COURSE CATALOGUE 2013/2014

VsiTe

Contents

MISSION 4
VISION 4
Professional Study of Information Technology 5
Professional Graduate Study of Information Technology 5
ECTS methodology 6
Compulsory and Optional Courses 7
Academic calendar 2013- 2014 8
Professional Study of Information Technology – Study Program 9
Professional Graduate Study of Information Technology – Study Program 10
Linear Algebra 12
Mathematical Analysis 1 14
Applied and Numerical Mathematics 16
Mathematical Analysis 2 18
Discrete Mathematics 20
Physics 22
Industrial Traineeship 24
Final Paper 25
Business Ethics 26
Company Organization and Economics 28
English Language 1 29
English language 2 30
English for Engineers 31
Fundamentals of Electrical Engineering 33
Fundamentals of Electronics 34
Digital and Microprocessor Technique 35
Architecture and Organization of Digital computers 36
Introduction to Computer Programming 37
Programming Methods and Abstractions 39
Data Structures and Algorithms 40
Object-Oriented Programming 41
UNIX Programming Tools 42
Advanced Windows Programming 44
Java Programming 45
C# Programming 46
Project Management and Documentation 47
Object-Oriented Modeling 48
Distributed Object Programming 49
Computer and Program Usage 50
Operating Systems 51
Computer Networks 52
Personal Computer Architecture 53
Computer Networks Design and Management 54
Server Computer Architecture 55
Server Management 56
Computer and Data Security 57
Multimedia Networks and Systems 58
Databases 59
Database Design 60
Network Services and Programming 61

Internet Programming 62
Web Design 63
Information Systems 64
Information Systems Design 65
Informatization of Management 66
E-Business 67
Public Information Systems 69
Informatization of Production 71

College for Information Technologies

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MISSION

The VSITE mission is to develop and implement the education of the highest quality that will motivate each participant (male student / female student, teachers and business people) within their ambitions and interests to involve themselves into the management of modern information technology courses. Professional activity is achieved within projects in economy and other areas of general and public interest, which contribute to raising the applied knowledge in the areas of VSITE activity. College for Information Technologies cooperates even outside of Croatia, which contributes to improvement of mission through the knowledge transfer and mobility of students and teachers. There is a strong emphasis on raising public awareness of the place and the role of information technology in broader social context.

VISION

College for Information Technologies is a modern institution for professional study of information technology that educates professional engineers, bachelors of information technology. Its program is continually being aligned with contemporary world developments in information technologies and their application, conforming to the requirements and trends of domestic and international labour markets. In this approximation, it equally takes into account the needs of individuals, the labour market and society as a whole, through the prism of promoting innovation and excellence.

VSITE, College for Information Technologies is a private school in Zagreb, Croatia, which offers courses of undergraduate and graduate IT studies. Studying at the College for Information Technology is carried out in two segments:

1. Professional Studies in Information Technology and
2. Specialist Graduate Professional Studies in Information Technology

In this way the College for Information Technology ensures vertical mobility in education for students taking Professional Studies in IT and an opportunity for students from related undergraduate university professional studies to attend the Specialist Graduate program.

Professional Study of Information Technology

The three-year undergraduate program of information technology provides students with practical expertise, necessary to fit into the work environment with greatest possible efficiency.
The professional study of information technology is organized for full-time and part-time students in two modes of study.
Full-time students study for three years with full annual requirements of approximately 60 ECTS credits.
Part-time students study for four and a half years, three of which require approximately 40 ECTS credits, and a fourth year requiring 50 ECTS credits, after that they have to complete professional practice and write a final paper for 8 ECTS credits.
Reduced annual workload allows part-time students to successfully study while working.
Upon completing the program the student can achieve a minimum of 180 ECTS credits, and receive the academic title of a Bachelor of Information Technology.
Four areas of specialization are provided through elective courses:

a) **designing user software support,** includes generating and testing parts of the program using program interpreters and application generators,
b) **integration and maintenance of computer systems and networks,** includes operations in stages of installation, usage and expansion of computer equipment and system software support, designing computer networks according to the principles of structured cabling and workgroups, constructing and testing networks, connecting the network to the Internet, and connecting individual computers to the network,
c) **designing databases and web sites,** includes designing, generating and testing parts of the database and the data access system using the database program and web scripting languages that are processed on the client or on the server computer, and
d) **designing and use of information systems,** includes the development cycle of an information system using the techniques of system modeling and CASE tools.

Professional Graduate Study of Information Technology

Specialist graduate professional study of information technology is divided into two groups of courses.
The first group consists of the core subjects (mathematics, languages, systems, social sciences) where the professional specialist information technology engineer achieves advanced knowledge that is necessary for continuously monitoring the advancement of engineering in the field of IT.
The second group consists of elective specialist courses, and their content is improved according to professional requirements, each generation of students is given the opportunity to master particular contemporary technology and to accomplish the possibility of joining the work process without additional training.
This dual approach is in line with the latest findings, which are aimed at training the professional specialist engineer to continuously monitor the progress of information technology.
This level also has two modes of study.
Full-time students study for two years with full annual requirements of 60 ECTS credits.
Part-time students study for three years and have an annual requirement of approximately 45 ECTS credits.
At the end of the study, the student acquires 120 ECTS credits, which means, in addition to the professional study credits, a total of 300 ECTS credits. At the end of the study the student receives the academic title: Specialist Engineer of Information Technology.
Students choose one of the three specializations of the study:

a) **designing user software support and information systems** is advanced from the level of professional study, which includes:

- basic bachelor training in programming and program implementation, to the level of the specialist graduate study that trains the professional specialist engineer to independently apply the paradigms of software engineering, management of software projects and to independently perform complex tasks of implementing software systems, and
- databases and web applications and information systems design, at the specialist level. Trains the professional specialist engineer for the implementation and management of complex information systems based on modern technologies and to actively advance the technology of information systems.

b) integration and maintenance of computer systems and networks is advanced from the level of the professional study, which provides knowledge which is important for work in stages of installation, usage and expansion of computer equipment and software support, and for designing and implementing computer networks, to the level of specialist studies that trains the professional specialist engineer for strategic computer security and efficiency management, and mastering the complex technologies of fine-tuning, monitoring and controlling computer systems,

c) **embedded and mobile computers** is a new specialization derived partly from Programming, and partly from the course Computer Systems, which trains professional specialist engineers for work on the increasingly important segment of small mobile and embedded computers. Professional specialist engineers who choose to specialize in embedded computers will learn to design and implement software solutions for control systems and mobile computers, and to design dedicated connection hardware

In order to apply for this college, candidates must have a three or four year high school degree. The classification procedure is followed through on the basis of high school achievement and an interview with the candidate.

ECTS methodology

As full-time students, candidates must take 60 ECTS per year over a period of three years, whereas part-time students take only 40. This allows part-time students to successfully manage their work and studies over a period of four and a half years.

The tuition is calculated according to the number of ECTS.

With the introduction of the ECTS point system the possibility of measuring the total workload of students is achieved, which is required for mastering the material and achieving learning outcomes of individual courses. The workload of students includes participating in active teaching (lectures, exercises, practical work) and individual work (individual studying, writing homework, preparation for exercises, working in laboratories and the library, writing individual reports).

