

# Transilvania University of Braşov, Romania

## Study program: Computers

Faculty: Electrical Engineering and Computer Science

Study period: 4 years (bachelor)

### 1<sup>st</sup> Year

| Course title         | Code    | No. of credits | Number of hours per week |         |            |         |
|----------------------|---------|----------------|--------------------------|---------|------------|---------|
|                      |         |                | course                   | seminar | laboratory | project |
| Communication Skills | CALC101 | 3              | 1                        | 2       | 0          | 0       |

**Course description (Syllabus):** Interpersonal Perception; Communication – an introduction; Verbal and nonverbal Communication; Communication and transactional analysis; Communication and Conflict; Communication Ethics and Etiquette; Personal development within the organization. Workshop: Organising the Seminar Activity; The Portrait of an Unknown Person; Interpersonal Perception within a Group; Active Listening; Delivering a Public Speech; Curriculum vitae, Letter of Application/The Application; The Letter of Application / The Application; The Identification of one's Own Way of Managing and Communicating in the case of Conflictual Situations; Group Communication-taking part in a discussion group; Cooperation and Interpersonal Behaviour: roles in group problem solving; Self-presentation for a Job Interview: practising self-presentation strategies for the job interview; Evaluation of the Seminar Activity.

| Course title                          | Code    | No. of credits | Number of hours per week |         |            |         |
|---------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                       |         |                | course                   | seminar | laboratory | project |
| Using Computers and Internet Services | CALC102 | 4              | 1                        | 0       | 2          | 0       |

**Course description (Syllabus):** Introduction to computer networks and services implemented in computer networks with direct examples on Internet. Gaining knowledge of main Internet Services (TCP/IP, SMTP, POP3 protocols, DNS service, e-mail, WWW, ftp, Usenet, interactive web services (PHP, Javascript), search engines, client – server architecture and peer-to-peer architecture). Introductory notions related to computer networks (addressing in Internet and intranet, host connection to network (dial-up, ISDN, ADSL, VSAT), security notions (crypting, PGP, VLAN).

**Laboratory:** Use the knowledge of fundamentals gained in problems solving like: read/write e-mails, file transfer with FTP, search for information using WWW; Ability to create a web page in HTML or CSS, and upload it on a web hosting server.

| Course title          | Code    | No. of credits | Number of hours per week |         |            |         |
|-----------------------|---------|----------------|--------------------------|---------|------------|---------|
|                       |         |                | course                   | seminar | laboratory | project |
| Mathematical Analysis | CALC103 | 6              | 3                        | 2       | 0          | 0       |

**Course description (Syllabus):** Relations. Ordered sets. The set of real numbers; Sequences and series of real numbers. Convergence criteria for series; Real functions: limits, continuity, derivatives. Taylor's formula; Riemann integrability. Improper integrals; Sequences and series of real functions. Power series; The Euclidean space  $R^n$ . Functions of several variables; Limits, continuity and differential calculus on  $R^n$ . Extreme values of differentiable functions of several variables; Parameter-dependent integrals. Euler's functions; Line integrals. Multiple integrals. Integral formulas.

| Course title                                         | Code    | No. of credits | Number of hours per week |         |            |         |
|------------------------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                                      |         |                | course                   | seminar | laboratory | project |
| Linear Algebra, Analytical and Differential Geometry | CALC104 | 6              | 3                        | 2       | 0          | 0       |

**Course description (Syllabus):** Linear algebra (Vector spaces, Linear transformations, Linear forms, Bilinear forms, Square forms); Analytic geometry (Bound vectors. Free vectors. Products of vectors, Plane and straight-line in space, Distances and angles, Conics, Quadrics); Differential geometry (Plane curves (Definition of a plane curve, The contact of

two plane curves, The tangent to a plane curve in a regular point. Normal to a plane curve, Oscilating circle of a plane curve, The curvature and curvature radius of a plane curve, Remarkable plane curve), Space curves (Definition of a space curve, Frenet's triedre, The curvature and tension of a space curve), Surfaces (Analytical definition of surface, Curves lying on a surface. Coordinate curves, Tangent plane to a surface. Normal to a surface, The first fundamental form of a surface, Applications of the first fundamental form of a surface).

| Course title                                     | Code    | No. of credits | Number of hours per week |         |            |         |
|--------------------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                                  |         |                | course                   | seminar | laboratory | project |
| Computer Programming and Programming Languages I | CALC105 | 6              | 3                        | 0       | 3          | 0       |

**Course description (Syllabus):** Representation of information. The structure of computers. Fundamentals of languages C/C++: Program structure; Input/ output functions; Data types; Constants and variables; Operators and expressions; Control structures. Arrays: Uni-dimensional arrays; Strings; Multi-dimensional arrays. Pointers: Operations with pointers; Arrays and pointers; Dynamic variables. Functions: Prototypes; Function definition; Transfer of parameters; Returned values; Recursion; Function pointers; Passing by references; Default arguments; Overloading functions. Defining your own types: enumerations, structures, bit fields, unions. Classes and objects: class type, this reference, constructors and destructors, static members, pointer of member functions; handling objects. Friend functions and classes; Overloading operators. Inheritance. Derived classes.

**Laboratory:** Introduction in C++ programming environment. The C++ program structure. Input/output functions for the console. Data types. Constants. Variables. Operators and expressions. (precedence and associability of operators, type conversions). Statements (expressions, blocks of statements, decision statements, loop structures). Arrays (uni-dimensional arrays, strings, multi-dimensional arrays). Pointers (operations with pointers, arrays and pointers, dynamic variables). Functions (transfer of parameters, returned values, recursion, function pointers). Defining your own types (enumerations, structures, bit fields, unions). Classes and objects (class type, this reference, constructors and destructors, static members, overloading operators, inheritance and derived classes); handling objects.

| Course title               | Code    | No. of credits | Number of hours per week |         |            |         |
|----------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                            |         |                | course                   | seminar | laboratory | project |
| Computer-Assisted Graphics | CALC106 | 3              | 1                        | 0       | 2          | 0       |

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

| Course title       | Code | No. of credits | Number of hours per week |         |            |         |
|--------------------|------|----------------|--------------------------|---------|------------|---------|
|                    |      |                | course                   | seminar | laboratory | project |
| English Language I | LE01 | 2              | 1                        | 1       | 0          | 0       |

**Course description (Syllabus):** Computer Users; Computer Architecture; Computer Applications; Peripherals; Interview Former Student; Operating Systems; Graphical User Interface.

| Course title        | Code    | No. of credits | Number of hours per week |         |            |         |
|---------------------|---------|----------------|--------------------------|---------|------------|---------|
|                     |         |                | course                   | seminar | laboratory | project |
| Special Mathematics | CALC209 | 6              | 3                        | 2       | 0          | 0       |

**Course description (Syllabus):** Differential Equations (Mathematical methods which lead to differential equations, Equations of the first order and degree. Cauchy Problem. Existence and uniqueness Theorem, Separation variables.

