes, interfaces, multiple inheritance, inheritance hierarchies, polymorphism; application programming interface: GUI programming, event dispatch/handling; exception handling: throwing and catching exceptions; the base of network programming and JDBC. The course is divided into two interacting sections: a lecture-based theory section and a laboratory-based programming section. Each laboratory session tackles different programming problems that are typical of this style of program design. The lecture-based sections prepare the laboratory tasks, but it deals with some concepts in larger context as well. Knowledge of concepts and theories of object-oriented programming. To become familiar with Java language syntax.To design, develop and test applications in an object-oriented programming language – especially in Java –, including event-driven, client-side network-based applications with a simple graphical user interface, threads and synchronization techniques.

**Digital logic design I.**
Number of Credits: 4
Weekly Hours: 2 lectures, 2 seminars, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 1.
Prerequisites: -
Brief Syllabus
The majority of the instruments in information technology are digital systems. The course helps the students to understand the mathematical and electronic basics of these systems, and gives instructions for the planning and creation of them. Starting from the simplest building elements, the level of digital computers is reached systematically. Tasks, operation and architecture of the logic systems. Boole algebra, logic functions, two- and more-valued logic. Planning of combinational networks. Minimizing of logical functions, hazards, elimination of them. Combinational networks from memory elements and programmable logic circuits. Sequential networks: types and description modes of them. Elemental and complex sequential networks. Basics of microprocessor systems, main parts and tasks. Introduction to the assembly programming.

**Digital logic design II.**
Number of Credits: 4
Weekly Hours: 1 lecture, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 2.
Brief Syllabus
The majority of the instruments in information technology are digital systems. The course helps the students to understand the mathematical and electronic basics of these systems, and gives instructions for the planning and creation of them. Starting from the simplest building elements, the level of digital computers is reached systematically. Complex sequential networks (counters, shift registers, encoders, decoders etc). Electrical parameters of digital systems (signal level, transfer characteristics, propagation time, dissipation, quality factor, fan-out, fan-in). Logical circuit technologies (TTL, ECL, MOS, CMOS), comparison. Memories (RAM, ROM EPROM, EEPROM ect.), registers, bus systems. Application techniques.

**Digital logic design III.**
Number of Credits: 5
Weekly Hours: 2 lectures, 0 seminar, 2 tutorials

Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 5.
Brief Syllabus
The majority of the instruments in information technology are digital systems. The course helps the students to understand the mathematical and electronic basics of these systems, and gives instructions for the planning and creation of them. Starting from the simplest building elements, the level of digital computers is reached systematically. Evolution of digital circuits, general purpose logical networks. Types and classification of programmable logic arrays. General block diagram and main units of programmable logic arrays. Burning and testing of programmable logic arrays. Macrocell based devices: PAL, GAL, HAL, FPLA. Complex, large scale integrated devices. Architecture, operation, parameters of FPGAs. Architecture, operation, parameters of CPLDs. Implementation modes of logical networks in programmable logic arrays.

**Digital logic design IV.**
Number of Credits: 4
Weekly Hours: 2 lectures, 1 seminar, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 6.
Brief Syllabus
Parameters of digital systems, hardware and software characteristics. Design principles of digital systems. Sampling, quantization. The concept of adaptivity. Characteristics of adaptive systems. Discrete Fourier transform. Duality theorem. Operation and properties of Fast Fourier Transform. FFT algorithms. Basic principles of digital filtering. Design, operation and characteristics of FIR filters. Design, operation and characteristics of IIR filters. Adaptive signal processing. Wiener filtering, signal processing with and without learning algorithms. Principle and implementation of adaptive channel equalizers. Principle and implementation of adaptive signal compression. Principle and implementation of optimal resource management. Adaptive antennae, antenna systems. Architecture and properties of Digital Signal Processors (DSP). Fixed-point and floating point implementations.

**Computer networks I.**
Number of Credits: 5
Weekly Hours: 3 lectures, 0 seminar, 1 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 4.
Prerequisites: Computer Architecture I.
Brief Syllabus
The course discusses the aims and function of computer networks. Physical and theorethical limitations and expectations shaped the evolution of telecommunication. During the lectures, we classify networks and compare them. The lecture discusses the lower layers of computer networks. History of computer networks, types of computer networks. Standards for computer networks. ISO-OSI reference modell. Physical and data link layer, multiplexing, modulation methods. Local and city networks. After completion of the course the student will be able to: describe the OSI-ISO reference modell, to understand the lower level components of a computer network, to understand the technology of the lower layers.