Full workload of regular students amounts to 60 ECTS points per study year. 1 ECTS is equal to 30 hours of student work, which represents the total workload of 1800 hours per year. All study materials of each separate course, are defined in a way that is appropriate and achievable in relation to the 1800 working hours for a student per year.

In these 1800 hours, around 40% is active teaching, and around 60% is the individual work of the student. In principal, courses with 30 hours of lectures and 30 hours of exercises require total student participation of around 5 ECTS (150 hours), and courses with 45 hours of class require around 7 ECTS (6-8, depending on a course).

Duties of part-time students amount to around 40 ECTS per study year. According to that, a part-time student has 1200 hours of work, which enables him/her to study while working. By registering a smaller number of ECTS, and having classes and exercises in the afternoon hours, part-time students are study with a full scope of school work obligations, which is identical for to the full-time students.

Compulsory and Optional Courses

Compulsory courses can be divided into groups of fundamental professional courses and social courses.

Compulsory fundamental professional courses include five courses of mathematics, physics, electrical engineering, electronics, digital technics, computer architecture, and computer networks, two courses of programming, databases and information systems. Achieved competences provide the bachelor with an engineering approach to problems, capability for designing and performing, analytics and modelling, and for active adjustment to the requirements of the future workplace.

Compulsory social classes include economics, ethics and three English language courses. Competences achieved through those are enabling the expert bachelor to see the wider aspect of the work process, and to involve into the work process on the basis of ethics and understanding of economical laws. English language courses as the language of the IT profession enable the student to use computer literature.

Optional courses are elected according to the four majors. Second year students select four out of eight offered optional courses, from which two are compulsory courses of the selected major. During the third year, students choose eight out of sixteen offered courses, with a recommendation of the course selection regarding the chosen major. Freedom of choice in the last year enables the student to correct the choices made in the second year.

- Optional courses of the Computer Systems and Networks major include the architecture of personal computers, computer networks design, server computer architecture, managing server computers, multimedia systems, and computer and data security. Competence which these courses provide is to ensure the successfulness of the professional bachelor as a system engineer of the server computers and computer networks in phases of design, implementation, and maintenance of the system functionality.
- Optional classes of the Software Development major include data structures and algorithms, object-oriented programming, advanced windows programming, java programming, c# programming, objective oriented modelling, Unix programming tools, distributed object programming, and project management and documentation. These courses provide competence for independent performing of programming tasks on Windows and Unix OS platforms.
- Optional courses of the Database major include database design, network services and programming, Internet programming and web page design. Competences include independent database design and creation of web-sites and applications.
- Optional courses of the Information Systems major include information systems design, informatization of management, e-business, public information systems and informatization of production. Courses provide competence in the field of creation, re-engineering and implementation of complex information systems. I

Academic calendar 2013- 2014

Professional Study of Information Technology – Study Program

1st Semester	Teaching hrs.	ECTS
Linear Algebra	30+30	5
Physics	45+30	6
Fundamentals of Electrical Engineering	30+45	6
Digital and Microprocessor Technique	45+45	7
Computer and Program Usage	15+30	3
English Language 1	30+0	2
Total:	**195+180**	**29**

2nd Semester	Teaching hrs.	ECTS
Mathematical Analysis 1	30+45	6
Fundamentals of Electronics	30+45	6
Architecture and Organization of Digital Computers	45+45	7
Introduction to Computer Programming	45+60	8
Business Ethics	30+0	3
English Language 2	30+0	2
Total:	**210+195**	**32**

3rd Semester	Teaching hrs.	ECTS
Applied and Numerical Mathematics	45+30	6
Programming Methods and Abstractions	45+60	8
Databases	30+45	6
Information Systems	60+0	6
English for Engineers	45+0	3
Total:	**225+135**	**29**

4th Semester	Teaching hrs.	ECTS
Operating Systems	30+30	5
Computer Networks	30+30	5
Elective course of the chosen Major	30+30	5
Elective course of the chosen Major	30+30	5
Elective course (from other Majors)	30+30	5
Elective course (from other Majors)	30+30	5
Total:	**180+180**	**30**

Elective Courses – Software Development	Teaching hrs.	ECTS
Data Structures and Algorithms	30+30	5
Object-Oriented Programming	30+30	5
Elective Courses – Database and Web Design	**Teaching hrs.**	**ECTS**
Database Design	30+30	5
Network Services and Programming	30+30	5
Elective Courses – Computer Systems and Networks	**Teaching hrs.**	**ECTS**
Personal Computer Architecture	30+30	5
Computer Networks Design and Management	30+30	5
Elective Courses – Information Systems	**Teaching hrs.**	**ECTS**
Information Systems Design	30+30	5
Informatization of Management	30+30	5

5th Semester	Teaching hrs.	ECTS
Company Organization and Economics	30+0	3
Mathematical Analysis 2	45+30	6
Elective Course of the 5th Semester	30+30	5
Elective Course of the 5th Semester	30+30	5

Elective Course of the 5th Semester	30+30	5
Elective Course of the 5th Semester	30+30	5
Total:	**195+150**	**29**

6th Semester	**Teaching hrs.**	**ECTS**
Discrete Mathematics	45+30	6
Elective Course of the 6th Semester	30+30	5
Elective Course of the 6th Semester	30+30	5
Elective Course of the 6th Semester	30+30	5
Elective Course of the 6th Semester	30+30	5
Industrial Traineeship	0+0	0
Final Paper	0+0	8
Total:	**165+150**	**34**

Elective Courses – 5th and 6th Semester	**Teaching hrs.**	**ECTS**
Server Computer Architecture	30+30	5
Server Management	30+30	5
Computer and Data Security	30+30	5
Multimedia Networks and Systems	30+30	5
UNIX Programming Tools	30+30	5
Advanced Windows Programming	30+30	5
Java Programming	30+30	5
C# Programming	30+30	5
Project Management and Documentation	30+30	5
Object-Oriented Modelling	30+30	5
Distributed Object Programming	30+30	5
Internet Programming	30+30	5
Web Design	30+30	5
E-Business	30+30	5
Public Information Systems	30+30	5
Informatization of Production	30+30	5

Professional Graduate Study of Information Technology – Study Program

Elective courses – 1st Semester		
Course title	**Teaching hrs.**	**ECTS**
Elective Courses - Core		
Statistics	45+30	6
Discrete Mathematics	45+30	6
Elective Courses - Social		
Accounting Basics	30+15	4
Sociology of the Information Society	30+15	4
Elective Courses - Embedded and Mobile Computers		
Embedded and Mobile Systems	30+30	5
Basics of Robotics	30+30	5
Elective Courses - Software Engineering and Information Systems		
Advanced Algorithms and Data Structures	30+30	5
Principles of the Object Oriented Design	30+30	5
Database Programming	30+30	5
PHP Programming	30+30	5
Elective Courses – Computer Systems		
Computer Security Management	30+30	5
Information System Reliability	30+30	5

