UNIVERSITY "POLITEHNICA" OF BUCHAREST

FACULTY OF ENGINEERING IN FOREIGN LANGUAGES

COMPUTERS AND INFORMATION TECHNOLOGY in ENGLISH LANGUAGE, 2025-2026

CONTENT OF THE LECTURES FROM THE STUDY PLAN

14 Weeks/semester

Legend: "Ver" = evaluation form (E=exam in exam session, C or V = semester evaluation) "C" =
Lectures (hours/week); "S" = Tutorial; "L" = Labwork; "P"=Project

From the optional subjects, only one of the two will be taught, depending on students' choice.

I Year, 1st Semester

Subject	Credit points	Hours / week				Ver
		C	S	L	P	
Mandatory subjects						
Calculus 1	4	2	2			E
Linear Algebra, Analytical and Differential Geometry	4	2	2			E
Electrical Engineering 1	4	2	1			E
Operating Systems 1	4	2		2		V
Programming Languages	4	2		2		E
Computer Aided Graphics	3	1		1		V
Chemistry	3	1	1			E
Professional Communication 1	2			2		V
Physical Education 1	2			1		V

CALCULUS 1

Calculus 1 continues the theory of functions of one single variable (from the college); in the first part it contains: real and complex numbers, sequences and series of numbers, sequences and series of functions. In the second part, the differential calculus of functions of several variables is presented: partial derivatives, the differential, extrema and conditional extrema, implicit functions.

LINEAR ALGEBRA AND DIFFERENTIAL GEOMETRY

The discipline Linear Algebra sets as its main goal the development of abilities of handling the concepts of the Linear Algebra by presenting them in direct relation with other sciences;

Main objectives, techniques and concepts of the course: Explaining the theoretical and practical contents of Linear Algebra and Analytic Geometry [Details: Solving linear systems. Vector spaces and subspaces, basis and dimension. Scalar product, orthonorming. Linear mappings. Eigenvectors andeigenvalues, diagonal form. Isometric transformations: translations, rotations, symmetries; the decomposition theorem for Euclidean isometries. Quadratic forms - canonic expression, signature. Operations with free vectors, Cartesian coordinates, the straight line and the plane in space. Conics and quadrics]; using advanced applicative methods in solving linear systems, dealing with isometric mappings, algebraic curves and surfaces.

ELECTRICAL ENGINEERING 1

Course content: 1. Topology of electrical circuits. Kirchhoff's laws. Powers. 2. Ideal and real elements of the DC electrical circuits. 3. Equivalences of the DC circuit elements. 4. Systematic methods for solving of the DC electrical circuits. 5. Theorems of the electrical circuits. 6. Electrical circuits in variable regime. 7. AC electrical circuits. 8. Equivalence of the AC circuit elements. 9. Resonance of the AC circuits. 10. Systematic methods for solving of the AC electrical circuits. 11. Electrical circuits in non-sinusoidal regime. *Subject general goal*: Understanding of the fundamental concepts for the analysis of electrical circuits in DC regime, AC regime, non-sinusoidal regime and time variable (transient) regime.

CHEMISTRY

Nowadays an important accent is on the interdisciplinary character of the researchers. Chemistry is involved in all technical activities, not only at the level of materials, environmental protection, but also directly, through processes of chemical nature. The basic knowledge about chemical reactions and systems involved in chemistry is the key condition for understanding particular chemical aspects of different non-chemical

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engineering fields. The modern devices are based on new materials and a future engineer needs to possess knowledge about chemical structure and physic-chemical properties in order to be able to design new intelligent materials. This discipline insists on the structure and the properties of the most important materials in the nanomaterials era, on the possibility of spontaneous evolution of processes and insists also, on the electrode processes study, to understand the phenomena that govern device performance.

OPERATING SYSTEM 1

In order to prepare the students for real life event in IT&C world, this course provides an overview of the computer and networks security and it will raise student's awareness about computer network and computers itself operating systems issues. Also, some basic concepts concerning network management and computers network security will be presented. The course has as main objective to provide an overview of the computer operating systems. This course aims to introduce basic concepts and mechanisms of modern operating systems and virtualization. The emphasis is on principles and organization of operating systems, but also on practice, so as to illustrate key concepts in a practical context. At the end of the course, the students will understand some of the basic concepts concerning computers operating systems. At the end of the course, the students will be able to configure basic computer operating systems, interconnect two or more computers, and to apply basic security and protection to operating systems. During the practical laboratory/project part of the course, the students will develop practical skills about enabling computers security, setting up firewalls and Network Address Translation tables and policies using "iptables" software, configuring of firewalls in order to solve specific issues. During project assignments, the students will improve self-learning and team work capabilities. The teaching is in English and that helps the students to improve their English language command. In the same time, the students will consolidate their English language usage because the teaching, bibliography and support materials are in English.

PROGRAMMING LANGUAGES

This course is about computer programming. It emphasizes principles of sound design and good programming practice, aimed at developing programs of high quality and maintainability.

The course objectives are: To introduce the Java language as a true object-oriented language. To develop skills in the software design and programming using Java and its standard class libraries. To develop understanding of problems and build skills in the use of abstraction in order to manage the problem complexity.

A student completing this course should: Have a clear understanding of the OO terminology generally and that used to describe features of Java. Be able to design and write Java programs to solve moderately complex problems that meet requirements expressed in natural language. Have a clear understanding of

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what comprises a correct program in Java. Be able to understand the Java API documentation. Have an informal understanding of the semantics of object-oriented programs in terms of responsibility and collaboration.