The homogeneous type. Linear equations. Bernoulli equations. Exact equations. Integrating factors, Linear equations of higher degree with variable coefficients and with constant coefficients). Differential systems (Linear systems with constant coefficients, Prime integral. Symmetric systems). Stability Theory. Basic concept. Stability of the linear and non-linear systems. Complex Functions (Complex number. Complex plane. Sequences. Series, Elementary functions. Continuity, derivability, Cauchy-Riemann conditions, Complex Integral. Cauchy's Integral Formulas, Taylor and Laurent series, Residues. Applications). Laplace Transform ( Definition, properties and theorems, Inverse of the Laplace Transform, Applications in solving differential and integral equations). Fourier series (Basic results on Fourier series, Fourier Transform. Applications). Z – Transform (Basic results and applications).

**Seminar:** Integration of the first order differential equations: equations with separable variables, homogeneous equations, linear equations, Bernoulli equations, exact equations, integrating factors. Solving of the linear differential equations with constant coefficients. Solving of the systems of linear differential equations with constant coefficients and symmetric systems. Calculus with complex numbers and complex functions: Cauchy-Riemann conditions, properties of holomorphic functions, representation of complex functions by Taylor and Laurent series, solving the complex integrals with residues. Solving of the equations and systems of differential and integral equations with Laplace transform. Representations in Fourier series. Calculus with Fourier transform and solving of equations. Calculus with Z-transform and obtaining of the Z -transform from Laplace transform.

| Course title    | Code    | No. of credits | Number of hours per week |         |            |         |
|-----------------|---------|----------------|--------------------------|---------|------------|---------|
|                 |         |                | course                   | seminar | laboratory | project |
| Electrotechnics | CALC210 | 6              | 4                        | 2       | 0          | 0       |

**Course description (Syllabus):** Basic concepts: charge, voltage, current, power and energy, electric and magnetic field, Kirchhoff's laws, circuit elements. Electrostatics & Electrodynamics: main principles and relations, phenomena. Main laws and theorems that explain the functioning of the electrical installations, apparatus and electric machines. Simple DC and AC circuits. Three-phase circuits with different connections with balanced and unbalanced loads. Two ports and filters: connections, parameters, equations, calculus. Maxwell's equations. Wave Propagation.

| Course title                                        | Code    | No. of credits | Number of hours per week |         |            |         |
|-----------------------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                                     |         |                | course                   | seminar | laboratory | project |
| Theory of Probabilities and Mathematical Statistics | CALC211 | 4              | 2                        | 1       | 0          | 0       |

**Course description (Syllabus):** Probability spaces; Conditional probability spaces; The theorem of total probability and Bayes theorem; The concept of a random variable; Distribution function and density function; Expectation and variance of a random variable; Probability distribution in several dimensions; Characteristic function; Selection theory; Selection expectations and variances; Estimation theory; Statistical assumptions; Statistical tests.

| Course title | Code    | No. of credits | Number of hours per week |         |            |         |
|--------------|---------|----------------|--------------------------|---------|------------|---------|
|              |         |                | course                   | seminar | laboratory | project |
| Physics      | CALC212 | 6              | 3                        | 2       | 1          | 0       |

**Course description (Syllabus):** Oscillations and waves; Electromagnetics (introduction in electromagnetic field, electromagnetic waves); Optics; Preliminary of quantum mechanics; Physics of atom; Solid state physics and semiconductors; Semiconductors at equilibrium.

| Course title                                      | Code    | No. of credits | Number of hours per week |         |            |         |
|---------------------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                                   |         |                | course                   | seminar | laboratory | project |
| Computer Programming and Programming Languages II | CALC213 | 6              | 2                        | 0       | 3          | 1       |

**Course description (Syllabus):** Classes. Abstract data; Operator overloading; Classes derivation; Polymorphism; Template classes; Standard template library; Standard C++ ; Case study: string processing; Laboratory: Introduction; How to write the first C++ class; The classes Time, Date, DateAndTime, Complex; Constructors and destructors. The this pointer; Operator overloading: classes RationalNumber, Polynomial; Classes inheritance. Base classes. Derived

classes; Multiple inheritance in C++; Virtual functions. Pure virtual functions. A simple graphical package; Template classes; Standard; Template Library; Standard C++.

| Course title        | Code | No. of credits | Number of hours per week |         |            |         |
|---------------------|------|----------------|--------------------------|---------|------------|---------|
|                     |      |                | course                   | seminar | laboratory | project |
| English Language II | LE02 | 2              | 1                        | 1       | 0          | 0       |

**Course description (Syllabus):** The Internet; The World Wide Web; Websites; Interview: Webpage Creator; Communication Systems; Computing Support; Data Security I; Data Security II; Interview:ex hacker; Software Engineering; People in computing; Recent Developments in IT; The Future of IT Interview:Electronic Publishing.

| Course title        | Code | No. of credits | Number of hours per week |         |            |         |
|---------------------|------|----------------|--------------------------|---------|------------|---------|
|                     |      |                | course                   | seminar | laboratory | project |
| Physical Training I | EF01 | 1              | 0                        | 1       | 0          | 0       |

**Course description (Syllabus):** Basic technical elements of the sport optional full practice rules chosen sport; Regulatory practice under the chosen discipline;

| Course title         | Code | No. of credits | Number of hours per week |         |            |         |
|----------------------|------|----------------|--------------------------|---------|------------|---------|
|                      |      |                | course                   | seminar | laboratory | project |
| Physical Training II | EF02 | 1              | 0                        | 1       | 0          | 0       |

**Course description (Syllabus):** Basic technical elements of the sport optional full practice rules chosen sport; Regulatory practice under the chosen discipline;

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

| Course title  | Code    | No. of credits | Number of hours per week |         |            |         |
|---------------|---------|----------------|--------------------------|---------|------------|---------|
|               |         |                | course                   | seminar | laboratory | project |
| System Theory | CALC301 | 6              | 3                        | 2       | 0          | 0       |

**Course description (Syllabus):** Introduction in system control. Definitions and clasifications. Exemples; Automated linear and continous systems' performances; Automated linear and continous systems' performances analyse; Method of integrating differential equations; Transfer function method; Frequency methods; State variables and phase method; Stability of automated systems; Discrete systems.

**Seminars:** Types of signals used in Automatics; Mathematical models in-out; Performances of automated systems; Response calculation method of system integration differential equations; Laplace Transformation; Transfer functions of complex schemes; Phase amplitude characteristic; Logarithmic frequency characteristic; Sistems stability; Choosing state variables; Discrete systems.

| Course title            | Code    | No. of credits | Number of hours per week |         |            |         |
|-------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                         |         |                | course                   | seminar | laboratory | project |
| Electronic Measurements | CALC302 | 5              | 1                        | 0       | 3          | 0       |

**Course description (Syllabus):** Principle of measuring technique. Components of the measurement process. Electrical quantities. Measuring methods for electrical quantities. Accuracy. Accuracy calculation. Analog instruments. Classification. Operation. Applications. Analog electronic instruments. Measuring devices by comparison. Comparison methods of measurements DC Bridges and potentiometers. Circuits. The bridges balancing. Characteristics. Oscilloscope. Block diagram. Cathode ray tube. Scanning generator. Operation. Applications. Digital measuring instruments. Conversion principles. Analog-to-digital converter A/D and D/A converters. Operation and characteristics.