**Computer networks II.**
Number of Credits: 5

Weekly Hours: 2 lectures, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 5.
Prerequisites: Computer networks I.
Brief Syllabus
To introduce the students to the functions of upper layers. To make students to get familiarized with different network protocols. To introduce standards used is computer networks. This course is intended to help students understand the mechanisms of upper OSI layers. We will focus on an overview of network, transport and application layers. Students who successfully complete this course will have a concept and knowledge building, operating and managing computer networks. Students will also have hands on experience in building computer networks, configuring active network devices, switches, routers through lab sessions. Students who successfully complete this course will have a comprehensive overview of computer networks as well as more in depth understanding of a number of focus areas that they select throughout the course. Furthermore, students will have hands on experiences in computer networks. At the end of the semester, the students will be able to: design physical and logical plans of LAN networks, to calculate with IP addresses, making subnets, to select devices appropriate to the network requirements, to build and configure SOHO networks, to build and configure enterprise networks, to configure routing and switching.

**Computer networks III.**
Number of Credits: 5
Weekly Hours: 2 lectures, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 6.
Prerequisites: Computer networks II.
Brief Syllabus
To introduce the students to the basics of telecommunication networks. To make students to get familiarized with different type of access and core network technologies like ADLS, HFC, FTTx, SDH, ASON…etc. To give advanced knowledge in order to build, operate and manage networks. This course is intended to help students understand the basics of telecommunication networks. We will focus on an overview from early telephone networks, through CaTV networks to nowdays new generation telecommunication networks. Students who successfully complete this course will have a concept and knowledge about telecom protocols and systems. Students will also have hands on experience in building VoIP networks, analyzing network protocols, building integrated networks through lab sessions. Students who successfully complete this course will have a comprehensive overview of telecommunication networks as well as more in depth understanding of a number of focus areas that they select throughout the course. Furthermore, students will have hands on experiences in telecommunication networks. At the end of the semester, the students will be able to analyze network protocols and solving network problems, to change conventional telephone systems to IP based VoIP systems, to make advanced configurations in LAN and WAN computer networks, to build and configure Wireless networks, to build and configure virtual local area networks, to use centralized computer network management systems.

**Electronics I.**
Number of Credits: 4
Weekly Hours: 2 lectures, 0 seminar, 1 tutorial
Language of Instructions: English
Grading: Exam

Place of Subject in Curriculum: 2.
Prerequisites: -
Brief Syllabus
The aim of this course is to provide an introduction to the fundamentals of analogue electronics. Methods of electronic circuit analysis and synthesis are presented and illustrated at laboratory practice. Passive devices. Methods of passive circuit analysis. First order filters. Resonance filters. Characteristics of quadrupoles, amplifiers. Transfer functions. Noise, noise rejection, distortion. Basic principles of semiconductor devices. P-N junction, semiconductor diodes: structure, characteristics, packaging, transient phenomena in switching mode. Varactors, Zener diodes. Applications: rectifiers, voltage clippers, potential, voltage multipliers. Structure, principle of operation and characteristics of bipolar junction transistors. H-parameter model. Miller principle. Early-effect. Basic circuits (common-emitter, common-collector, common-base, cascode amplifiers) modeling, characterization, biasing. Structure, principle of operation and characteristics of field effect transistors. H-parameter model. Basic circuits (common-source, common-drain, common-gate) modeling, characterization, biasing. Multistage amplifiers, feedback (series, parallel, voltage, current feedback). Effects on amplifier parameters (voltage gain, current gain, input and output impedance). Amplifier types (voltage-, current-, transimpedance- and transadmittance-amplifiers). Power amplifiers. Amplifier classes: A, B, AB, C, D. Darlington connection. Overcurrent protection. Photometry. Optoelectronic devices, photoresistor, photodiode, phototransistor, LED, optocoupler.