Elective Courses – 2nd Semester		
Course title	**Teaching hrs.**	**ECTS**
Elective Courses - Core		
Numeric Modelling	45+30	6
Automata and Languages	45+30	6
Elective Courses - Social		
Marketing Basics	30+15	4
Introduction to Research	30+15	4
Elective Courses - Embedded and Mobile Computers		
Digital Signal Processing	30+30	5
Digital Instrumentation	30+30	5
Elective Courses - Software Engineering and Information Systems		
Software Engineering	30+30	5
Advanced Java Programming	30+30	5
Reliable Software Design	30+30	5
Service Based Computing	30+30	5
Advanced .NET Programming	30+30	5
Elective Courses – Computer Systems		
Computer Networks Security	30+30	5
Server Computer Tuning	30+30	5

Elective Courses – 3rd Semester		
Course title	**Teaching hrs.**	**ECTS**
Elective Courses - Core		
Operational Research	45+30	6
Mathematical Logic in Computer Science	45+30	6
Elective Courses - Social		
Ecology and Sustainable Development	30+15	4
Assistance Skills	30+15	4
Elective Courses - Embedded and Mobile Computers		
Digital System Design	30+30	5
Mobile Applications	30+30	5
Java and Mobile Platforms	30+30	5
Elective Courses - Software Engineering and Information Systems		
Computer Graphics	30+30	5
Dynamic Programming	30+30	5
Content Management Systems	30+30	5
Business Intelligence	30+30	5
Information Systems Integration	30+30	5
Elective Courses – Computer Systems		
Computer Forensics	30+30	5
Server Computer Virtualization	30+30	5

4th Semester		
Course title	**Teaching hrs.**	**ECTS**
Diploma Thesis	0+360	30
Total:	**0+360**	**30**

DESCRIPTION OF INDIVIDUAL COURSES

All courses are taught in Croatian, expect three ESL courses.

Linear Algebra

VSITE001

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0.5
ECTS laboratory exercises	0.5
ECTS seminars	0
ECTS individual work	3

Lectures (hours)	30
Auditorium exercises (hours)	15
Laboratory exercises (hours)	15
Seminars (hours)	0
Individual work (hours)	90

Contents	Natural numbers, integers, rational and real numbers, complex numbers. Mathematical induction. Operations with numbers. Algebraic expressions, properties of algebra. Linear equations with one or several unknowns. Linear inequalities. Matrices, matrix representation of a system of linear equations, solving triangular systems, Gaussian elimination, linear independence, the rank of a matrix, inverse matrix, determinants, QR factorization and the method of least squares, vector space and linear operators, eigenvalues and eigenvectors. Vectors, basic operations with vectors, unit vector, linear independence of vectors and the base of Euclidean space, vector products and applications. Coordinate systems. Points, straight lines, planes and the applications of analytic geometry.
Learning objectives	General. Understanding the basic elements of the mathematical language and linear algebra required for easier understanding and following other mathematical and expert courses and modern scientific-technological development. Adopting the methods of mathematical and logical thinking, developing intuition and creativity. Specific. Ability for precise defining of notions, presentation in the mathematical language and algorithmic solving of problems of matrix and vector algebra while using modern technologies. Applying the content of the course for understanding and solving problems from the field of students' future expertise and other engineering problems while raising the level of knowledge and interest for mathematics by using computers in the class.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Calculate the value of the arithmetic expression, to simplify or expand algebraic expressions, to distinguish between different sets of numbers. 2. To solve linear equations, quadratic equations and inequalities, and to solve some of the higher order equations by the application of substitution method and factorization. 3. To sketch the straight line, parabola and circle that are given by equations and to find intersections between curves graphically. 4. To define terms related to complex numbers, to plot complex numbers in complex plane, to determine trigonometric and exponential form and to be able to perform calculations with complex numbers. 5. To define the following basic terms: matrix, determinant, vector, linear dependence and independence of vectors, vector space and its basis, Euclidean space, linear operator, eigenvalue. 6. To compute with

	matrices and vectors, to solve homogeneous and non-homogeneous systems of linear equations by Gaussian elimination method and by matrix method. 7. To determine the equation of a straight line and a plane in space by application of matrix and vector algebra, and to determine the mutual position of two straight lines, two planes, and straight line and plane. 8. To create functions and programs for solving tasks and problems with the use of computer software (such as MATLAB) or by combination of standard way of solving problems and computer software.
Skills	Mastery of the basic methods of matrix algebra and the vector algebra. Solving systems of linear equations, application of the method of least squares. Application of analytic geometry in space. Application of methods to engineering problems.

Mathematical Analysis 1
VSITE 002

ECTS	6
ECTS lectures	1
ECTS auditorium exercises	1
ECTS laboratory exercises	0.5
ECTS seminars	0
ECTS individual work	3.5

Lectures (hours)	30
Auditorium exercises (hours)	30
Laboratory execises (hours)	15
Seminars (hours)	0
Individual work (hours)	105

Contents	Functions of real variable. Specifying and classifying functions, limits and continuity, asymptotes, review of elementary functions. Calculation of logarithm and general power. Exponential equations. Logarithmic equations. Sketching the graph of a function. Definition of trigonometric functions. Calculation of values of trigonometric functions. Derivation, differential, higher order derivations and differentials, mean value theorems, monotonicity, local extrema, curvature, examining the shape of a function. Integral calculus. Definition of an indefinite integral and basic methods of integration. Definition and properties of a definite integral. Newton-Leibnitz formula, improper integrals, applications of definite integrals. Sequences and series of real numbers, sequences and series of functions, Taylor's and Maclaurin's series.
Learning objectives	General. Use of differential and integral calculus for understanding and solving various problems in physics, engineering and studying other mathematical and expert courses. Development of conceptions by which the abstract contents are transformed into empirical and gaining basic, operational, creative and productive knowledge of mathematics. Specific. Understanding the basic idea, adopting and exercising basic algorithms and procedures and gaining the feel for application of mathematics of higher education. The ability for solving problems of differential and integral calculus and applications with the use of computers in symbolical, graphical and numerical fashion.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled, the student will be able to: 1. Precisely define the terms such as limit value of a function, continuity, derivation, indefinite, definite and improper integral and to list the properties and rules of the differential and integral calculus. 2. Calculate the limit value of a function, to determine the derivation of sum, product, quotient and composition of functions, and the derivation of implicit, parametric and inverse functions. 3. Explain the geometric and physical meaning of derivation, to apply derivation in various situations of measuring the speed of change of some quantity, to find the equation of tangent and normal line on the functions' graph and the linear approximation of a function. 4. Find the intervals of monotonicity and local extrema of a function, intervals of concavity and inflection points and to sketch the graph of a function. 5. Calculate the indefinite, definite and improper integral and to analyze the relations between them, to relate the indefinite integral and derivation. 6. Apply the integral calculus for calculation of the total position

	change, the distance, the work of a force, mean value of a function, area and volume. 7. Define sequence, series, and their convergence, name several convergence tests, and to examine the convergence of numeric series. 8. Find power series representation of a function and to determine the radius of convergence and to approximate functions with the Taylor's and Maclaurin's polynomial. 9. Define linear differential equation, general and particular solution and to solve the equation by the method of separation of variables and variation of parameters as well as by the Euler method. 10. Define the function of several variables, to define and sketch the domain for a function of two variables, to find partial derivatives, stationary points and total differential. 11. Create functions and programs for solving tasks and problems with the use of computer software (such as MATLAB) or by combining the standard way of solving problems and computer software.
Skills	Students gain basic knowledge about mathematical analysis of functions, differential and integral calculus, and sequences and series of numbers and functions. By adopting the terms and mastering skills in solving problems from the specified areas of mathematics enables them to follow other expert courses successfully.