**Laboratory:** Errors in measurement. Types of errors measurement of analog measuring instruments. Extending the limits of measuring the analog instruments. Measuring methods and measuring; resistances, inductances and capacities. Oscilloscope. Knowledge and applications. Components of digital measuring instruments; Measurements in time domain.

| Course title                      | Code    | No. of credits | Number of hours per week |         |            |         |
|-----------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                   |         |                | course                   | seminar | laboratory | project |
| Electronic Devices and Circuits I | CALC303 | 5              | 3                        | 1       | 0          | 0       |

**Course description (Syllabus):** Devices based on pn Junction (Diodes, Bipolar Transistor, Junction Field-Effect Transistor); MOS-FET Devices; Power Electronic Devices; Optoelectronic Devices Semiconductor device fabrication.

**Seminar:** The pn Junction Diode; The Bipolar Transistor; The Junction Field-Effect Transistor (JFET); The Metal–Oxide–Semiconductor Field-Effect Transistor (MOSFET); Optical Devices; The Thyristor.

| Course title                   | Code    | No. of credits | Number of hours per week |         |            |         |
|--------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                |         |                | course                   | seminar | laboratory | project |
| Data Structures and algorithms | CALC304 | 6              | 2                        | 0       | 3          | 0       |

**Course description (Syllabus):** Introduction to object oriented programming: abstraction, object's interface, hiding details of implementation, reusability, inheritance and polymorphism, exception handling, multithreading. Objects and references: References, Objects, Objects Release, New data types , The structure of a simple Java program. Execution handling: Using operators, Logic operators, bitwise operators , if-else ternary operators, String operators, execution control. Initialize and cleanup: Method overloading, "this", Finalize and garbage-collection, member initialization. Implementation hiding: Package library unit, Access specifiers, Interface and implementation. Class reusability: Composition, Inheritance, Upcasting, Key word "final", Class Initialization and loading. Polymorphism: Upcasting, Dynamic Links, Overriding and overloading, Abstract classes, Interfaces, Constructors and polymorphism. Collections: Arrays, Containers, Iterators, Sets. Collections: Sorted Lists, Hash. Threads. Initialize, Synchronize, thread manipulation. Communication between threads. G.U.I. development using AWT. Event handling models. Applet development. Basic controls presentation. G.U.I. using Swing. Basic controls presentation.

**Laboratory:** Program editing and compilation using basic commands; Objects and references in Java; Execution handling in Java; Initialize and cleanup. Encapsulation; Class reusability. Polymorphism; Interfaces and abstract classes Collections; Threads; GUI using AWT; GUI using Swing.

| Course title      | Code    | No. of credits | Number of hours per week |         |            |         |
|-------------------|---------|----------------|--------------------------|---------|------------|---------|
|                   |         |                | course                   | seminar | laboratory | project |
| Signal Processing | CALC305 | 6              | 3                        | 0       | 2          | 0       |

**Course description (Syllabus):** Fourier analysis of signals (Fourier series and Fourier transform, usefulness and properties of Fourier transform, the Fourier transform of several signals of interest in electronic engineering). Sampling (sampling theory, types of sampling). Random variables (probabilities, random variables, probability density functions, cumulative distribution functions, distributions, statistical moments). Pairs of random variables (joint probability density functions, 2nd order statistical moments). Random signals (definition, characterization, autocorrelation and cross-correlation functions, power spectrum). Signal filtering (ideal low-pass filter, ideal band-pass filter, filter design, statistical analysis of input-output dependency). Signal detection (Bayes criterion). Parameters estimation (using the least square error criterion). Integral transforms (definition, properties, the Karhunen Loeve transform). Signal quantization (uniform quantization, optimal Max-Lloyd quantization).

**Seminar:** Fourier series. Fourier transform for signals of interest. Properties of Fourier transform; Continuous random variables; Discrete random variables; Theorem of mean; Pairs of random variables; Random processes; The Wiener-Khinchin theorem; Signal filtering (convolution theorem); Signal detection; Parameter estimation.

**Laboratory:** Introduction to MATLAB; Sampling 1-dimensional signals; Fourier transform; Ideal low-pass filter; Signal-adapted filter; Statistical analysis of signals; Correlation; Linear regression; Spectral analysis of signals; Signal quantization; Principle component analysis.

| Course title         | Code | No. of credits | Number of hours per week |         |            |         |
|----------------------|------|----------------|--------------------------|---------|------------|---------|
|                      |      |                | course                   | seminar | laboratory | project |
| English Language III | LE03 | 2              | 1                        | 1       | 0          | 0       |

**Course description (Syllabus):** Hardware; Some useful words; The workstation; The keyboard; The mouse; Scanning; Some useful adjectives.

| Course title                   | Code    | No. of credits | Number of hours per week |         |            |         |
|--------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                |         |                | course                   | seminar | laboratory | project |
| Formal Languages and Compilers | CALC408 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Compilation phases, categories of high-level languages, lexical analysis, parsing tree, syntactic analysis, optimization, errors. Finite automata: deterministic, nondeterministic, equivalence between them, reducing the number of states. Regular expressions: equivalence with finite automata. Regular grammars, regular languages: left linear grammars, linear grammars right, equivalent regular expressions, demonstrating that a language is not regular. Context-free grammars (denoted IDC): top-down parsing, ambiguous IDC grammars, IDC grammar simplification, elimination of unnecessary rules, elimination of lambda-rules, elimination unitary rules, Chomsky normal form, Greibach normal form. Implementation of a compiler with Lex and YACC.

**Laboratory:** Implementing some applications: deterministic finite automaton running simulation, simulation of deterministic finite automaton operation, transforming nondeterministic to deterministic, reducing the number of states. Exercises: automatically transforming nondeterministic to deterministic, reducing the number of states, proving that a language is not regular, construction finite automaton for a given regular expression. Writing a compiler that translates source code written in Romanian language using Romanian keywords (daca, atunci, cattimp, executa etc.) to MIPS object language.

| Course title        | Code    | No. of credits | Number of hours per week |         |            |         |
|---------------------|---------|----------------|--------------------------|---------|------------|---------|
|                     |         |                | course                   | seminar | laboratory | project |
| Digital Electronics | CALC409 | 6              | 4                        | 0       | 2          | 0       |

**Course description (Syllabus):** Logic support for digital systems (Boolean logic formalism, Logic support- gates, Noise sources and rejection); Logic combinational circuits, CLC (Synthesis and implementaion of the CLC, De facto standard CLC types: coders, decoders, multiplexors/demultiplexors, ROM, PLA, arithmeric circuits); Sequential Logic Circuits, SLC (Synthesis and implementaion of the SLC, De facto standard SLC types: flip-flops and related devices, counters, registers, RAMs); Circuistic supports for applications design.