**Electronics II.**
Number of Credits: 4
Weekly Hours: 2 lectures, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.
Prerequisites: Electronics I.
Brief Syllabus
This course provides basic knowledge and design principles of electronic circuits based on operational amplifiers. Advanced applications include analogue and switched capacitance active filters, linear and switching power supplies, analogue-digital and digital-analogue converters.
Structure and properties of voltage-feedback and current-feedback operational amplifiers. Analysis and synthesis of circuits with operational amplifiers. Single supply Op Amp design techniques. Voltage detection, voltage limiting, comparators. Multivibrators, function generators, pulse width modulation techniques. Differential amplifiers. Logaritmic and exponential amplifiers, precision rectifiers. Sine wave oscillators, Wien bridge, double T, phase shift, quadrature oscillators. Analogue and switched capacitance active filters, Bode analysis. Linear and switching power supplies. Analogue-digital and digital-analogue converters.

**Electronics III.**
Number of Credits: 3
Weekly Hours: 2 lectures, 0 seminar, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 4.
Prerequisites: Electronics II.
Brief Syllabus
The aim of this course is to provide introduction to advanced analogue and front end digital electronic circuits. Introduction to fundamentals of power electronics. Characteristics, control

circuits, cooling of power semiconductor devices. Architecture, operation principle, control solutions of inverters and frequency converters. Modeling of electronic noise. Active noise rejection methods. Clock signal preparation, jitter minimization, direct digital synthesizer (DDS) circuits. Modulators, demodulators, lock-in amplifiers. Radio communication measurements. Graphics displays.

**Electrical Power Engineering 1.**
Number of Credits: 4
Weekly Hours: 3 lectures, 1 seminar, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
The main aim of this course is to introduce students to the energy sources, energy generation, the types of power plants, electrical networks and consumers, the dimensioning of conductors, the over-voltage protection, the fundamentals of the electric safety. To provide students with the fundamental and high level basic knowledge essential for the work of elelctrical engineers. Nonrenewable and renewable primary and secondary energy sources. Electric energy generation, types and structures of power plants, electric networks and consumers. Structure and characteristics of the electric energy system. Power and data conductors and cables. Considerations and methods of dimensioning conductors. Over-current protection devices and their dimensioning. Fundamentals of the electric safety, dimensioning the protection against electric shock. Fundamentals of over-voltage protection.

**Electrical Power Engineering 2.**
Number of Credits: 6
Weekly Hours: 2 lectures, 2 seminars, 1 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 5.
Brief Syllabus
The main aim of this course is to introduce students to the structure, elements, short-circuits, star point handling of electric systems, to the method of the symmetric components, and to the application of these in case of different types of short-circuits. To give students a knowledge of short circuit calculations, the electric and mechanical properties of the overhead lines, poles and insulators. The structure, elements and nominal voltages of electric energy systems. The method and application of symmetrical components. Impedance of network elements for symmetrical sequences. Serial and shunt failures of networks, types of short-circuits and their calculation. Effect of the star point handling on earth faults. Methods of short-circuit calculation. Electrical and mechanical properties of overhead lines and their mechanical state equation. Dip diagram and its application. Poles, insulators, forces, foundations, grounding and installation of overhead lines.

**Building Surveillance System**
Number of Credits: 4
Weekly Hours: 2 lectures, 1 seminar, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 6.
Prerequisites: -

Brief Syllabus
The main aim of this course is to introduce the students to the fundamentals and the practical knowledge of the building supervisory systems, intelligent buildings and energy management.Tasks, functions, sensors and actors of building supervisory systems in energy saving and intelligent buildings. Management of heating, air cooling, ventilating and lighting systems. Dimensioning and management of household sized photovoltaic systems. Energy management, smart metering. Up to date electricity installation. Structure and supervision of smart networks, virtual power plants, micro-grids. Access management systems, room control.

**Communication Engineering**
Number of Credits: 4
Weekly Hours: 2 lectures, 0 seminar, 1 tutorial
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 4.
Prerequisites: -
Brief Syllabus
The main aim of this course is to introduce the fundamentals of communication engineering, the classification and characteristics of communication networks.Fundamentals of communication engineering. Classification and characteristics of communication networks. Line-, package- and cell-connected systems. Properties and application possibilities of data transfer media: coaxial cable, twisted wire pair, optical lead, wireless solutions. Concept, properties and production of analogue and digital signals. Concept and properties of analogue and digital signal transfer. Properties and application possibilities of modulation procedures: analogue and digital signal with sinusoidal or pulsed carrier. Concept and application areas of scalar and vector modulation. Production of encoded signals, properties and application possibilities of encoding procedures: PCM signal, multilevel signals. Error detection and error correction encoding solutions. Reduction of the amount of information to be transferred: loss free and lossy compression procedures. Principle, implementation and application possibilities of multiplex systems: FDM, TDM, CDM, TDD. Frequently applied standard multiplex solutions. Communication network solutions.