Applied and Numerical Mathematics
VSITE003

ECTS	6
ECTS lectures	1.5
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3.5

Lectures (hours)	45
Auditorium exercises (hours)	0
Laboratory exercises (hours)	30
Seminars (hours)	0
Individual work (hours)	105

Contents	Ordinary differential equations: Definition and examples. First order ordinary differential equations. Solving certain types of first order differential equations. Second order ordinary differential equations. Linear differential equations of second order with constant coefficients. Laplace transform: Definition and properties of the Laplace transform. Application of the Laplace transform for solving the initial value problem of nonhomogeneous linear differential equations of second order with constant coefficients. Fundamentals of probability theory and statistics: Descriptive statistics. The concept of probability and basic theorems. Discrete and continuous random variables. Basic theoretical distributions. Adjustment of theoretical distributions to empirical data. Introduction to numerical mathematics: Approximate value and the error of approximate value. Numerical methods for solving nonlinear equations. Interpolation and approximation of a function. Numerical integration. Numerical solution of the initial value problem for the first order differential equations.
Learning objectives	General. Understanding laws, processes and phenomena in physics, biology and chemistry described by differential equations and their relation with the Laplace transforms. Understanding the phenomena and data from everyday life with the use of basics of descriptive and inferential statistics. Solving problems given by the empirical data through the use of methods of numerical mathematics. Specific. The ability to independently solve complex expert problems with the use of methods, basic algorithms and procedures of applied and numeric mathematics. Skills for writing programs and functions with the use of software package Matlab. Understanding the probability calculus with the application in everyday life.
Learning outcomes	It is expected that after the obligations determined by the curriculum are fulfilled, the student will be able: 1. To define Laplace transform of a function and to solve the problem with the use of Laplace transforms. 2. To define and describe basic terms of descriptive statistics and to calculate and interpret arithmetic mean, variance and standard deviation for grouped and ungrouped data. 3. To define the concept of permutation, combination and variation (with and without repetition), basic concepts of probability calculus and to calculate probability of simple events. 4. To define discrete and continuous random variable; to define, calculate and interpret mathematical expectation, variance and standard deviation of a random variable, probability density function and distribution function. 5. To

	describe and to apply the binomial, Poissons, uniform, normal and exponential distribution, to adjust theoretical distributions to empirical data and to determine theoretical frequencies. 6. To define absolute and relative (borderline) error, to compare and interpret them, to explain the problem of solving equations approximately, to find real solutions by bisection, tangent and secant method and to solve nonlinear system with the use of Newton's method. 7. To explain the problem of approximation of a function and to determine Lagrange interpolating polynomial and polynomial of 1st and 2nd order using the least squares method. 8. Numerical integration through the use of left and right rectangle formula, trapezoid and Simpson's formula, to evaluate the accuracy and to compare methods. 9. To write function m-files and programs in Matlab by which problems in numerical mathematics are solved.
Skills	Student is trained to model simple problems from the expert practice. He/she adopts the required knowledge of differential equations, numerical mathematics and statistics. He/she is introduced to software package MATLAB.

Mathematical Analysis 2

VSITE004

ECTS	6
ECTS lectures	1.5
ECTS auditorium exercises	1
ECTS laboratory exercises	0
ECTS seminars	0
ECTS individual work	3.5

Lectures (hours)	45
Auditorium exercises (hours)	30
Laboratory exercises (hours)	0
Seminars (hours)	0
Individual work (hours)	105

Contents	Basics of combinatorics. Binomial and polynomial theorem. Set of real and complex numbers. Complex functions: Derivative and integral of a complex function. The concept of analytic functions. Residues. Vectors: Operations with vectors. Vector space. Coordinate system. Plane and line in space. Functions of several variables: Derivative and integral of a function of several variables. Optimization problem. Vector functions of one and several variables. Divergence and curl of a vector field. Sequences and series of functions: Power series. Fourier analysis: Fourier series and Fourier integral. Orthogonal trigonometric systems, expansion of functions into Fourier series and applications, Parseval's equality.
Learning objectives	General. Understanding mathematics of changes in the finite dimensional spaces and its relation to the basic laws of classical physics, which, together with previous mathematical knowledge, provides a comprehensive basic mathematical competence for understanding and evaluating a wide range of problems in physics, engineering and other fields of work. Specific. Understanding of functions of multiple inputs and multiple outputs, understanding and the technique of their derivation and integration in a variety of conditions, and understanding its application on the formulation of basic laws of classical physics.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled, the student will be able to: 1. Through the use of vector language and system of linear equations know how to set up and solve problems with lines and planes. 2. Understand the relation between algebra of linear mappings and algebra of matrices and to apply that relation in solving problems with linear transformations and in interpreting operations with matrices. 3. Understand the basic ideas and techniques of mathematics of changes. 4. Know how to derive and integrate vector functions of a scalar variable and by using that apparatus know how to analyze motions and curves, and to understand mathematics which underlies Newtonian mechanics. 5. Know how to derive and integrate scalar function of a vector variable and know how to apply that to corresponding problems with scalar fields. 6. Know how to derive vector functions of a vector variable and to know how to apply that to analysis of transformation of space and coordinates. 7. Know how to integrate scalar and vector fields on curves and surfaces, analyze conservative fields, understand basic theorems about gradient, rotation and divergence, and to understand mathematics which underlies Maxwell's laws of electromagnetism.

Skills	The course provides broader knowledge of integrating techniques, definite integrals and their applications, Fourier series and applications, basics of differential equation, and functions of several variables and multiple integrals.

Discrete Mathematics
VSITE005

ECTS	6
ECTS lectures	1.5
ECTS auditorium exercises	1
ECTS laboratory exercises	0
ECTS seminars	0
ECTS individual work	3.5

Lectures (hours)	45
Auditorium exercises (hours)	30
Laboratory exercises (hours)	0
Seminars (hours)	0
Individual work (hours)	105