**Seminar:** The topics of the lectures are taken again in the form of practical examples; Also, are exposed details and completions for topics of the lectures; **Laboratory;** Measurements aparatus. Digital signals parameters; Digital signals measurements; Logic gates; Schematic capture; Combinatorial logic; Decoders. Multiplexers; Flip-flops.

| Course title       | Code    | No. of credits | Number of hours per week |         |            |         |
|--------------------|---------|----------------|--------------------------|---------|------------|---------|
|                    |         |                | course                   | seminar | laboratory | project |
| Analog Electronics | CALC410 | 5              | 2                        | 0       | 2          | 1       |

**Course description (Syllabus):** Introduction; Rectifiers; Linear Voltage Regulators; Power Amplifiers; Operational Amplifiers (OA); Other Analog Integrated Circuits. **Laboratory:**

**Laboratory** presentation and electric shock prevention; Unfiltered single phase rectifiers; C filtered single phase rectifiers; Zener voltage regulators; Integrated voltage regulators; Class B power amplifier; NI ELVIS system and OA introduction; Basic OA amplifiers; Static OA errors; Dynamic OA errors; Basic OA applications; Comparators; Timers; Final discussion. **Project:** Double Voltage Regulator Design; Project presentation and data distribution; Transformer design; Rectifiers design; Voltage regulators design; Final schematic design; PSPICE simulation; Project evaluation.

| Course title                  | Code    | No. of credits | Number of hours per week |         |            |         |
|-------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                               |         |                | course                   | seminar | laboratory | project |
| Fundamentals of Communication | CALC411 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Introduction to telecommunications: The necessity of modulation, informational signal types; the general structure of a chain of communication; the communications systems classification. Communications with linear modulation: Introduction to linear modulation; AM (DSB+C), DSB-SC, SSB, QAM. Signal characteristics and methods for obtaining. Heterodyne process into a chain of communication and asynchronous (linear detection), synchronous (with Carrier recovery processes) and pseudo-synchronous demodulation techniques. Exponential (angular) modulation: Introduction to EM and presentation of specific parameters (instantaneous frequency and frequency deviation, instantaneous phase and phase deviation); frequency modulation and phase modulation; spectral characteristics of the EM signals of broadband and narrowband . Types of FM and PM

modulators. Chain structure reception and exponential demodulation techniques. Digital modulation. Introduction (bit rate, signaling rate, data encoding, polar diagram, constellation diagram); Transmission and reception using ASK, FSK, MSK, GMSK, PSK and QAM modulations. Analysis methods in time domain and frequency domain for digital modulated signals: power spectral density, specific constellation diagrams. Pulse modulation. Sampling and quantization. Study of PAM, PWM / PPM and PCM modulations (absolute and differential, linear compression, compression laws). Effect of noise and bandwidth of communication channel. Laboratory: Heterodyne radio transmitter with AM, DSB, SSB modulation. Transmitter with frequency modulation. Chain of communication with digital modulation (ASK, FSK, BPSK, QPSK, QAM). Chain of communication with pulse modulation (PAM, PWM / PPM, PCM).

| Course title       | Code    | No. of credits | Number of hours per week |         |            |         |
|--------------------|---------|----------------|--------------------------|---------|------------|---------|
|                    |         |                | course                   | seminar | laboratory | project |
| Algorithms' Design | CALC412 | 5              | 3                        | 0       | 2          | 0       |

**Course description (Syllabus):** Introduction. Elementary Data Structures; Algorithm Complexity Analysis; Greedy Algorithms. Divide-and-Conquer Algorithms; Dynamic Programming Algorithms. Graphs' Exploration; String Processing Techniques. Probabilistic Algorithms; NP Completeness;

**Laboratory:** C/C++/Java implementation of the studied algorithms.

| Course title        | Code | No. of credits | Number of hours per week |         |            |         |
|---------------------|------|----------------|--------------------------|---------|------------|---------|
|                     |      |                | course                   | seminar | laboratory | project |
| English Language IV | LE04 | 2              | 1                        | 1       | 0          | 0       |

**Course description (Syllabus):** Printing; Mobile phones; Other devices; Inside a computer; Data Storage; Connectivity; Networks; Electronic Payments; Your Computer; Software-the basics; Using Software; The Control Panel; Applications.

| Course title        | Code    | No. of credits | Number of hours per week |         |            |         |
|---------------------|---------|----------------|--------------------------|---------|------------|---------|
|                     |         |                | course                   | seminar | laboratory | project |
| Practical Placement | CALC413 | 4              |                          |         |            | 30      |

**Course description (Syllabus):** Aspects of safety and health in practice activities; Soldering technology; Technology of printed circuit board; Small signal bipolar transistor amplifier; Adjustable power source; Dual power source; Virtual implementation using open-source software FRITZING; Resistors colour-coding.

| Course title          | Code | No. of credits | Number of hours per week |         |            |         |
|-----------------------|------|----------------|--------------------------|---------|------------|---------|
|                       |      |                | course                   | seminar | laboratory | project |
| Physical Training III | EF03 | 1              | 0                        | 1       | 0          | 0       |

**Course description (Syllabus):** Basic technical elements of the sport optional full practice rules chosen sport; Regulatory practice under the chosen discipline;

| Course title         | Code | No. of credits | Number of hours per week |         |            |         |
|----------------------|------|----------------|--------------------------|---------|------------|---------|
|                      |      |                | course                   | seminar | laboratory | project |
| Physical Training IV | EF04 | 1              | 0                        | 1       | 0          | 0       |

**Course description (Syllabus):** Basic technical elements of the sport optional full practice rules chosen sport; Regulatory practice under the chosen discipline.

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

| Course title                  | Code    | No. of credits | Number of hours per week |         |            |         |
|-------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                               |         |                | course                   | seminar | laboratory | project |
| Microprocessors' Architecture | CALC501 | 7              | 4                        | 2       | 2          | 0       |

**Course description (Syllabus):** Microprocessor-based system organization; Instruction Set Architecture, ISA; Datapath; Controlpath; Current techniques and organizations for high performance microprocessors.

**Seminar:** The topics of the lectures are taken again in the form of practical examples. Also, are exposed details and completions for topics of the lectures.

| Course title | Code    | No. of credits | Number of hours per week |         |            |         |
|--------------|---------|----------------|--------------------------|---------|------------|---------|
|              |         |                | course                   | seminar | laboratory | project |
| Database     | CALC502 | 5              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Basic Concepts. The concept of database, utility and advantages, data independence, the fundamental objectives of DB. Database Management Systems (DBMS). Database environment. DB architecture with three levels. DB languages. Data models and conceptual modeling. Functions and components of a DBMS. Multiuser architectures. The system catalog. Relational data model. Terminology. Relational integrity. Relational languages. Relational DBMS. SQL language. Normalization of relations. The purpose of normalization. Functional dependencies. Normalization process - decomposition of relation schemes. The first normal form (1NF). The second normal form (2NF). The third normal form (3NF). Boyce-Codd Normal Form (BCNF). Fourth normal form (4NF). Concurrent operations in DB.