**Programmable logic controllers**
Number of Credits: 4
Weekly Hours: 2 lectures, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 6.
Prerequisites: Digital logic design
Brief Syllabus
The course provides the students with the fundamental concepts of programmable logic control including the operating principles of PLC. The course explains the basic programing concepts and skills required to write an appropriate real-time open-loop control program. Upon completion of this course, students will demonstrate the ability to: Explain operating principles and major components of a Programmable Logical Controllers. Develop control strategy in several IEC 61131 conform languages. Convert state chart and function block diagrams into PLC programs. Edit, monitor and analyze PLC programs. PLC evolution. Advantages of PLCs, criteria for selection of suitable PLC. Compact and modular PLCs. Block diagram of PLC. Principle of operation. CPU – memory organization, I/O modules, Input/output types. The IEC 61131-3 standard. Program organization units. Data types. Symbols used: relays and logic functions.

Programming methods IL, FBD, Ladder methods and Sequential function chart (SFC). Pulse edge evaluation, timer instructions, counter instructions. Timer and Counter applications. Binary and digital controls. Arrays in control applications. Development of PLC Projects.

**Project laboratory I.**
Number of Credits: 3
Weekly Hours: 0 lecture, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 5.
Prerequisites: Electronics III.
Brief Syllabus
Through individual practice, students get acquainted with the use of circuit design and simulation software packages, design, production and debugging of electronic circuits. Overview of printed circuit production from design to manufacturing. Theoretical and practical issues of printed circuit design. Overview of circuit design software packages. Presentation of the TINA circuit simulator program. Presentation of the Eagle circuit design software package. Practice on Eagle circuit design software through an actual design task.

**Project laboratory II.**
Number of Credits: 3
Weekly Hours: 0 lecture, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 6.
Prerequisites: Measurement technology II
Brief Syllabus
This laboratory practice provides basic insight into the use of advanced electronic measurement instruments. Measurement of analogue, digital and non-electrical quantities by means of a recording digital oscilloscope. Computer aided measurements: choice of interface cards, application of software packages. Use of logical analyzers for multichannel digital signal measurements. Watching and measurement of parallel and serial port communications. Analysis of high speed signals.

**Project laboratory III.**
Number of Credits: 3
Weekly Hours: 0 lecture, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 7.
Prerequisites: Project laboratory I.
Brief Syllabus
Students in small teams carry out a complex electronic development task using the available infrastructure. Assignments can be chosen from a list comprising department development needs and industrial assignments respectively. Configuration of technical specification, task formulation, scheduling. Provided the infrastructure, the students work out and implement the assigned task.

**Measurement technology I.**
Number of Credits: 4
Weekly Hours: 2 lectures, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Term Mark

Place of Subject in Curriculum: 3.
Prerequisites: Electrical Engineering I.
Brief Syllabus
The main objective is cognition, knowledge deepening and practice of electrical measurement technology. Synthetic review of operation principles of direct operation electromechanical, analogue and digital electronic instruments and oscilloscopes. Presentation of measurement methods and practice in laboratory environment. Measurement accuracy, error, error propagation. Complex measurements in single-phase and three-phase circuits.

**Measurement technology 2.**
Number of Credits: 4
Weekly Hours: 1 lectures, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 4.
Brief Syllabus
The main aim of this course is to introduce the electrical measurement and the operational principles of electrical measurements. The objective is familiarization and practice of electrical measurement of non-electrical quantities based on the knowledge acquired at Measurement technology I. Therein the cognition of operation principles of sensors and structure of related electrical measurement and signal transfer circuits. Concerned areas within the frame of this subject are cognition and practice of electrical measurement of temperature, radiation and mechanical quantities in laboratory conditions.