COMPUTER AIDED GRAPHICS

The Computer Aided Graphics, on which designing, project making and manufacturing are based, is one of the most important study disciplines in superior technical education. Computer Aided Graphics is a science and a language too; it's a tool of knowledge, communication and social interaction. The components of this science are: Descriptive geometry, Technical drawing, and Computer graphics. Descriptive Geometry establishes laws which are to enable the representation of spatial objects and of spatial situations. These laws (rules) are coming directly from the elementary geometry. Technical drawing relies on orthogonal (orthographic) projection, which supplies the best conditions for describing shape of an object, and it is best fitted to make dimensioning, which is the second function of a technical drawing.

PROFESSIONAL COMMUNICATION 1

The practical course (seminar) Professional Communication 1 is addressed to first year bachelor level of the FILS. Its general objective is the development of the communicative competence of the students in English which is used as a medium of instruction in FILS. Stress is placed on the four fundamental components: listening, writing, reading and oral communication, developed based on the adequate grammatical and lexical support corresponding to the required level, viz. B2/C1 - CEFR. The teaching of this subject has the following secondary objectives: the capacity to use in real context communication situations certain adequate simple/phraseological units incorporating cultural and civilization connotations, appropriately using the necessary lexical and grammatical structures, with a focus on those structures encountered in the professional contexts of the future engineers.

PHYSICAL EDUCATION 1

The aim of this course is to enhance physical and intellectual effort capacity, a Harmonious development of the body, to optimize health, to prevent the appearance of global and segmental physical deficiencies and to form and maintain correct body attitudes.

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I Year, 2ⁿᵈ Semester

Subject	Credit points	Hours / week				Ver
		C	S	L	P	
Mandatory subjects						
Calculus 2	4	2	2			E
Physics 1	5	2	1	1		E
Electrical Engineering 2	4	2	2			E
Electronic devices	5	2	1	1		E
Data Structures and Algorithms	4	2		2		E
Applied Informatics	4	2		2		V
Professional communication 2	2		1			V
Physical Education 2	2			1		V

CALCULUS 2

The course Calculus 2 is a presentation of the theory of the integral of functions of several variables. The main topics are: the Riemann integral, improper Riemann integral, functions defined by integrals, double and triple integrals, line and surface integrals. The integral formulae (Green-Riemann, Gauss-Ostrogradski and Stokes) and an introduction to the field theory are presented too. The course contains also a brief introduction to the metric spaces theory and applications of the fixed point principle.

PHYSICS 1

Short description: The ultimate goal of Physics I Course is to provide the students with an opportunity to develop their knowledge of the physical world through study in wave optics. Students will learn the concepts, principles and technical vocabulary associated with optics areas of very wide-ranging application. The course will describe the nature and properties of light, its propagation, light – matter interactions, the main optical phenomena and their applications. The students will acquire theoretical and practical knowledge about some modern equipments and techniques using optical phenomena.

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ELECTRICAL ENGINEERING 2

Students will develop a professional understanding of electromagnetics and its role as a pillar in EEC education. Students will be provided with a wide foundation that prepares them for diverse specialization paths, useful also for immediate employment after graduation. Students will develop the ability to apply electromagnetic field laws to obtain analytical field solutions for discrete and continuous charge and current distributions, for both time-varying and quasistatics fields, to calculate resistances, inductances and capacitances, electric and magnetic forces; o calculate magnetic circuits, to understand electromagnetic energy, power flow. Content: Solving methods for Time-periodic linear circuits and transient state of linear circuits. Introduction to electromagnetic field theory Primary and secondary quantities. Elements of vectorial calculus, Electrostatics. Coulomb's law, Electric field. Point, linear, surface and volume charge distribution. Constitutive law of electric field, Electric flux (Gauss') law: spherical and cylindrical charge distributions. Scalar Electric potential. Poisson's and Laplace's equations, Dielectrics. Capacitors (parallel plates, cylindrical, spherical). Capacitance. Series and parallel connections. Electrostatic energy. Forces in electric field, Law of charge conservation. Law of electric conduction. Ohm's law. Law of electric power transfer through conduction. Law of electrolisys. ,Faraday's law of Induction, Stationary currents, Magnetostatics. Divergence, magnetic potential vector and curl of a magnetic field. Constitutive law of magnetic field. Law of magnetic flux. Biot-Savart-Laplace formula, Magnetic (Ampere's) circuit law: examples. Magnetic circuits. Magnetic energy. Forces in magnetic field, Maxwell's equations in integral form in free space. Differential form of Maxwell's equation, Poynting's theorem. Power flow, electromagnetic energy, power in electric circuits.

ELECTRONIC DEVICES

The discipline familiarizes students with the basic principles of electronics. Understanding the role of electronic devices is facilitated. The main objectives are: creating the skills to apply general knowledge in understanding the basic principles of electronics. The following are considered in particular: familiarization with the main types of electronic devices; establishing practical skills

DATA STRUCTURES AND ALGORITHMS

Data structures have multiple cross-domains applications. Understanding their usage, their performance capabilities and their internal mechanisms can help one to make informed decisions regarding the most appropriate solution for a particular problem. This course addresses the design, development and implementation of the fundamental data structures and data structure-related algorithms in the C/C++

programming language. The topics covered by the course are related to C/C++ programming (such as struct vs. classes, template classes, dynamic memory allocation) the Abstract Data Type concept and the following data structures: stack, queue, linked lists, graphs, hash tables, binary trees, binary search trees and heaps.