**Laboratory** Overview of DBMS: Designing and creating a database. Creating tables and establishing the types of data fields. Primary keys, foreign keys, relationships between DB tables. Forms and Subforms. Design of SELECT queries. Design of ACTION queries.

| Course title             | Code    | No. of credits | Number of hours per week |         |            |         |
|--------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                          |         |                | course                   | seminar | laboratory | project |
| Digital Circuits Project | CALC503 | 2              | 0                        | 0       | 0          | 2       |

**Course description (Syllabus):** Introduction, stating the project content, general specifications, methodology, evaluation. Defining the system's interface: input/output ports, connections, and on-board I/O peripherals used. Generic system architecture. Main functional blocks. Modelling the duty cycle. Module's schematic and internal architecture. Modelling the frequency. Module's schematic and internal architecture. Defining the quantum pulse generator. Using quantum pulse for generating final signal. External input signals. Debounce/edge detect techniques. Xilinx ISE flow and Spartan 3E implementation guidelines. Evaluation.

| Course title            | Code    | No. of credits | Number of hours per week |         |            |         |
|-------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                         |         |                | course                   | seminar | laboratory | project |
| Artificial Intelligence | CALC504 | 6              | 3                        | 0       | 2          | 0       |

**Course description (Syllabus):** Preliminaries in neural computing; Fundamental concepts; The perceptron; Feedforward neural networks; Feedback neural networks; Associative memories; Self-organizing neural networks; Radial basis function neural networks; Fuzzy neural networks; Genetic algorithms.

**Laboratory:** The implementation of the learning rules; The training algorithm of a perceptron; The „Backpropagation of error“ training algorithm; The „Winner takes all“ training algorithm; Training the fuzzy neural networks; The implementation of a genetic algorithm; Homeworks.

| Course title               | Code    | No. of credits | Number of hours per week |         |            |         |
|----------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                            |         |                | course                   | seminar | laboratory | project |
| Electronic Instrumentation | CALC505 | 6              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Introduction and some analog signal conditioning circuits: attenuators, amplifiers. Analog - to - digital conversion and digital - to analog conversion. ADC converters (successive approximation, flash, double slope, voltage - to - frequency converters, sigma - delta modulation ADC) and DAC converters (resistance network, switched capacitors). Electronic stand-alone measuring instruments: digital multimeters, universal counters, impedancemeters, Q-meters, measurement of distortions. Instruments for the analysis of analog signals: oscilloscopes, spectrum analyzers, signal generators. Data acquisition structures: acquisition modules on computer buses, USB interface acquisition modules. Compact, high speed backplane acquisition systems: VXI, MXI, PCI, LXI. Specific interfaces for data acquisition: RS family, GPIB (IEEE 488), CAN, Fieldbus, wireless systems.

**Laboratory:** Use of electronic instruments in usual and special applications. Programmable electronic instruments and measuring systems.



| Course title            | Code    | No. of credits | Number of hours per week |         |            |         |
|-------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                         |         |                | course                   | seminar | laboratory | project |
| Sensors and Transducers | CALC506 | 6              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Concepts, terminology, classification, structure transducers, static and dynamic features, energy characteristics, design features, reliability features; Sensors for electrical quantities (current); Sensors for geometrical quantities (proximity, displacement/ position linear and angular, level); Sensors for cinematic quantities (linear speed, rotational speed, acceleration, vibration and shock); Sensors for mechanical quantities (force, weight, torque); Sensors for physical quantities (pressure, flow, temperature); Sensors for chemical quantities (gas composition, humidity).

**Laboratory:** Linear displacement transducers - Linear Variable Differential Transformer – LVDT; Pressure transducers - strain gauges; Position sensors - optical rotary position sensor; Level sensor - Float resistive, capacitive, resistive a.c. bridge; Differential pressure transducer; Proximity Sensors - Reed sensor; Temperature sensors (thermocouples, thermal-resistance, thermistor).

| Course title                        | Code    | No. of credits | Number of hours per week |         |            |         |
|-------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                     |         |                | course                   | seminar | laboratory | project |
| Electronic Materials and Technology | CALC507 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Electronic materials. Electric and magnetic characteristics. Passive electronic components. Constructive and functional characteristics. Series of standardized values. Fixed and variable resistors. Construction. Characteristics. Applications. Fixed and variable capacitors. Construction. Characteristics. Applications. Coils. Construction. Characteristics. Applications. Semiconductor. Structure. Electrical conduction. Technologies for silicon wafers. Lithography and etching. Manufacture junctions and integrating components and devices. Bipolar and CMOS technologies. Integrated circuit technology. Techniques for encapsulation. The transfer of thermal energy. Technology of printed circuit boards.

| Course title                                 | Code    | No. of credits | Number of hours per week |         |            |         |
|----------------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                              |         |                | course                   | seminar | laboratory | project |
| Computer aided Design for Electronic devices | CALC508 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Small signal amplifiers; Power amplifiers; Negative feedback in amplifiers; Oscillators; Laboratory: Drawing electronic circuits with OrCAD Capture; Creating symbols in OrCAD Capture; Spice simulation: DC analysis, Time domain analysis, Frequency analysis; PCB Design with OrCAD Layout; Creating footprints; Creating parts and assigning Spice model.

| Course title                       | Code    | No. of credits | Number of hours per week |         |            |         |
|------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                    |         |                | course                   | seminar | laboratory | project |
| Logical and Functional Programming | CALC609 | 4              | 3                        | 0       | 2          | 0       |

**Course description (Syllabus):** The logical foundations of the Prolog programming; The structure of the Prolog programming. The Turbo Prolog perspective; Working with lists in Prolog. The Turbo Prolog perspective; Working with files in Prolog. The Turbo Prolog perspective; The specifics of the functional programming. The WinHugs perspective; The basics of the Haskell programming. The WinHugs perspective; Working with lists in Haskell. The WinHugs perspective; Other Haskell-oriented programming environments.

| Course title                   | Code    | No. of credits | Number of hours per week |         |            |         |
|--------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                |         |                | course                   | seminar | laboratory | project |
| Hardware Description Languages | CALC610 | 4              | 1                        | 0       | 2          | 1       |

**Course description (Syllabus):** HDL Concepts: VHDL and Verilog; HDL syntax; Behavioural Description; Structural Description; From the idea to the implementation.