Contents	MATHEMATICAL MODELING. Mathematical structures. Language and formal procedures. Discrete and continuous models. MATHEMATICAL LANGUAGE. Symbolization and the use of variables. Elements of mathematical language. Definitions and proofs. LOGIC. Propositional logic. Introduction to predicate logic. Introduction to logical programming and Prolog. The problem of program correctness. SETS. Algebra of sets. Power set. Ordered pair and Cartesian product. RELATIONS. Ordering relations. Topological sorting. Equivalence relations. Application to the relational databases. FUNCTIONS. Introduction to functional programming and Lisp. STRUCTURES. Structures, isomorphism, specification and realization of structures. Algebra of modulo *n* and symmetric cryptography. Data structures. INDUCTION AND RECURSION. The structure of natural numbers. Principle of proving by induction. Principle of defining by recursion. Sums. Recursive modeling. COMBINATORICS. Principle of addition and principle of inclusion and exclusion. Multiplicative principle and the selection tree. Permutations and selections. ALGORITHM COMPLEXITY. Comparison of asymptotic behavior. Asymptotic estimate of complexity. Complexity of recursive algorithms. Practical non-computability and public-key cryptography. P, NP and NP complete problems. GRAPHS. Chinese postman problem. Traveling salesman problem. The connectivity problem. Shortest path problem. Minimal tree problem. Flow problem. FORMAL LANGUAGES AND AUTOMATA. Languages, automata and grammars. Regular languages and finite automata. Context-free languages and pushdown automata. Turing machines and computability.
Learning objectives	General. Knowledge of basic logical and mathematical concepts as well as certain eloquence in mathematical and logical languages, required for reading technical literature and precise modeling and expression of ideas. Art of recursive modeling and inductive proofs. Analysis of the algorithm complexity. Modeling with the help of graphs. Specific. Knowledge of elements of mathematical and logical languages. Knowledge of basic mathematical vocabulary. Knowledge of basic notions of theory of computation. Art of inductive proof and recursive description. Determining the complexity of algorithms. Knowledge of specified algorithms on graphs.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Understand the basic elements of mathematical language on a deeper level. 2. Understand the language of logic and basic concepts in logic.

	3. Model problems in the language of logic. 4. Translate between natural language and the language of logic. 5. Know the basic mathematical vocabulary of sets, relations, functions and structures as well as their basic properties. 6. Know the terms related to computability and complexity of algorithms. 7. Understand the induction and recursion and to know how to use it in modeling and problem solving. 8. Know the basics of combinatorics and to know how to apply it to the analysis of the complexity of algorithms. 9. Know the basic concepts about graphs and to solve some sort of problems: the accessibility problem, the shortest path problem, the problem of minimal spanning tree, and sorting, inserting new elements and searching tree.
Skills	This course provides broader knowledge about discrete mathematics as the basis of technical studies.

Physics
VSITE011

ECTS	6
ECTS lectures	1.5
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3.5

Lectures (hours)	45
Auditorium exercises (hours)	0
Laboratory exercises (hours)	30
Seminars (hours)	0
Individual work (hours)	105

Contents	Modeling of physical phenomena: intuitive and formal models, transfer into other domains, e.g. economy; physical quantities and measurements - fractals. Kinematics: description of particle motion using diagrams, tables, graphics and mathematical formulas. Dynamics: Newton's laws of motion, difference equations, drag forces in fluids. Rotational motion: description of rotational motion. Laws of conservation of energy, momentum and angular momentum. Newton's law of universal gravitation: Kepler's laws, Newton's law of gravitation, high tide and low tide, rockets. Oscillations: description of oscillatory motion, harmonic oscillations, damped and forced oscillations, Q-factor, resonance. Waves: wave formation, plane wave, interference of waves, standing waves. Sound: acoustic pressure variation, sound intensity level in db, Doppler effect, Fourier's theorem. Fluids: kinetic theory of gases, internal energy and temperature, laws of thermodynamics, entropy - informational, thermodynamical and probabilistic definition, transport phenomena, airplane. Non-linear phenomena - complexity and chaos. Electricity and magnetism - qualitative introduction: electronic gas model, electric field and potential, magnetic dipole, electromagnetic induction, Hall probe. Electromagnetic waves: electric oscillatory circuit, plane electromagnetic wave, spectrum of e-m radiation. Light: mirrors and lenses, eye and camera, diffraction, resolution - computer graphics. Structure of matter - introduction to quantum physics: photo-electric effect, model of the hydrogen atom, model of the hydrogen molecule - wave function, LED, laser, QTM.
Learning objectives	General: How to formulate problem, to analyse it, to create a plan for problem solving (e.g. to choose an adequate tool), and to analyse the solution. Analogy usage in problem solving. Specific: Modeling of physical problems using mathematical and programming tools such as Matlab or C. Analogy usage in the analysis and problem solving from different fields of physics. Implementation and analysis of physical experiments conducted with the help of computers.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Solve conceptual problems in physics and to lead a quality discussion about them, and to solve some classes of problems analytically and/or numerically. 2. Relate different fields of physics to each other, and to relate physics to computer science, electrical engineering and mathematics. 3. Analyze physical model and to recognize the domain in which the model is a good approximation of the physical system described by the model. 4. Distinguish

	physical model from experimental data. 5. Identify and evaluate errors in experiments. 6. Present results of experiments in tables and graphically and to interpret them. 7. To fit the experimental data to the model.
Skills	Students are trained to: operationally use the kinematic and dynamic notions and laws within the context of mechanics and waves, recognize the elementary notions from quantum physics, model simple physical situations (and solve the corresponding difference equations), understand several types of data presentation (diagram, graph, table, formula, Euclidean and fractal geometry), and apply these procedures to solve problems in engineering and economy.

Industrial Traineeship
VSITE018

ECTS	2
ECTS lectures	0
ECTS auditorium exercises	0
ECTS laboratory exercises	0
ECTS seminars	1
ECTS individual work	1

Lectures (hours)	0
Auditorium exercises (hours)	0
Laboratory exercises (hours)	0
Seminars (hours)	30
Individual work (hours)	30

Contents	Industrial traineeship is being conducted with the aim to introduce a student to the working processes of real working environment and to gain first experiences in team work in everyday working tasks.
Learning objectives	General. Using team work in all life situations. Specific. Argument based discussion about various subjects from the domain of business life. Expressing views, negotiations and allowing others to express their views. Understanding processes which are important for the totality of conducting business.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Recognize the basic processes of working environment, 2. Understand the basic elements of team work.
Skills	It provides the candidate with insight into processes of actual working environment and it trains him/her for team work.

Final Paper
VSITE019

ECTS	8
ECTS lectures	0
ECTS auditorium exercises	0
ECTS laboratory exercises	0
ECTS seminars	2.5
ECTS individual work	5.5

Lectures (hours)	0
Auditorium exercises (hours)	0
Laboratory exercises (hours)	0
Seminars (hours)	75
Individual work (hours)	165

Contents	Based on the assigned problem, study states of the technique, propose an optimal solution, and verify it experimentally. Create the final thesis of approximately 40 pages.
Learning objectives	General. To use literature on his/her own to solve the assigned set of problems. Specific. Understand the process of writing professional papers and present them to the expert auditorium.
Learning outcomes	It is expected that the student will be able to: 1. Study literature by him-/herself 2. To create the theoretical part of the task. 3. To verify the solution experimentally. 4. To present the given problem and solution.
Skills	It trains him/her to study the literature on their own, to create solutions, to verify experimentally and to present the given problem and the solution.