**Operation of Electrical Installations 1.**
Number of Credits: 5
Weekly Hours: 2 lectures, 0 seminar, 1 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 5.
Prerequisites: -
Brief Syllabus
The main aim of this course is to introduce students to the electric equipments, devices and other repairing materials, to their functions, operation, choosing them and to provide students with knowledge about intagrating them in the electric designs and automation. Types of electric equipment and devices. Heating up and heat dissipation. Contacts, electric arc and its suppression. Switches, fuses, low and high voltage isolators and circuit breakers. Thermoswitches, relays, contactors, motor protection devices and their dimensioning. Motor starting, motor management. Types of sensors, electrical symbols for schematics. High voltage overvoltage protection devices. Protection against electric shock. Creating electric designs.

**Microelectronics**
Number of Credits: 3
Weekly Hours: 2 lectures, 0 seminar, 0 tutorial
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 4.
Prerequisites: -
Brief Syllabus
This course provides insight into state of the art electronic technologies. Introduction to

microelectronic technologies. Component suite of monolithic integrated circuits. Implementation examples of digital, analogue and radiofrequency circuits. Design methods for very large scale integration. Debugging procedures. Monolithic memories. Programmable devices (microcontrollers, PLD, FPGA). Programming, speed and signal level adjustment.

**Microcomputers**

Number of Credits: 4
Weekly Hours: 2 lectures, 0 seminar, 0 tutorial
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 5.
Prerequisites: -
Brief Syllabus
This course provides fundamentals of Microcomputers. Architecture of microcomputers. Fundamentals of microprocessors (bit number, buses, interrupt, DMA, stack, etc). Structure of simple microprocessors: architecture, units (ALU, control unit, registers), operation (phase, machine cycle, command). Instruction suit, instruction groups, machine code. Assembly programming. Peripherals and peripheral couplers (typical fitting tasks, characteristics of VLSI circuits, the concept of intelligence, multipurpose elements). Levels of information storage. Memories (types, grouping, parameters, functions, properties, interface, application technique). Microprogrammed and wired control units. RISC and CISC processors (concepts, objectives, benefits, drawbacks, tendencies). Architecture and instruction set of PIC and INTEL 8051 microcontrollers. Developer environments, programming techniques, simulators, debugging.

**Control Engineering I.**

Number of Credits: 4
Weekly Hours: 2 lectures, 2 seminars, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.
Prerequisites: Digital Engineering I.
Brief Syllabus
This course provides fundamentals of open loop control as well as an introduction to programmable logic controllers. At seminars students get acquainted with the design steps of open loop control system, principles and practice of PLC programming. Subdivisions of control engineering, open and closed loop control, disturbance compensation. Open loop control systems, combinational and sequentional logic circuits. Electromagnetic relays, relay logic, ladder diagrams. Semiconductor logic gates, flip-flops, delay circuits, signal conditioners, signal adapters. Programmable Logic Controllers, functions, architecture, cyclic operation principle, programming. Configuration of PLC systems.

**Control Engineering II.**

Number of Credits: 4
Weekly Hours: 2 lectures, 1 seminar, 0 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 4.
Prerequisites: Mathematics II.
Brief Syllabus
The aim of this course is to provide insight into fundamentals of closed loop control theory. Characteristic functions of systems theory in frequency and Laplace operator domain

respectively. Nyquist and Bode plots. Steady state error, disturbance compensation. Stability criteria, gain and phase margin, controller tuning. Numerical simulation and design of control systems.

**Control Engineering III.**
Number of Credits: 4
Weekly Hours: 2 lectures, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 5.
Prerequisites: Control Engineering II.
Brief Syllabus
This course offers an overview of sampling control theory and practice, state space representation of control systems and optimal control. Programming practice and hands-on training of PLC-based control systems is provided in laboratory. Fundamentals of Direct Digital Control (DDC). Mathematical and physical sampling, Shannon theorems. Mathematical modeling of discrete time control, Z transform. Stability, analogy with continuous time control systems, dimensioning to finite response. State variables, state space representation of linear systems. Controllability, observability. Optimal control strategies. PLC programming practice.

**Control Engineering IV.**
Number of Credits: 2
Weekly Hours: 2 lectures, 0 seminar, 0 tutorial
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 6.
Prerequisites: Control Engineering III.
Brief Syllabus
This course offers an overview of controller peripheral devices, structure and operation principle of sensors and actuators. Static and dynamic properties of sensors. Proximity switches, inductive, capacitive, galvanic and Hall sensors. Rotation speed sensors. Digital rotation speed metering based on frequency and period measurement. Alternating current and voltage sensing. Reference signal forming. Difference forming. Power supplies, voltage stabilizers. Controller architectures.