APPLIED INFORMATICS

The course Applied Informatics shows the students the basic elements of Web Application Development, one of the most inciting and asked for on the job market. The students learn the basics of the most important programming languages for the web (HTML, CSS, Javascript, PHP) and also learn how to apply them using correct principles for web development. We discuss also practical aspects needed in web development like accessibility, usability and client-server applications, session implementation. The course also improves the students' programming skills as they have to implement functions and small algorithms using different types of languages (Javascript and PHP).

The course has to be continued with a more advanced web development course that handles data management, development models and so on.

The course is adapted to the job market and it has the premises to prepare the students for a career in web development.

PROFESSIONAL COMMUNICATION 2

The practical course (seminar) Professional Communication 2 is addressed to first year bachelor level of the FILS. Its general objective is the development of the communicative competence of the students in English which is used as a medium of instruction in FILS. Stress is placed on the four fundamental components: listening, writing, reading and oral communication, developed based on the adequate grammatical and lexical support corresponding to the required level, viz. B2/C1 - CEFR. The teaching of this subject has the following secondary objectives: the capacity to use in real context communication situations certain adequate simple/phraseological units incorporating cultural and civilization connotations,

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adequately using the necessary lexical and grammatical structures, with a focus on those structures encountered in the professional contexts of the future engineers.

PHYSICAL EDUCATION 2

This course goal is to increase the physical and intellectual effort capacity, to implement a harmonious development of the organism, to improve the health state and to prevent the onset of global and specific physical deficiencies.

II Year, 1st Semester

Subject	Credit points	Hours / week				Ver
		C	S	L	P	
Mandatory subjects						
Special Mathematics	4	2	2			E
Probability Theory and Mathematical Statistics	4	2	1			E
Physics II	4	2		1		E
Fundamental Electronic Circuits	4	2	1			E
Digital Integrated Circuits	4	2		2		E
Databases	4	2		1		V
Object Oriented Programming	4	2		2		V
Microeconomics	2	1	1			V

SPECIAL MATHEMATICS

The main goal of the course is the acquisition by students of the operating capabilities of the fundamentals, methods and techniques provided by Applied Mathematics, as well as students' training for analysis, drawing up and utilization of the mathematical models in engineering.

Attending this course, students assimilate theoretical knowledge, basic formulas and algorithms for solving problems of Mathematical Physics, Fluid and Solid Mechanics, Electrical Engineering and Control Engineering. This course improves abilities in using specialized the software packages Matlab and Maple. Topics: Higher-Order Differential Equations. Systems of Differential Equations. Stability. Routh-Hurwitz criterion. Lyapunov functions. Complex Functions. Residues theory. Conformal mappings. Fourier series, Fourier Transform, Laplace Transform, Z Transform.

PROBABILITY THEORY AND MATHEMATICAL STATISTICS

The objectives of this course are: the formation of the capacities of handling the concepts of the probability and statistics by presenting them in direct relation with other sciences; the completion of the students knowledge with theoretical and applicative notions; the students will be able to understand applied models

from reliability, physics, game theory and much more; they would be able to realize predictions based on preexisting data or to estimate parameters in optimization issues.

Topics: The notion of probability. Geometric probability. Conditional probability. Applications to reliability. Sequence of independent trials. Limit theorem. Random variables. Distribution functions. Random vectors. Numerical characteristics. Correlation. Regressions. Characteristic functions. Classical laws via characteristic functions. Data representation and analysis. Estimation of parameters. Confidence intervals. Approximation theory in statistics. Least squares methods.

PHYSICS II

Short description: With the growing interest in nanotechnology, quantum physics has recently become increasingly important for an ever-widening range of engineering disciplines. The Physics II course is intended to provide the student with a clear and logical presentation of the basic concepts and principles of quantum physics and to strengthen an understanding of the concepts and principles through practical applications. During the first part of the course students learn phenomena that have led to the quantum ideas. Then, the formalism of quantum physics is presented in two steps. Probability plays a central role in making sense of quantum physics. Applications are emphasized whenever possible, including those related to the mathematical formalism, i.e., the quantum computer and quantum cryptography. Quantum mechanics formalism is used in the explanation of the periodic table of elements and the understanding of electrical properties of solids.

FUNDAMENTAL ELECTRONIC CIRCUITS

The course studies the main building blocks used in today's electronics industry. Emphasis is applied over the nanometric MOS circuits. The endless application ranges and high demand of highly trained engineers in multinational companies such as: Infineon, Microchip, ON Semiconductor have established in Romania some powerful research and production facilities. The course is giving the students tools to comprehend modern devices and circuits, as well as the concepts of modeling and scientific research. The general target of the discipline is the study of Analog devices (diodes, bipolar and field-effect transistors) and basic circuits such as small signal amplifiers, differential amplifiers, analog mathematics, active filters.

DIGITAL INTEGRATED CIRCUITS

The subject introduces the students to the organization and functioning of computer systems based on digital principles. Digital representation of information is followed by presentation of binary and hexadecimal

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representations. There are covered digital logic design issues, including combinational and sequential logic. For Sequential Logic there are presented applications using Finite State Machines.

DATABASES

Relational DataBase Management Technology is a dominant area of the digital world. Therefore understanding the basic concepts of structured data, the relational model, OnLine Transaction Processing and OnLine Analytical Processing are highly relevant for any professional working in the knowledge economy. The course aims beyond SQL standard and language by overviewing the new trends in data management such as Big Data, Data Lake, Machine Learning, NoSQL, Autonomous Database and Blockchain with the intention to offer the students a comprehensive perspective of the way data is managed in a digitally oriented organization. By contrast, the laboratory hours focus on the SQL language fundamentals using the educational content provided by Oracle Academy in partnership with FILS as a first step in achieving Oracle 12C database associate international certification.