Business Ethics
VSITE021

ECTS	3
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	0
ECTS seminars	0
ECTS individual work	2

Lectures (hours)	30
Auditorium exercises (hours)	0
Laboratory exercises (hours)	0
Seminars (hours)	0
Individual work (hours)	60

Contents	Descriptive, normative ethics, contemporary business ethical theories. Ethical principles. The position of the individual in society. Basic human rights. Co-existence in social relations. Forms of discrimination and their avoidance. Ethical relationships and realization of individual rights in the working environment. Business relations, confidential relationships. Basics of business ethics. Disloyal competition and its avoidance. Corruption. Conflict of interests. Protection of data confidentiality. Privacy and equality of workers. Accuracy and transparency of data. Gifts, services and entertainment. Abuse and health protection. Socially acceptable business conduct. Intellectual ownership protection. Law and other regulations from the domain of human rights, business conduct and intellectual property.
Learning objectives	The goal of studying business ethics is to present to students, in the framework of IT and communication technologies, the issue of interpersonal relations in a more transparent way, and those relations are dynamically changing under the influence of IT technology. The goal is to demonstrate the basic laws of moral conduct through the demonstration of changes in different social times. The goal is to encourage them to think and to actively participate in discussing ethical problems in the insufficient conduct policies in ICT within the undefined moral principles which are the result of quick changes in technologies (WWW and Internet).
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Understand modern ethical theories. 2. Understand the influence of the IT technological core on applied ethics and especially on ICT and business applied ethics. 3. Understand basic concepts, virtues and principles in ICT and business applied ethics. 4. Understand vacuums of conception and chaos of concepts in applied computer ethics. 5. Connect, interpret and describe behaviors according to virtues and principles in business and applied computer ethics. 6. Connect changes in basic human rights, social relations and in working environments related to changes in technologies, especially regarding changes encouraged by Internet and WWW. 7. Change ethical theory and recommendations of the ethical code of the profession for well personal behavior, conduct and behaving in new-coming situations in ICT. 8. Know the recommendations of the profession's ethic code and personal rights and obligations related to privacy, law and other regulations from the field of human

	rights, business and intellectual property, copyrights and license, environment protection, data accuracy, privacy protection and the security of users and workers at ICT.
Skills	Students gain basic knowledge and attitudes from the field of interpersonal relations and human rights, respectful professional and business relations, protection of human rights, protection of copyrights and intellectual ownership.

Company Organization and Economics
VSITE022

ECTS	**3**
ECTS lectures	**1**
ECTS auditorium exercises	**0**
ECTS laboratory exercises	**0**
ECTS seminars	**0**
ECTS individual work	**2**

Lectures (hours)	**30**
Auditorium exercises (hours)	**0**
Laboratory exercises (hours)	**0**
Seminars (hours)	**0**
Individual work (hours)	**60**

Contents	Company and business theory: theory, goals and values of the company (enterprise); the notion of an entrepreneur and entrepreneurship; participants in the enterprise and their relations; principles of enterprise business conduct; enterprise functions; sources of enterprise; measures of business success. Enterprise organization: the notion of an organization, theory of an organization, organizational structure, basic business functions in the enterprise. Cost theory: notion and the meaning of costs; nature and types of costs; places and cost bearers; cost feasibility and retentivity. Calculations: notion and element of calculation; types of calculations, calculation of equivalent numbers and related products; application of cost theory in price policy in different market situations. Production: basic notions; total, average and borderline productivity; capacities- notion, types and utilization; maintenance and the replacement of sources. Business result: expenses; incomes; business result (gain and loss); measuring of the business success- productivity, economy, profitability.
Learning objectives	General: This course enables gaining knowledge about basic notions of economy and business organizations and their mutual relations: enterprise, entrepreneurship, sources, work, pay, expenses, production, calculation, balance, gain, gain distribution. Special: Analyzing situations of economic relationships in practical examples of conducting business in IT technologies. Including students in analysis of concrete business situations, creation of calculations, formation of enterprise, tax issues.
Learning outcomes	It is expected that after fulfilling tasks defined by the curriculum the student will be able to: 1. Understand basic goals and values of the enterprise. 2. Understand mediums and sources of mediums. 3. Understand basic factors of working processes. 4. Connect the working process with the dynamics of cost motion. 5. Analyze costs and gain competence for creation of basic calculation of the product. 6. Apply cost theory for understanding pricing policy. 7. Use the accounting statement for understanding business results of an enterprise. 8. Understand the measures for tracking successfulness of conducting enterprise business.
Skills	This course provides basic knowledge about economics and the organization of the enterprise as a general social basis of technical studies and it enables the attendants for evaluation of economical and organizational goals of the work task.

English Language 1
VSITE041

ECTS	**2**
ECTS lectures	**1**
ECTS auditorium exercises	**0**
ECTS laboratory exercises	**0**
ECTS seminars	**0**
ECTS individual work	**1**

Lectures (hours)	**30**
Auditorium exercises (hours)	**0**
Laboratory execises (hours)	**0**
Seminars (hours)	**0**
Individual work (hours)	**30**

Contents	Extreme climatic conditions; reading and listening of various weather reports. Biographies of famous and creative people; interviews; writing about other peoples' lives; describing people. Media world; planning new TV programmes and giving propositions. Health and charitable health organizations; conversation about life experiences; giving advice about health. Tourist destinations and natural beauties of the world; reading tourist guides and describing places. Analysis of society and family; conversation about various types of families.
Learning objectives	General. Using basic language skills- talking, listening, reading and writing. Specific. Managing in everyday life situations, whether it is communication on the street, market, store, hotel, bank or is it some casual conversation with acquaintances about various areas of life. Writing simpler forms of text, such as short notifications, reports, e-mails, etc. Understanding spoken material, and reading simpler literal or newspaper articles, in the sense of finding relevant information.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled, the student will be able to: 1. Understand the main thoughts from general text or text from a prescribed literature and unfamiliar words within the context in which they were used. 2. Understand speaking or lecture about a familiar subject. 3. Describe subjects and contents related to interests. 4. Read, analyze and present a short written general material. 5. Ask questions and provide feedback. 6. Give advice, propositions, etc. 7. Follow and participate in discussion about familiar topics. 8. Write a short essay/report listing pros and cons. 9. Make short notes.
Skills	Student is enabled to use basic lingual skills- talking, listening, reading and writing. He/she can confidently get around everyday situations and in casual conversation with acquaintances about various areas of life. He/she is trained, in written communication, to write simpler forms of texts. He/she is trained, in the same fashion, to understand speaking material, as well as for reading simpler literary and newspaper articles.

English language 2
VSITE042

ECTS	2
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	0
ECTS seminars	0
ECTS individual work	1

Lectures (hours)	30
Auditorium exercises (hours)	0
Laboratory execises (hours)	0
Seminars (hours)	0
Individual work (hours)	30

Contents	Science and inventions; attitudes about various scientific questions; reading graphs. Scientific facts about sleeping, advantages and disadvantages of working during the night. Work and industry; negotiations and business deals. People and organizations related to various global questions. Care for environment; causes and consequences of global warming. Various topics related to sports; sport psychology and influence on health.
Learning outcomes	General. Using all language skills required in everyday life, i.e. speaking, listening, reading and writing. Specific. Argumentative discussing about various topics such as politics, religion and other forms of public life. Expressing views, negotiation. Presenting propositions and views on various topics without lingual difficulties. Writing short stories, essays, reports, formal e-mails, and description of processes. Understanding original speaking materials related to various aspects of life, as well as using written texts with the goal of finding relevant information.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Understand the main thoughts from a general text or a text from the prescribed literature and unfamiliar words from context within which they are said. 2. To understand a speech or lecture about a familiar topic. 3. To describe topics and contents related to interests. 4. Read, analyze and present general written material. 5. Discuss about some general topics with arguments. 6. Negotiate with the use of matching vocabulary. 7. Follow and participate in discussions about familiar topics. 8. Write an essay, report, short story. 9. Use written texts for finding relevant information.
Skills	Student is trained to use all language skills required in everyday life, i.e. speaking, listening, reading and writing. He/she can use English language for shopping, to talk about health and health issues, express his/her views on interests, hobbies and spending free time. He/she can present propositions and views on various topics, without lingual difficulties, talk about traveling, real-estates and various types of interests. Student can successfully participate in discussions related to religion, politics and all forms of public life. He/she also gains skills for understanding original speaking materials related to various aspects of life, and also using written texts with the goal of finding relevant information.