**Laboratory:** HDL simulation with ModelSim; Logic Circuits; Sequential Circuits.

| Course title                           | Code    | No. of credits | Number of hours per week |         |            |         |
|----------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                        |         |                | course                   | seminar | laboratory | project |
| Computer Architecture and Organization | CALC611 | 5              | 3                        | 0       | 2          | 0       |

**Course description (Syllabus):** Several aspects related the place, role and principal informational flows meet on embedded computers that implement processes or/and their applications; Definition of terms: architecture and organization of computers; History and actual trends in computers; Main aspects about functioning of computer systems (components: central processing unit -CPU-, computers buses, memory, interfaces and communication protocols that are used on computers); Hierarchies reflected by computers' organization; Processing nodes versus communication channels Information flows, full conditioned information flow, hierarchies on computers and their role, interfaces, transfer sessions (explicit versus implicit communication protocols) Common memory model for information transfer versus message passing communication interfaces in computers; Role and importance of communication protocols on computers; Data link: processor - memory: cache memory, organization of information input/output flows, cache mapping, strategies for data replacing in cache & main memory, efficiency of communication protocols on computers, synchronization, examples mono versus multi processor computers; Synchronization of data transfers -interrupts: principles, functionality, events, event arbitration, time scheduling of data transfer processes , block transfer (see Direct Memory Access -DMA) versus programmed transfer, Examples of AVR 8 platform; Bridge Devices: buses, communication channels existing on computers; Hardware & Software Interfaces (communication protocols).

| Course title      | Code    | No. of credits | Number of hours per week |         |            |         |
|-------------------|---------|----------------|--------------------------|---------|------------|---------|
|                   |         |                | course                   | seminar | laboratory | project |
| Operating Systems | CALC612 | 4              | 3                        | 0       | 2          | 0       |

**Course description (Syllabus):** Development of the operating system, basic concepts; Structure and main roles of the operating system; Processes. Scheduling; Memory management techniques; File system; Input/Output Management; Synchronisation mechanism. Deadlock.

**Laboratory:** C/C++ Programming; Basic operating commands;Processes; Signals; Inter Process Communication; Semaphores.

| Course title           | Code    | No. of credits | Number of hours per week |         |            |         |
|------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                        |         |                | course                   | seminar | laboratory | project |
| Programming Techniques | CALC613 | 5              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Programming by specifications; GUI Design (QTDesigner); Software application internationalization (language support); Basic widgets;Dialogue with the database; Events; Environment.

**Laboratory:** Programming style and code writing rules; Automatic generation of documentation based on the code and rules of writing comments; Creating controls by using QTDesign; Graphical interfaces programming using QT library – controls; QT specialized classes - processes, threads, timers; QT application internationalization using translation tools; Methods for automatic generation of configuration files - qmake, make sigcc.

| Course title    | Code    | No. of credits | Number of hours per week |         |            |         |
|-----------------|---------|----------------|--------------------------|---------|------------|---------|
|                 |         |                | course                   | seminar | laboratory | project |
| Sensor Networks | CALC614 | 5              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Concepts, terminology, classification, structure transducers, static and dynamic features, energy characteristics, design features, reliability features; Sensors for electrical quantities (current); Sensors for geometrical quantities (proximity, displacement/ position linear and angular, level; Sensors for cinematic quantities (linear speed, rotational speed, acceleration, vibration and shock); Sensors for mechanical quantities (force, weight, torque); Sensors for physical quantities (pressure, flow, temperature);Sensors for chemical quantities (gas composition, humidity).

**Laboratory:** Linear displacement transducers - Linear Variable Differential Transformer – LVDT; Pressure transducers - strain gauges; Position sensors - optical rotary position sensor; Level sensor - Float resistive, capacitive, resistive a.c. bridge; Differential pressure transducer; Proximity Sensors - Reed sensor; Temperature sensors (thermocouples, thermal-resistance, thermistor).

| Course title                        | Code    | No. of credits | Number of hours per week |         |            |         |
|-------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                     |         |                | course                   | seminar | laboratory | project |
| Design of Human Computer Interfaces | CALC615 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** This course covers the principles of human-computer interaction and the design and evaluation of user interfaces. Topics include an overview of human information processing subsystems (perception, memory, attention, and problem solving); how the properties of these systems affect the design of user interfaces; the principles, guidelines, and specification languages for designing good user interfaces, with emphasis on tool kits and libraries of standard graphical user interface objects; and a variety of interface evaluation methodologies that can be used to measure the usability of software.

| Course title            | Code    | No. of credits | Number of hours per week |         |            |         |
|-------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                         |         |                | course                   | seminar | laboratory | project |
| Multimedia Technologies | CALC616 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Introduction to the multimedia technologies: Historical view, the concepts of static and dynamic media, data flows. Multimedia components: text, images, sound, video. Interaction. Multimedia data compression: introduction. Algorithms for lossless and lossy data compression. Text compression. Examples. Image Compression and Processing: Introduction: the human eye, digitizing images. Color models. B/W and grayscale image compression (RLE, BTS, Huffman). Color image compression (TIFF, JPEG, JPEG2000). Image processing. Sound Compression and Processing: Introduction: the human ear. Digitizing sound. Sampling and quantization. Audio file formats. Lossless sound compression. Psychoacoustics. Lossy sound compression. Multichannel sound. Video compression and Processing: Methods and standards for video compression. H263, H264, MPEG1-7. Multimedia Devices: Historical perspective and evolution. Image sensors, audio devices, SD and HD television. Optical memories: CD, DVD, Blu-Ray. Magnetic memories. Random access memories. Media Servers: Introduction, specific differences to the classical servers. Disc and process scheduling for multimedia.

**Laboratory:** Getting familiar with sound processing software. WAV Files. Sound compression. Processing sound. Getting familiar with image processing software. File formats. Vector and raster graphics. Image compression. Getting familiar with video processing software. File formats. Video compression. Getting familiar with multimedia authoring software.

| Course title    | Code    | No. of credits | Number of hours per week |         |            |         |
|-----------------|---------|----------------|--------------------------|---------|------------|---------|
|                 |         |                | course                   | seminar | laboratory | project |
| Web Programming | CALC617 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** This course provides an introduction of web-development techniques that use HTML, CSS and JavaScript as web development essentials including database connectivity (JDBC), Basics of PHP, Basics of Java for Web Development and Basics of ASP.NET as an advanced technique of web programming.

| Course title        | Code    | No. of credits | Number of hours per week |         |            |         |
|---------------------|---------|----------------|--------------------------|---------|------------|---------|
|                     |         |                | course                   | seminar | laboratory | project |
| Practical Placement | CALC618 | 4              |                          |         |            | 30      |

**Course description (Syllabus):** Elements of communication in office (Personal computers, printers, copier: functional characteristics, operation, maintenance; PBX: operating mode, transfer and recording messages). Computer Networks (Network configuration, constituents, tests, software configuration, wireless network). Software used in communications (Management, process control, testing etc.). Assistance and contributions to company communications projects. Internet Services.

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

| Course title     | Code    | No. of credits | Number of hours per week |         |            |         |
|------------------|---------|----------------|--------------------------|---------|------------|---------|
|                  |         |                | course                   | seminar | laboratory | project |
| Embedded Systems | CALC701 | 7              | 3                        | 0       | 2          | 1       |

**Course description (Syllabus):** Embedded Systems (EmS): Course objectives, competences, main characteristics of EmS; Introduction to EmS design methodology; Specific computer architectures for EmS, microcontrollers, IO interfaces, power management; DSP techniques in EmS: architecture, data buffers, digital decimation and interpolation; Interfacing EmS with real world: data acquisition, isolation, filtering, oversampling Introduction in distributed EmS: architectures, real-time, case studies.