OBJECT ORIENTED PROGRAMMING

This course resumes the introduction to object-oriented programming with new object-oriented concepts: inheritance, class reusing, polymorphism, object oriented containers, object factories, and exception handling. It also covers some specific characteristics of the Java language (applets, graphics, event handling, threading), and applies object-orientation concepts to the design, coding, and testing of Java programs. Students in the course should expect to spend a fair amount of time on their own developing programs. Programming, like most other skills, is best learned by doing.

The course objectives are to present advanced programming concepts in Java language, to develop skills in the software design and programming using Java and its standard class libraries, to develop understanding of problems and build skills in the use of abstraction in order to manage the problem complexity.

MICROECONOMICS

The subject teaches microeconomics notions laws and principles for engineers. The goal of such a subject is to support with basic economic knowledge the foundation of a future engineer in approaching correctly decisions in companies. Microeconomics is about individuals' choices of where to live and work how much to save, what to buy, and firms' decisions about allocation, hiring, firing, and investment - involves issues that concern us on a daily basis. This course develops students' abilities to construct and sustain an argument, develop the literacy and verbal communication, skills necessary for presenting reasons of economic nature. Upon completion, students should be able to identify and evaluate consumer and business alternatives in order to achieve economic objectives efficiently.

II Year, 2nd Semester

Subject	Credit points	Hours / week				Ver
		C	S	L	P	
Mandatory subjects						
Microprocessor Architecture	5	2		2		E
Numerical Methods	5	2		2		E
Operating Systems 2	5	2		2		V
Signals and Systems	3	2	1	1		E
Electronic Measurements, sensors and transducers	5	2		2		E
Macroeconomics	2	1	1			V
Optional subject 1						
Electrical Engineering 3	5	2		2		E
Data Acquisition and Processing						

MICROPROCESSOR ARCHITECTURE

The course offers an introduction to the computer/microprocessor architectures and addresses in more details two different implementations: AVR-8 and x86 (limited to 8086/8088). Both hardware aspects and some software mechanisms are explored through a series of significant examples/problems.

The course starts with the historic perspective of digital computers evolution and addresses both theoretical and technological aspects. The course is also considering the laws that shaped the impact of technology evolution: Moore's Law, Dennard Scaling, Amdahl's Law.

Instruction Set Architecture (ISA) and General Purpose Computer Architecture are analyzed together with the mechanisms used to improve performance. The lab is intended to initiate the students with hardware development and low-level programming for AVR-8 microcontroller family. The problem sets and lab exercises are intended to give students "hands-on" experience in using microprocessors and develop specific applications.

SIGNALS AND SYSTEMS

The course defines the basic notions and concepts of signal and system theory. Continuous-time and discrete-time signals and systems are analyzed. The course gives the basic notions of the signal theory and

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also the systems and associated general concepts are presented. The main purpose of this course is to create abilities to apply the fundamental notions concerning the concepts of signal and system and also to apply signal processing methods to realize specific functions in electronics.

NUMERICAL METHODS

This course provides an introduction to numerical methods and computer programming for the solution of various types of scientific problems. The primary objective of the course is to develop the basic understanding of the construction of numerical algorithms, their applicability and limits of their appropriate use. The course is interdisciplinary in nature, incorporating a number of case studies in information technology, electronic engineering, mechanics and chemistry.

OPERATING SYSTEMS 2

Understanding fundamental concepts in architecting, designing, developing, fine-tuning, and using modern operating systems, as well as those of the top actual implementations (Unix/Linux versus Windows and Mac OS X, as well as iOS versus Android). Understand what is going on "behind the scene" from the moment of powering on a computer, to OS kernel and then software application start, runtime, and end, and up to finally shut down, in modern multi-tasking, multi-user, and multi-processor platforms. Understand major advantages and drawbacks of both OS fundamental theoretical solutions and their existing implementations. Be able to fine tune modern OS platforms. Solving homework and preparing and defending a semester project, by using the theory and practice learned during lectures and labs.

Transversal competence: Becoming familiar with team work roles and activities for analyzing requirements, designing, implementing, testing, documenting, and defending a project, by using an operating system facilities. Becoming aware of the need of continuous improvement; efficient use of resources and solving techniques developed during lectures and labs for elaboration of an operating system project and documenting all of its steps.

ELECTRONIC MEASUREMENTS, SENSORS AND TRANSDUCERS

Measurement is a fundamental skill for engineers, including software engineers. This course will provide students with basic knowledge on measurements techniques, analog and digital instruments architecture and use, methods and transducers to measure principal physical variables. All automatic systems demand measurements in one stage or another. For this reason al electric engineers with software or electronics formation should be acquainted with measurements. Lectures are sustained by a workshop for the practical formation of students in the field of electrical measurements.

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MACROECONOMICS

Macroeconomics studies the aggregate behavior of the economy. This course provides an introduction to the economic analysis of key macroeconomic variables such as output, employment, inflation, interest rates and exchange rates. The important elements of the course include measurement of macroeconomic variables, the development of models and theories to explain the behavior of macroeconomic variables, the use of empirical evidence in evaluating different models, and the role of government policy in seeking to influence macroeconomic outcomes. The course will provide students with a framework for understanding the workings of the whole economy and the various interactions among households, business and governments.

ELECTRICAL ENGINEERING 3

The students get used to different CAD software for electric circuits modelling and for electromagnetic field modelling. The students will be able to solve electric circuits in different functioning regimes: (dc, ac, transient). The students will be able to model different applications specific for electromagnetic field devices working in different states. They will be able to apply the knowledge received during El. Eng. 1 and El. Eng. 2. They will be given a better understanding of electromagnetic phenomena and they will understand the importance of using CAD for electric circuit/electromagnetic field problems simulation.