English for Engineers
VSITE043

ECTS	3
ECTS lectures	1.5
ECTS auditorium exercises	0
ECTS laboratory exercises	0
ECTS seminars	0
ECTS individual work	1.5

Lectures (hours)	45
Auditorium exercises (hours)	0
Laboratory exercises (hours)	0
Seminars (hours)	0
Individual work (hours)	45

Contents	Computer users; writing short descriptions; computer architecture; finding certain information within text; technical information exchange; writing instructions; computer applications; reading diagrams; neglecting unimportant information; describing process; peripheral devices; function description; operating systems, predictions; graphical user interface; reading diagrams; explaining; taking notes; recommending; multimedia; finding information in diagram and text; user support; providing instructions; networks; listing advantages and disadvantages; Internet; computerized communication. WWW; web pages; evaluation; transferring information; web page creator, definitions and collocations; communication systems; describing systems; data security; scanning, explaining criminal acts done with the use of computer technologies; reading tables; programme development; people in computer industry; comparing different types of text; presentation; writing reports; writing summaries; defending one's own decision.
Learning objectives	General. Using language skills required in the world of computer technology. Ability for clear and efficient written and oral expression in English language, including public presentation skills. Specific. Communicating in all fields of one's profession, describing how something works, comparing, describing functions, posing questions, reading and drawing diagrams, prediction, writing notes, understanding and writing simple and complex instructions, exchanging information, giving recommendations, finding relevant information in text; describing processes, describing advantages and disadvantages, writing and understanding warnings, explaining.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Define and describe the application of computers in a proper way, peripheral devices, operating system, GUI (graphical user interface), application programmes, multimedia, computer networks, Internet, WWW, communication systems, data security, software engineering. 2 Know and use terminology about the mentioned things in English language. 3. Describe topics and contents related to profession. 4. Read/understand, analyse and present written or audio-visual IT material with writing short notes. 5. Prepare and present a presentation. 6. Present a certain topic related to profession in a simple way, while emphasizing important elements and significant details. 7. To write, in a clear manner, a short, coherent written work (report, summary) within the framework of

	teaching units.
Skills	Student is trained to use language skills required in the world of computer technology. He/she can, in English language: communicate in all fields of his/her profession, describe how something works, compare, describe the function of something, pose a question, read and draw diagrams, predict, write notes, understand and write simple and complex instructions, exchange information, recommend, find relevant information within text; describe processes, describe advantages and disadvantages, write and understand warnings, explain.

Fundamentals of Electrical Engineering

VSITE101

ECTS	6
ECTS lectures	1
ECTS auditorium exercises	0.5
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3.5

Lectures (hours)	30
Auditorium exercises (hours)	15
Laboratory exercises (hours)	30
Seminars (hours)	0
Individual work (hours)	105

Contents	ELECTROSTATICS: Basic concepts of electricity. Electrostatic interference of charged objects (Coulomb's law). Electrical field. Electrical flux - Gauss' law. Potential energy and electrostatic field potential. Conductors and dielectrics in electrostatic field. Electrical capacitance and capacitors. Energy and force in electrostatic field. DIRECT CURRENTS: Electrical values. Basic laws of current flow in electrical circuit. Determining equivalent resistance. Basic electrical circuit. Electrical work, power and energy. Methods for linear DC circuit analysis. ELECTROMAGNETISM: Magnetic field intensity, magnetic flux and density. Magnetic field effects (law of electromagnetic induction, forces in magnetic field). Inductivity and mutual inductivity. Object in a magnetic field. Magnetic field energy. ALTERNATING CURRENTS: Sinusoidal EMPF and current. Loads in AC circuit. Resonance. Coil with magnetic core. Transformers. Three-phase systems.
Learning objectives	General: Knowing basic laws of electrical-engineering and electrical circuits analysis. Specific. DC and AC circuit design. Calculation of basic low-voltage electrical circuits characteristics. Knowing basic measuring methods in electrical engineering. Understanding influences on electrical devices functioning. Basic safety of electrical installations.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Know the basic laws of electrical engineering and basic characteristics of elements of electric circuits. 2. Use the basic measuring methods in electrical engineering. 3. Analyze simple low-voltage electrical circuits and dimension elements in DC and AC circuits. 4. Understand the influence on the operation of computers and other electrical devices. 5. Apply basic safety measures for low-voltage electrical installations.
Skills	This course provides basic knowledge in electrical engineering as a basis of technical studies, with adopting the engineering way of thinking, building on gained knowledge in physics and mathematics.

Fundamentals of Electronics
VSITE102

ECTS	6
ECTS lectures	1
ECTS auditorium exercises	0.5
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3.5

Lectures (hours)	30
Auditorium exercises (hours)	15
Laboratory exercises (hours)	30
Seminars (hours)	0
Individual work (hours)	105

Contents	Semiconductors: intrinsic, p and n type, generation and recombination process, drift and diffusional motion of carriers. PN junction: Contact potential, permeable and non-permeable polarization, current-voltage characteristic and equivalent circuits of semiconductor diode, capacitive diode, Zener diode, Light Emitting Diode. Bipolar transistors: types, modes of operation, parameters, static characteristics, equivalent models. Unipolar transistors: types, modes of operation, parameters, static characteristics, equivalent models (JFET, MOSFET, VMOS). Amplifiers: basic concepts, amplifier circuits with bipolar and field-effect transistors, Darlington amplifier, differential amplifier, level adjustment circuits. Power amplifiers: Class A, B, and AB, amplifiers with VMOS transistors. Voltage rectification and stabilization assembly. Half-wave and full wave rectifier. Operational amplifier: Inverting and non-inverting amplifier, voltage follower, differential amplifier and summing amplifier. Impulse signal and linear shaping: RC circuit, operational amplifier based derivator and integrator. Multivibrators: Bistable, monostable, astable and Schmitt trigger. Generator of saw-tooth and staircase waveforms.
Learning objectives	General: Working principles and main features of semiconductor electronic components and basic electronic circuitry. Specific: Knowledge about key phenomena in semiconductors and working principles of semiconductor diodes of various types and bipolar and unipolar transistors. Designing basic electronic circuits with diodes and transistors (rectifiers, limiters, amplifiers).
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Know physical basics of operation and characteristics of semiconductor elements. 2. Analyze the operation and apply the basic electronic circuitry (rectifiers, stabilizers, amplifiers with bipolar and unipolar transistors, operating amplifiers, oscillators, multivibrators). 3. Use the basic measuring methods in electronics.
Skills	This course provides basic knowledge in electronics as a basis of technical studies, with adopting the engineering way of thinking, based on previous knowledge in physics, mathematics and electrical engineering.