**Electrical Safety Technology**
Number of Credits: 4
Weekly Hours: 2 lectures, 0 seminar, 1 tutorial
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 7.
Prerequisites: -
Brief Syllabus
The main aim of this course is to introduce the students to the fundamentals and the practical knowledge of protection for safety and fault protective provisions. The standard HD 60364-4-41: Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock. Basic protective provisions under normal conditions and fault protective provisions under single fault conditions. Different methods of fault protection. Methods and dimensioning of automatic disconnection of supply. Protective grounding in systems with direct grounding (TT). Neutralizing in TN-C, TN-S, TN-C-S systems. Application of residual current devices (RCD). Protective grounding in systems with no direct grounding

(IT). Fault protective provisions without automatic disconnection of supply. On-site measurements and supervisions with devices meeting the standard EN 61557. Measurement of insulation resistance. Test of continuity of protective conductors, equipotential bonding and grounding connections. Measurement of earth resistance and specific earth resistance of the soil. Measurement of the fault loop impedance and determination of the expected short-circuit current. Measurement of RCDs in TN and TT systems. Supervision of low-voltage networks. Calculation and measurement of powers with different methods. Harmonic analysis of consumer devices. Documentation of tests.

**Electromagnetic Compatibility**

Number of Credits: 2
Weekly Hours: 2 lectures, 0 seminar, 0 tutorial
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 5.
Prerequisites: -
Brief Syllabus
The main aim of this course is to introduce the students to the fundamentals and the practical knowledge of electromagnetic compatibility, electrostatics and measurements. Goal, terminology and topics of the electromagnetic compatibility (EMC). Electrostatic discharge/damage (ESD), electromagnetic pulse (EMP), over-voltage protection. Low frequency interference (LFI), harmonics, voltage disturbances, network reactions, filters, shielding. Radio frequency interference (RFI), conductive data transmission. EMC calculations, measurements, measuring devices, modeling, simulation EMC directive, regulation and standards.

**Design and Production Technology**

Number of Credits: 5
Weekly Hours: 2 lectures, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 5.
Prerequisites: -
Brief Syllabus
The main aim of this course is to introduce the students to the fundamentals and the practical knowledge of product developmnet and production lines.Task specification, requirement schedule compilation. Component knowledge, mounting through holes, surface mounting, casing. Basic principles and process of design and elaboration. Failure Mode and Effect Analysis, Flowchart, Control Plan. Manufacturing documentation, printed board design programs. Aspects of prototype production. Mass production. State of the art production lines. Aspects of product development and production efficiency enhancement. Lean manufacturing. Environment protection aspects, lead-free soldering, Restriction of Hazardous Substances (RoHS).

**Design of Microelectronic Systems**

Number of Credits: 5
Weekly Hours: 2 lectures, 0 seminar, 2 tutorials
Language of Instructions: English
Grading: Term Mark
Place of Subject in Curriculum: 6.
Prerequisites: -

Brief Syllabus
Printed board design. Displacement of components, loading and speed issues. Electrical and mechanical standards, consideration of limitations. Presentation and comparison of hardware solutions for application of various peripherals (ADC and DAC issues, keyboards, displays, etc) Functions and practical applications of CAD systems. Harmonization of design and manufacturing systems. Design and construction of electric circuits.

**Embedded Computer Programming, Autonomous Intelligent Systems**
Number of Credits: 4
Weekly Hours: 2 lectures, 0 seminar, 1 tutorial
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 7.
Prerequisites: -
Brief Syllabus
The main aim of this course is to introduce the students to the fundamentals and the practical knowledge of programming skills, embedded systems and artificial intelligence. Recollection of fundamental programming skills. Special software requirements of embedded systems (speed, size, cost). Fundamental devices and methods of artificial intelligence: knowledge based, fuzzy, artificial neural networks, genetic algorithms. Design of intelligent and autonomous embedded systems. Applicable programming techniques: C, C++ and other object oriented languages and frameworks. Examples from various industrial fields (nuclear energy, automotive industry etc).