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III Year, 1st Semester

Subject	Credit points	Nr. ore/sapt				Ver
		C	S	L	P	
Mandatory subjects						
Algorithm Design	4	2		1		E
Computer Networks	4	2		2		E
Formal Languages and Compilers	4	2		2		E
Advanced Computer Graphics	4	2		2		V
Money and Banking	2	1	1			V
Computer Architecture	4	1		2		E
Optional subject 1						
Quality and Reliability	4	2		1		V
Introduction to SAP						
Optional subject 2						
Data Transmissions	4	2		1		V
Internet of Things						

ALGORITHM DESIGN

The aim of the course is to understand the basic notions needed for algorithm design and efficient problem solving. For this, in the first part of the course are presented several elements for measuring the complexity of algorithms, including introductory elements for computability theory and classes of problems. Afterwards, we introduce the most important algorithm design techniques: divide et impera, greedy algorithms, dynamic programming and backtracking with optimizations. Each of these techniques is accompanied by a set of efficient solutions for several essential problems, as well as comparisons between alternative solutions using the asymptotic notations for measuring complexity. In the last lectures, there are discussed several problems using graphs, together with a series of algorithms for solving them, thus highlighting the use of the aforementioned design techniques. Algorithm design and efficient problem solving are important competencies that are at high demand for engineers.

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COMPUTER NETWORKS

The aim of this course is to introduce the issues and basic principles of computer networks. The objectives are to develop a framework into which more detailed material regarding specific aspects of the computer networks will be studied such as computer topologies, layered network models, networks protocols, computer configurations, algorithms routing, security in networking, etc.

FORMAL LANGUAGE AND COMPILERS

The aim of this course is to introduce the issues and basic principles of formal languages and compilers. The objectives are to develop a framework into which more detailed material regarding specific aspects of formal language and compilers are studied such as automata theory, regular languages, regular expressions, push down automata, grammars, Turing machines.

ADVANCED COMPUTER GRAPHICS

Computer graphics is an important branch of computer science, including areas such as computer-aided design (CAD), scientific visualization, movies and games, virtual and augmented reality. As part of the "Advanced computer graphics - ACG" course, students are introduced to the field of computer graphics through theoretical and practical content including (but not limited to) 2D and 3D geometric transformations, rasterization, projections and clipping, detection of visible surfaces in a scene or notions of lighting. During the ACG laboratory, students combine in a practical manner the knowledge acquired in mathematics, trigonometry, geometry and programming to create 2D and 3D graphic scenes using the OpenGL language. From a simple graphics window, from the lowest level of the pixel, continuing with the generation of 2D polygons and reaching advanced notions of clipping, interpolation and approximation, generation of 3D objects, lighting and rendering effects., they will be able to create their own mini-game engine and learn the basics that can be essential for a future career in the gaming industry or in research based on virtual and augmented reality.

MONEY AND BANKING

The subject focuses on interest rates, the concept of money, exchange rates and monetary policy. Topics covered include banking structures and function, the European Central Bank, determinants of the money supply, fiscal policy and monetary policy, and international economies. The course will present an opportunity to discuss the financial institutions and monetary policies of different nations and evaluate their relative success in recovering from the financial crisis. Within this, the interaction between the financial system (in terms of its institutions and instruments) and the macro-economy will be examined and there

will be a strong practical and policy related element to the course.

COMPUTER ARCHITECTURE

This course presents computer architecture. We will focus on digital logic design, microprocessor instruction set and assembly language, memory system, input-output and computing optimization. The student gets the grasp of the computer hardware, its design and interface to software, as well as methods for performance enhancement. At the end of the lecture, the students should be able to: Show understanding of digital logic principles, Use combinational and sequential logic circuits, Minimize logical functions using Karnaugh maps, Work with numbers in the bases 2, 8 and 16, Work with fixed and floating point representations., Show familiarity with the Intel 8086 processor, Show understanding of computer memory design, cache concepts, and bus fundamentals, Demonstrate understanding of virtual memory, process concepts, and parallel architectures.

QUALITY AND RELIABILITY

The general goal is the development of abilities required to assess and improve total quality and the development of methods and tools to control the uncertainty involved in all the stages of the product life cycle.

DATA TRANSMISSIONS

This course offers an introduction into the concepts, principles and terminology used in the design, operation, and maintenance of data transmissions systems. The subject covers the following: signals analysis and processing, transmission systems, baseband and passband data transmissions, and advanced data transmissions techniques for modern systems.

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III Year, 2nd Semester

Subject	Credit points	Hours / week				Ver
		C	S	L	P	
Discipline OBLIGATORII						
Digital Signal Processing	3	2		2		E
Neural Networks and Genetic Algorithms	3	2		2		V
Business Administration	2	1	1			V
Web Programming	3	2		2		V
Software Development Methods	4	2		1	1	E
Human-Computer Interaction	4	2		1	1	E
Optional subject 1						
Functional Programming	3	2		2		E
Programming Paradigms						

DIGITAL SIGNAL PROCESSING

The subject introduces the students to the Digital Signal Processing Domain. The laboratory and project are performed in Python. There are discussed continuous and digital representation, digital signals and systems, convolution, Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) digital filters and their realizations. The signals are studied in the time and in the frequency domain. Special attention is given to the compression and to the real-time processing of signals.