**Laboratory:** Software development in C, for different applications with 8 bits PIC microcontrollers.

| Course title           | Code    | No. of credits | Number of hours per week |         |            |         |
|------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                        |         |                | course                   | seminar | laboratory | project |
| Memory and Peripherals | CALC702 | 7              | 4                        | 0       | 2          | 0       |

**Course description (Syllabus):** History and classification. Structure. Serial and parallel data transfer. Data transfer between CPU and PE (Peripheral Equipment). Transfer modes: programmed (polling), interrupt, DMA. Computer bus, principle of selection. Connecting an PE to a computer. The role of a data buffer. Specific actuators and transducers. Wireless interfaces. Magnetic drives. Principle of magnetic recording. Organizing information. Adjusting the reading. Hard disc drive. Optical devices, CD, DVD. Graphic display and graphic peripherals: LCD, plasma, LCD projector, Scanner, graphic tablet, plotter. Printers. Ink Jet printers. Laser printers. Thermal printers. Microcontroller on chip interfaces. Memory flash card. Secure Digital Card. Discussion, questions, project presentations.

**Laboratory:** Introduction. Assembly Language Programming; Connecting an PE to a computer; Parallel interface programming (I8255); Timer programming (I8253); Serial interface programming (I8251); Stepper motors control; DC motor control; Final examination.

| Course title                              | Code    | No. of credits | Number of hours per week |         |            |         |
|-------------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                           |         |                | course                   | seminar | laboratory | project |
| Data Transmission and Computer Networks I | CALC703 | 5              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Introduction to computer networks (Internet, communication protocols, packet switching); Computer network classification. Standards (ISO-OSI, TCP/IP, Internet models); Application layer I (network applications architecture, processes communicating); Application layer II (process-network interface, transport services available to applications, process addressing); Application programming (Berkeley sockets); Network applications I (HTTP); Network applications II (DNS); Midterm exam; Transport layer. TCP and UDP; Network layer; Internet network layer (IPv4, IP addressing); Internet routing; Routing protocols.

**Laboratory:** Linux operating system; Linux system calls (working with files); Simulating SLIP; Problem solving. Designing a high level protocol; TCP socket programming; Multithreading TCP socket programming. Implementing a HTTP 1.0 server; UDP socket programming; Implementing a UDP ping application; Implementing a file sharing application using TCP; Implementing a chat application using TCP; Implementing a chat application using UDP; Problem solving: IP address allocation.

| Course title                                   | Code    | No. of credits | Number of hours per week |         |            |         |
|------------------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                                |         |                | course                   | seminar | laboratory | project |
| Computer Architecture and Organization Project | CALC704 | 3              | 0                        | 0       | 0          | 2       |

**Course description (Syllabus):** Demo system (LCD, SD / MMC (SPI), ADC, INT0, INT1, USART0, USART1); GPS system (LCD, USART0, USART1); Intelligent Access System (LCD, RTC (I2C) EEPROM, USART0, USART1); Weather station (LCD, RTC (I2C) SHT11 (I2C), SD / MMC, USART0, USART1); Car acclimatization system (FUZZY controller) (LCD, RTC (I2C) SHT11 (I2C), SD / MMC, PWM, ADC, USART0, USART1); Automatic positioning system of a solar panel (LCD, RTC (I2C), PWM, ADC, USART0, USART1); Audio player for wav files (LCD, PWM, GPIO, SD-MMC CARD, USART0, USART1).

| Course title     | Code    | No. of credits | Number of hours per week |         |            |         |
|------------------|---------|----------------|--------------------------|---------|------------|---------|
|                  |         |                | course                   | seminar | laboratory | project |
| Image Processing | CALC705 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Introduction to image processing (pinhole camera model, mathematical model of images); Geometrical transforms (translation, rotation); Image enhancement (contrast enhancement, maximum

contrast stretch, binarization, histogram equalization); Image filtering (linear and non-linear image filtering, smoothing, rank filters); Image transforms (2D Fourier, cosine, sine, Haar and Hadamard transforms, elements of wavelet transform); Image restoration (inverse filter, inverse filter with constraints, Wiener filter); Image compression (lossy and lossless compression methods, LZW, RLE, quad tree-based compression, transform-based compression); Image segmentation (formalism, edge detection, region-growing methods, Sobel and Prewitt filters); Mathematical morphology for binary and grey-scale images (dilation, erosion, closing, opening, properties); Image reconstruction from projections (Radon transform, back-projection operator); Shape analysis (statistical moments, Hu invariants, contour-based characterization); Texture analysis (cooccurrence matrix, Haralik parameters, fractal geometry).

**Laboratory works:** Introduction to Intel OpenCV library; Introduction to image processing; Image enhancement (contrast enhancement); Histogram equalization; Geometric transformations; Image filtering; Image transforms; Image compression; Image segmentation; Image processing using fuzzy logic.

| Course title                           | Code    | No. of credits | Number of hours per week |         |            |         |
|----------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                        |         |                | course                   | seminar | laboratory | project |
| Communication Protocols and Interfaces | CALC706 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Protocols: Introduction, Definitions, OSI Model; IEEE 1284 Interface; Serial interfaces; Serial asynchronous interface RS-232, The serial port of a PC computer; I2C interface; SPI interface; USB interface; JTAG interface; Programmable circuits: serial communication, parallel communication, timers, interrupt controller, DMA controller.

**Laboratory:** I/O system of a PC computer; System function and services; low level access; Interfacing parallel port (LED application, Stepper motor application); Serial asynchronous port; Interfacing the system bus (Design and review of an interface, Parallel programmable interface, Serial programmable interface, Programmable timers).

| Course title         | Code    | No. of credits | Number of hours per week |         |            |         |
|----------------------|---------|----------------|--------------------------|---------|------------|---------|
|                      |         |                | course                   | seminar | laboratory | project |
| Software Engineering | CALC707 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Elements regarding the general theory of the systems; Information systems. Information flows. Information systems with automated components; The concept of methodology; The UML modeling language; Introduction to the IT project management; Tools that assist the UML development of a problem's solution. The presentation of the tool Visual Paradigm for UML.

| Course title                          | Code    | No. of credits | Number of hours per week |         |            |         |
|---------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                       |         |                | course                   | seminar | laboratory | project |
| Parallel Algorithms and Architectures | CALC708 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Motivation and History; Parallel Architectures; Parallel Algorithm Design The Sieve of Eratosthenes; Floyd's Algorithm Performance Analysis; Matrix-Vector Multiplication Document Classification; Matrix Multiplication; Sorting; The Fast Fourier Transform.

**Laboratory:** Message-passing Programming; Shared-memory Programming; Programming with MPI and OpenMP.

| Course title | Code    | No. of credits | Number of hours per week |         |            |         |
|--------------|---------|----------------|--------------------------|---------|------------|---------|
|              |         |                | course                   | seminar | laboratory | project |
| VLSI Design  | CALC809 | 5              | 3                        | 0       | 2          | 0       |

**Course description (Syllabus):** Digital IC Design Flow; CMOS Technology; CMOS Testing.

| Course title                                | Code    | No. of credits | Number of hours per week |         |            |         |
|---------------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                             |         |                | course                   | seminar | laboratory | project |
| Testing and Reliability of Computer Systems | CALC810 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Test technology of the electronic circuits (test methods, metrics related to testing, discussion over test related criteria such as: observability, controllability and testability; types of defects are presented, with test strategies used for each of them). Boundary Scan standard, JTAG standard are presented and discussed in

terms of functionality, architecture, efficiency. BIST type of circuits are described (LFSR are analysed, LFSR usage is described in the BIST context). Testing based also on data coding and error checking techniques is also mentioned. Functional verification introduced as a separate alternative in improving reliability of an electronic system (functional verification flow, verification methodology, verification plan). Verification alternatives: verification steps, simulation, verification languages, functional and code coverage, formal analysis). Verification environment description (structure and components description). Current verification methodologies description: eRM, OVM, UVM, System Verilog.