NEURAL NETWORKS AND GENETIC ALGORITHMS

The subject introduces the students to the artificial intelligence connectionist approach. Neural Networks (NNs) are similar in functioning to the brain - they are based on the idea of parallel and distributed computation and the connections between the network elements are used to store the information. The laboratory is performed in Python. There are discussed model architectures (Perceptron, Feed-Forward

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Neural Network, Hopfield, Competitive Learning, etc..) as well as the training methods and data representation issues. There are introduced the Genetic Algorithms (GAs), a searching model inspired by the natural selection. There are presented several applications of NNs and GAs like non-linear regression, time series prediction, classification, clustering, etc. A Large part of the lecture is dedicated to Deep Learning and to Convolutional Neural Networks, with Keras and TensorFlow.

BUSINESS ADMINISTRATION

The purpose of the course is to completely integrate the area of economic subjects thought to engineering students with an applied project in the area of business administration and entrepreneurship. Three major components comprise the course: initial analysis (marketing environment, promotion, price, distribution, product) for an organization/product, the development of future strategies with ethical, competitive and environment considerations and the implementation plan. Students are asked to complete a business plan on a new product or a new business in the market and all the mandatory steps are followed in order to actually lunch the idea in the market. Another objective of the course is to encourage team work, most of the projects are completed in a team and if it's possible in a multicultural team.

SOFTWARE DEVELOPMENT METHODS

As an academic course topic Software Development Methods is a subset of the Software Engineering field. Software development methods are used to contribute to the software process. They prescribe human actions and activities, tools, and intermediate products for developing software systems and claim to improve characteristics of the software (e.g., reliability) or its production (e.g., total cost or schedule predictability).

Many software development methods have come into practice over the last decades, and new methods are emerging. The new methods are more powerful than the old ones, but many of their concepts, guidelines, or techniques are alike. The course chose the object - oriented methodology, but aims to put emphasis on what is inherent, persistent in all software development methods.

Usually, the software development methods focus on two activities in the software process: analysis and design. Analysis is concerned with understanding and modeling of the "real world" system we want to implement (the problem domain). Design is concerned with the mapping of the analysis results in a description of the software product that should support the "real world" system.

The Unified Modeling Language (UML) is currently the industry standard for communicating many of object - oriented development artifacts. In this course UML is the vehicle for learning Object - Oriented Analysis and Design. Analysis and design methodologies promote development of software systems with visual languages and CASE tools. The course laboratory effectively uses such tools.

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WEB PROGRAMMING

This course targets one of the main positions in information engineering industry – web application development. The course builds upon the competencies gained in Programming Languages, Introduction to Web Programming and Computer Networks courses. During the course the students learn the software architectures behind today`s web applications, Java Enterprise Edition server side technologies, using databases and also dynamic web pages using asynchronous calls. The laboratory follows a pragmatic approach, focusing on real life programming tasks and latest web technologies.

HUMAN-COMPUTER INTERACTION

The aim of this course is to acquire basic knowledge concerning human-computer interface design and evaluation and to design and implement some simple specific interfaces. Course content: Human perception and memory; Human psychology, reasoning and problem solving techniques; Hardware for interfaces; Interface design principles, rules and heuristics; Interface usability evaluation; Interface implementing tools

FUNCTIONAL PROGRAMMING

Functional programming course is based on the programming paradigm according to which calculus consists of the evaluation of some functions. Algorithms and programs in functional languages such as Schemes and Haskell will be developed. Students will learn basic concepts, common to all programming languages: predefined functions, recursive functions, curry functions, function composition, but will also acquire knowledge specific to functional programming languages: Lambda calculus, higher-order functions, reduction strategies and lazy evaluation. In Scheme (BiwaScheme and DrRacket dialects), students will work with lists and vectors, conditional and iterative forms, and will simulate a Turing machine using the λ calculation. The data structures in Haskell (the WinGHCi compiler) will include lists, list comprehension, tuples and binary trees. Students will use special types of function definition (pattern matching, guards), currying, modules and Input/Output operations.

IV Year, 1st Semester

Subject	Credit points	Hours / week				Ver
		C	S	L	P	
Mandatory subjects						
Bioinformatics	5	2		2		E
Software Engineering	4	2		1	1	E
Systems Engineering	4	2		1	1	V
Software Design Techniques	5	2		2		E
Fundamentals of Management	2	1	1			V
Optional subject 1						
Artificial Intelligence	5	2		2		E
Image Processing						
Optional subject 2						
Communication systems	5	2		2		E
Programmable Systems with FPGA						
Microprocessor Systems						

BIOINFORMATICS

In this course, students learn fundamental concepts and methods in bioinformatics, a field at the intersection of biology and computing. It surveys a wide range of topics including computational sequence analysis, sequence homology searching and motif finding, gene finding and genome annotation, protein structure analysis and modeling, genomics and SNP analysis, network/systems biology, and biological knowledge discovery. It serves a gateway course for all entry-level bioinformatics graduate students. Prerequisite: students should be enrolled in the graduate program of bioinformatics or have advanced training in at least one of the following areas: computer science, applied mathematics, quantitative biomedical sciences, bioengineering, biotechnology, and biostatistics.

SOFTWARE ENGINEERING

The aim of this course is to introduce the issues and basic principles of software engineering. The objectives

are to develop a framework into which more detailed material regarding specific aspects of the software engineering process techniques and issues can fit, including requirements, verification, testing, validation, and quality processes.

SOFTWARE DESIGN TECHNIQUES

The course is concerned with the design of complex software systems, that is the design of objects that populate the run-time environment and then the architecture of the overall software product.

In software systems the building blocks must be carefully verified and integrated to ensure that the resulting applications are robust and maintainable. The necessity to integrate, reuse, and maintain large collections of software components has led to important challenges for software engineers which, in turn, resulted in the elaboration of various component models, design patterns, and integration mechanisms. Design patterns are the first main issue of the course. A Design Pattern is a best practice solution to a frequently occurring problem in various specific context. Design patterns encapsulate proven, reusable solutions to common design issues. The study of design patterns can help advance the technical expertise of software professionals. The course includes design pattern presentation at both architectural and low levels.

Software architecture is a collection of high level design decisions that, if they are wrong, are expensive to change. It delineates the structure of the system, showing its major aspects that need to be understood in order to understand how the system is put together. In this course the students will acquire the concepts and techniques that will enable them to understand, analyze, maintain, and improve the architecture of large software systems. At laboratory, several example problems will be studied to investigate how to make good design decisions at either architectural or object level. Students are expected to practice their use in modeling, designing, building, and validating practical, high-quality software systems.

FUNDAMENTALS OF MANAGEMENT

The course objectives are to understand the role and importance of management in the future activity of graduates and to understand the basic technical and economic notions. Professional significance: Capacity to work with some basic technical and economic notions, to use basic tools of management and specific scientific vocabulary, acquiring of skills necessary in approaching the decision process through information and calculation. Topics: Management – art or science? Managers. Foreseeing in management. Activity organization. Directing employees. Coordination and control.

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SYSTEMS ENGINEERING

The course defines complex systems and underlines why systems engineering is needed to develop complex systems; offers knowledge related to system life cycle model and phases in a system development process, related to the relation between systems engineering and project management, risk management and quality management; gives knowledge about model-based system engineering and how to develop models in specialized languages, mainly in SysML; identifies the best systems engineering practices which can be applied to software systems engineering. The laboratory gives the knowledge and qualification of working with systems engineering tools (such as MS Project, risk plan, quality plan, SysML tools – Modelio, Visual Paradigm), to model systems via SysML diagrams, to develop a WBS and Gantt chart, to develop a system engineering plan for a realistic project, in a small team.

ARTIFICIAL INTELLIGENCE

The course treats the theoretical and practical aspects of Artificial Intelligence and has as goal the creation of an overview of the discipline and of the main application domains, in which the Artificial Intelligence methods and techniques were successfully applied.

At the end of the course, the students will know the basic principles of Artificial Intelligence and the associated algorithmic approaches, for instance informed search strategies, game theory, knowledge representation models and specific inferences. Also, they will gain knowledge about how to build automated planning applications, natural language processing, theorems proving, machine learning and autonomous intelligent agents.

IMAGE PROCESSING

Digital Image Processing covers a wide range of methods that allow the transformation and interpretation of digitally-represented visual information. This course presents the fundamentals of these methods and practical implementation examples. The course introduces the students to general digital gray level image processing and analysis techniques (the chain of operations that enable feature extraction from visual data in order to make decisions) and their implementation in general software environments (C, C++) or dedicated software (Matlab). The laboratory introduces the students to the implementation of general digital gray level image processing and analysis techniques in Matlab. The project proposes to students the software implementation (under a programming language of their choice) of selected medium-complexity image processing and analysis structures. Students acquire experience in the skills of understanding algorithm description and translating the description into software.

PROGRAMMABLE ELECTRONIC SYSTEMS WITH FPGA

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The course is an introduction to programmable circuits using the Field Programmable Gate Array (FPGA) architecture and the VHDL hardware description language. At the end of the course, students should know: the principles of fundamental digital logic, the analysis of problem-specific programming logic, making simple circuits in VHDL language, Using the Basys 2 Spartan-3E FPGA and XILINX ISEDesign Suite, Design steps for simple solutions using programmable circuits.

COMMUNICATION SYSTEMS

The aim of this course is to present the basic principles used in the mobile communications systems, to present the main mobile communications systems is o to introduce the main technical aspects concerning the wireless access and sensor networks.

MICROPROCESSOR SYSTEMS

The subject refers to the basic and advanced elements of the design and programming microprocessor systems. It is composed of three main parts. The first part discusses about the main features and characteristics that define the internal architecture of a microprocessor. The focus is on INTEL microprocessors. It also presents the basic elements of a microprocessor system, namely the microprocessor and its support circuits, the memory subsystem and the I/O subsystem. The second part discusses about memory hierarchy based on locality principle, design and interfacing to the system bus of the main types of memories, including EPROM, SRAM and DRAM. The last part presents the I/O subsystem, interrupts, programming and interfacing various programmable controllers. Many software and hardware examples together with design solutions are considered for various application requirements.

IV Year, 2nd Semester

Subject	Credit points	Hours / week				Ver
		C	S	L	P	
Discipline OBLIGATORII						
Semantic Web	5	2		2		V
Distributed and parallel algorithms	4	2		1	1	V
Integrated security solutions	4	2		1	1	V
Management industrial/ Industrial Management	2	1	1			V
Optional subject 1						
Robotics and Intelligent Agents	5	2		2		V
Electronic CAD						
Optional subject 2						
Software Project Management	4	2		1	1	V
Virtual and Augmented Reality						

SEMANTIC WEB

Semantic Web applications exchange "intelligent" information via languages such as XML / RDF. This course aims at defining the main features of the Semantic Web and its constituents (meta-data, schemas, ontologies), highlighting the use of metadata (XML - Extensible Markup Language, RDF - Resource Description Framework, OWL - Web Ontology Language, queries SPARQL), defining and exploiting ontologies (OWL specification, ontology engineering, ontology alignment and fusion). The laboratory covers the same topics as the course, but from a very applied perspective. During the lab sessions, students will make applications using XML processing libraries, RDF and SPARQL queries; will develop ontologies using Protege instrument; will make exercises related to social network analysis; will develop wikis and a semantic web service.