**Laboratory:** The laboratory provided is giving the means of applying in practice the verification techniques studied along the course. The functional verification is exercised in VHDL / System Verilog, using modelsim simulator.

| Course title          | Code    | No. of credits | Number of hours per week |         |            |         |
|-----------------------|---------|----------------|--------------------------|---------|------------|---------|
|                       |         |                | course                   | seminar | laboratory | project |
| Communication Systems | CALC811 | 4              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Digital techniques for telecommunications networks; Plesiochronous digital networks; Synchronous digital hierarchy; Introduction to GSM; GPRS; 2G to 3G evolution; CDMA principles; Introduction to UMTS.

**Laboratory:** Study of the switching and PCM transmission system PCM30/32EV; Modem programming with asynchronous terminal and the constellation diagrams; Control of the telephone calls; Manual and automatic connection on switched network; Noise effect, error correction and data compression.

| Course title     | Code    | No. of credits | Number of hours per week |         |            |         |
|------------------|---------|----------------|--------------------------|---------|------------|---------|
|                  |         |                | course                   | seminar | laboratory | project |
| Mobile Computing | CALC812 | 3              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Introduction I (wireless networks, mobility); Introduction II (portability); Wireless networks and mobile networks; IEEE 802.11 wireless LANs (architecture, MAC); Midterm exam; IEEE 802.11 wireless LANs (frame structure, advanced features); Mobility management; Mobile IP; Mobile computers power management.

**Laboratory:** Tiny OS I (Crossbow Micaz); Tiny OS II (Crossbow Micaz); Tiny OS III (Crossbow Micaz); Wireshark lab – IEEE 802.11; Problems solving; Wireshark lab – IEEE 802.11; Configuring mobile IP Wireshark lab – mobile IP Configuring 802.11 access points.

| Course title                         | Code    | No. of credits | Number of hours per week |         |            |         |
|--------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                      |         |                | course                   | seminar | laboratory | project |
| Protection and Security in Computing | CALC813 | 3              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Cryptography and computer security (vulnerabilities in informatics; computer viruses; role of cryptography; symmetric cryptographic algorithms: ECB, CBC, CFB, OFB, Triple DES; asymmetric cryptographic algorithms: RSA, Diffie-Hellman, DSA). Internet protocol security (Virtual private networks (VPN); IPsec protocol; Web security protocols SSL-TLS; E-mail security: PEM, S/MIME). Electronic signatures and digital certificates (Signatures, Certificates, Revocation lists, Certification Paths; PKI components: CA, RA, Repository, Archive, Users; PKI architecture; X.509 certificates; CLR; Building and validating certification paths; PKI policies and procedures). Legislation for documents and electronic signatures (Legal controversies and international approaches for signatures; United Nations Commission Regulations on International Trade; EU regulations; The legal framework of the documents and electronic signatures in Romania). Electronic payment systems security (smart Cards; POS Payment systems (Point of Sale; Internet electronic "on" payment system - card based; SET protocol; electronic "off" payment system - electronic wallet based; CAFÉ system).

**Laboratory:** Experimental study of test generation; Experimental study of sequential logic scheme simulation (static and dynamic hazard); Experimental study of the properties of a fault simulator; Techniques and testing methods for hardware (CPU, interfaces, HDD, RAID); Techniques and testing methods for software (OS, drivers); Applications based on testing and verification languages (SystemVerilog, e, Vera).

| Course title            | Code    | No. of credits | Number of hours per week |         |            |         |
|-------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                         |         |                | course                   | seminar | laboratory | project |
| Human Machine Interface | CALC814 | 3              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Developing software applications for multimedia systems; User interface; GUI programming in Java; Advanced interfaces between mobile devices and user; Software applications for mobile terminals; Multimedia and augmented reality systems;

**Laboratory:** Java. Graphic components; Software applications on Java ME platform. Multimedia Player; Software applications on Android/Java platform. Multimedia Player; Software applications on Qt/C ++ platform. Multimedia Player.

| Course title        | Code    | No. of credits | Number of hours per week |         |            |         |
|---------------------|---------|----------------|--------------------------|---------|------------|---------|
|                     |         |                | course                   | seminar | laboratory | project |
| Scripting Languages | CALC815 | 3              | 2                        | 0       | 2          | 0       |

**Course description (Syllabus):** Introduction to scripting; JavaScript – introduction; Basic elements of the JavaScript language; Web Scripting – Client-side programming; HTML Forms, Dynamic HTML; Perl – introduction; Basic elements of Perl language; Web scripting – server-side programming (CGI); Interface with the operating system in Perl.

**Laboratory:** Introduction in scripting programming; JavaScript – Basics; Web scripting, HTML forms, Dynamic HTML, JavaScript and HTML integration; Basic elements of Perl; Web scripting – server-side scripting (CGI); Interface with the operating system in Perl.

| Course title     | Code    | No. of credits | Number of hours per week |         |            |         |
|------------------|---------|----------------|--------------------------|---------|------------|---------|
|                  |         |                | course                   | seminar | laboratory | project |
| Entrepreneurship | CALC816 | 2              | 2                        | 1       | 0          | 0       |

**Course description (Syllabus):** Business – concepts, characteristics. Business in services. Small businesses. The approach of business. Partners and clients. Organizational structures and business efficiency. Business planning. Strategic business decision. Business approach – the essential questions. Business: management and leadership. Entrepreneurship – concepts. Entrepreneurship and innovation. Creativity. Entrepreneurial strategies. Building the entrepreneurial organizations.

| Course title                       | Code    | No. of credits | Number of hours per week |         |            |         |
|------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                    |         |                | course                   | seminar | laboratory | project |
| Elaboration of the Diploma Project | CALC817 | 4              | 0                        | 0       | 0          | 3       |

**Course description (Syllabus):** The subject is related to the final graduation thesis. The implementation can be done in hardware and/or software. The professor will check periodically the status of the student's work.

| Course title                                      | Code    | No. of credits | Number of hours per week |         |            |         |
|---------------------------------------------------|---------|----------------|--------------------------|---------|------------|---------|
|                                                   |         |                | course                   | seminar | laboratory | project |
| Practical Activity for Diploma Thesis Elaboration | CALC818 | 5              | 0                        | 0       | 0          | 30      |

**Course description (Syllabus):** The subject is decided by student together with his/her supervisor professor at the ending of the 3rd year of studies. According to the subject of the thesis, the professor recommend the approach and supervise the student activity. The professor will check periodically the status of the student's work.