DISTRIBUTED AND PARALLEL ALGORITHMS

The aim of this course is to introduce the issues and basic principles of distributed systems. The objectives are to develop a framework into which more detailed material regarding specific aspects of the distributed systems are studied, including synchronization, logical clocks, mutex elections, naming. Distributed system memory and caching, virtual synchrony, concurrency, deadlocks, distributed file systems, Paxos, etc.

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SOFTWARE PROJECT MANAGEMENT

The course aims to present main project management methodologies and the IT tools which can be used in each case, with a special accent on agile ones. Aspects related to project planning, risk management, changes management, quality assurance management, costs. acquisition and human resources management are also debated. Case studies of successful and unsuccessful software projects are discussed. Students are put to work in groups and simulate the project management process for a given software project.

INTEGRATED SECURITY SOLUTIONS

In today's world, threats against people, companies or even against states are no longer only physical but also informational. In order to prepare the students for real life event in IT&C world, this course provides an overview of the computer and networks security and it will raise student's awareness about computer network and computers itself security issues. Also, some basic concepts concerning network management and computers network security will be presented.

The subject will cover topics such as network management, security applied to computer networks, principles of network security, cryptography, applications security, security for TCP connections, security at network layer level, network access control, firewalls, IPv6 security.

The course will present the needs for computer security and protection; it will help for a specific computer system, concerning the IT security, to identify and establish a good balance between advantages and drawbacks of any decision. The course shows different ways how to implement fundamental strategies and principles against IT criminality and for a specific security issue on a computer or computers network, design a solution to that issue.

During the practical laboratory/project part of the course, the students will develop practical skills about enabling computers security, setting up firewalls and Network Address Translation tables and policies using "iptables" software, configuring of firewalls in order to solve specific issues. During project assignments, the students will improve self-learning and team-work capabilities.

INDUSTRIAL MANAGEMENT

The purpose of this course is to offer students a broad understanding and knowledge of management applied in industrial organizations and also to bring information on the manner in which industrial units interact in national, European and international context. The objectives of this course are related to offering information that will lead to understanding and knowledge of several industrial management concepts, principles and methods. They include research & development, operations management, forecasting, scheduling, quality assurance, human resources management, finance & accounting management, and

commercial management. Emphasis will be placed on the application of these concepts to actual business situations.

ROBOTICS AND INTELLIGENT AGENTS

ROBOTICS AND INTELLIGENT AGENTS is an introductory–intermediate course that explores the fundamental concepts, models, and architectures underlying modern robotic systems and intelligent software agents. The course begins with an overview of robotics, covering key definitions, classifications, and real-world applications of robots in industry, services, and research. Students study classical and modern driving architectures, including deliberative, reactive, and hybrid approaches, and analyze how these influence autonomy and decision-making. The course then introduces agent theory, presenting core definitions, types of agents, and their essential properties. A significant focus is placed on multi-agent systems, with particular attention to learning, cooperation, and coordination among agents. Students examine the internal structure of intelligent agents, emphasizing cognitive capabilities such as perception, reasoning, learning, and action. The course highlights the close relationship between intelligent agents and autonomous robots, showing how agent-based models are applied to embodied robotic systems. By the end of the course, students gain a conceptual foundation for designing, analyzing, and reasoning about intelligent agents and autonomous robotic systems.

ELECTRONIC CAD

The "Electronic CAD" discipline offers to students under specializing in "Applied Electronics" the possibility to reach an appropriate level of theoretical and practical knowledge in the field of EDA (Electronic Design Automation), technological electronics engineering, electronic packaging and manufacturing of electronic modules/systems. The obtained knowledge will be very useful in the future engineering life because various electronic devices, modules and systems, in all industrial areas, are managed only by the electronics engineers having a solid background in design and manufacturing. At the end of „Electronic CAD", students will be able to manage various electronic projects from the CAE-CAD-CAM design and manufacturing points of view. The engineering skills accumulated during lectures, labs and the project will offer a larger outlook on various electronics industry aspects, electronic packaging and high performance CAD software systems issues. Finally, students will have the satisfaction to understand globally the numerous every-day problems which are usually placed "onto the desk" of electronics engineers in conception and development of electronic modules/systems.

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VIRTUAL AND AUGMENTED REALITY

VIRTUAL AND AUGMENTED REALITY is a comprehensive course that introduces students to the principles, technologies, and applications of immersive digital environments. The course begins with fundamental definitions and concepts of Virtual Reality (VR) and Augmented Reality (AR), analyzing their components, current state, and future development trends. It explores the physiological, psychological, and philosophical aspects of immersion, including perception, presence, interaction, and the distinction between real and virtual experiences. Students study a wide range of VR applications, from games and online social worlds to military training, medical simulators, education, and industrial and architectural simulations. The course examines multimodal VR devices, covering both input technologies (sensors, motion tracking, gloves) and output technologies (visual, audio, and haptic systems). Advanced topics include computer graphics fundamentals, stereoscopic display principles, real-time rendering, and large-scale virtual environment management. Students are introduced to game engines used in VR development, such as Unity, Unreal Engine, and CryEngine. The course also presents 3D modeling tools, including Maya and Blender, focusing on basic model creation. Augmented Reality technologies and applications are discussed, with examples using mobile AR platforms such as Vuforia SDK. The course concludes with an analysis of the evolution and future prospects of VR and AR technologies.