Digital and Microprocessor Technique

VSITE111

ECTS	7
ECTS lectures	1.5
ECTS auditorium exercises	0.5
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	4

Lectures (hours)	45
Auditorium exercises (hours)	15
Laboratory exercises (hours)	30
Seminars (hours)	0
Individual work (hours)	120

Contents	Digital and analog variables. Information. Coding. Numeric systems. Binary numeric system. Modulo arithmetics. Elementary logic circuits. Boole's algebra and logic algebra. Boole's functions. Minimization and realization of Boole's function through logic gates. Adder. Realization of Boole's function with the use of multiplexer and demultiplexer. Multiplexer-demultiplexer structure (ROM). Programmable logical structures. Time relations. Bistables. Synthesis of general bistables. Registers, shift registers and counters. Memories (RAM). Discrete finite digital automata. Specification and minimization. Structural synthesis. Programmable automata. Wilkie's model. Concept of micro-programming. Algorithms. Basis of micro-computer architecture. Processor. Memory, memory address circuit. Input-output circuit.
Learning objectives	General. This course provides basic knowledge about Boole's algebra and automata theory as a fundament of IT core. Specific. Practical knowledge of synthesis of combinatorial and sequential digital circuits, and programmable structures.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1.Use Boole's algebra and automata theory in synthesis of combinatorial and sequential digital circuits and programmable structures. 2. Know the principle of performance and structure of digital circuits of small, medium and large scale of integration. 3. Use basic measuring methods in digital electronics.
Skills	This course provides basic knowledge about Boole's algebra and theory of automata as the fundament of IT core, with practical knowledge of synthesis of combinatorial and sequential digital circuits, and programmable structures.

Architecture and Organization of Digital computers
VSITE112

ECTS	7
ECTS lectures	1.5
ECTS auditorium exercises	0.5
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	4

Lectures	45
Auditorium exercises	15
Laboratory exercises	30
Seminars	0
Individual work	120

Contents	Basic elements of electronic computers. Overview of computer development, their organization and architecture. Basic parts of a computer. Linking and data transfer. Buses and bus system. Interrupt mechanism. Direct memory access. Central processing unit. Arithmetic logic subsystem. Performing arithmetic operations. Register set. Execution control system. Integer arithmetic and fixed and floating point arithmetic. Command sets, RISC, CISC. Assembler. System memory unit. Memory elements. Memory system hierarchy. Memory record organization. Virtual memory. Addressing types. Basic functions of input and output unit. Computer input and output medium. Data entry. Data entry systems.
Learning objectives	Recognizing terms related to basic architecture of computers and recognizing terms related to creating complex digital circuits. Insight into fundamentals of computer operation. Setting the knowledge base required for development of hardware or complex hardware-software projects. Understanding basic processes which are going on in programmable circuits, possibility for individual learning and participation in teams which develop hardware solutions based on basic digital circuits.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1.Define basic parts of micro-computer and describe their function. 2. Define micro-processor and its position in relation to other electronic digital circuits, and also basic elements of its architecture. 3. Recognize and implement basic versions of programmable circuits which serve as building blocks of micro-processor technology. 4. Understand assembler programming. 5. Recognize basic problems and solutions when creating elements of micro-computer. 6. Gain starting knowledge for individual learning and participation in teams which create complex, micro-controller oriented solutions.
Skills	This course provides basic knowledge from the field of digital computer architecture as the fundament of computing science core, and it also provides insight into the principle of data processing on digital computers.

Introduction to Computer Programming

VSITE121

ECTS	8
ECTS lectures	1.5
ECTS auditorium exercises	0
ECTS laboratory exercises	2
ECTS seminars	0
ECTS individual work	4.5

Lectures	45
Auditorium exercises	0
Laboratory exercises	60
Seminars	0
Individual work	135

Content	Computer programs and programming languages. Bits and bytes. Numeric systems. Overview of .NET platform and Visual Studio .NET development environment. Creating console applications. Using variables for data storage. Identifiers naming guidelines. Basic data types. Value and reference types. Duration and visibility of the identifiers. Operators in expression processing. Constants. Decision and repetition structures. Logical operators. Bit comparison operators. Procedures and parameters. Using procedures and functions in modular programming. Using predefined functions. Sending parameters to procedures. Recursive procedures. Data structures. Arrays. Enumerations. Creating user defined types. Packaging of variables. Handling exceptions. Working with String and String Builder types. Basics of Object Oriented Programming. Classes and objects. Objects and memory. Encapsulation usage. Fields, properties, methods and events. Creating derived classes. Using constructor. Creating and formatting graphical user interface. Working with Windows forms and controls. Validation of user entries.
Learning objectives	General: Students obtain knowledge about functioning, development and maintaining software. Course explains the basic principles common for most programming languages. Specific: Using Visual Studio tools and understanding syntax of VB.NET programming language. Using all types of commands in VB.NET. Defining procedures, functions, as well as arrays and other more complex data types. Development of console as well as simpler Windows applications. Learn how to define classes and instantiate objects.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1.Explain and apply the basic principles as well as approaches in creating programming solutions. 2. Using basic possibilities of .NET architecture of application development as well as Microsoft Visual Studio development environment and VB.NET programming language. 3. Mastering the work with basic program elements (variables, constants, modules, etc.) 4. Apply algorithms of structures of branching and looping in programming languages, including the usage of comparative operators. 5. Creating software applications which comprise of more functions or normal procedures. 6. Create your own arrays and user data types when required by programming tasks. 7. Properly use the programming language commands. Apply basic principles of object

	programming and create simpler object oriented programming solutions.
Skills	This course provides basic knowledge in programming as one of the fundamentals of computing science and how to develop applications in the VisualBasic.NET programming language.

Programming Methods and Abstractions

VSITE122

ECTS	8
ECTS lectures	1.5
ECTS auditorium exercises	0
ECTS laboratory exercises	2
ECTS seminars	0
ECTS individual work	4.5

Lectures	45
Auditorium exercises	0
Laboratory exercises	60
Seminars	0
Individual work	135

Contents	Introduction to C language. Coding and data types. Writing programs and programming documentation. Correcting program errors. Lexical and syntactic structure of C language: types, variables, expressions, control flow, functions, variable's visibility and scope. Arrays. Modular programming and functional decomposition. User's data structures: structure, union and enumeration. Working with textual and binary files. Standard libraries.
Learning objectives	General: Complete deterministic program analysis of problems with recognition and description of all the marginal cases. Abstract modeling of simpler programming problems by iterative methods. Specific: development of command-line applications in programming language C with the use of Visual Studio development environment. Using C standard function library. Possibility of reading and understanding technical documentation of any C program library, and their use in one's own project.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Analyze the posed program problem, recognize the level of its complexity, and to parse it into elementary steps and to implement it within programming language C, i.e. to propose pseudo-code of solution for some other structured programming language. 2. To model a programming solution by grouping atomic operations into separated and generic components (functional decomposition). 3. To understand and to be able to analyze (visually and with the use of debug tools) already proposed programming solutions in C programming language.
Skills	This course provides advanced knowledge from the field of programming as the fundament of computing science core, and it trains the attendant for programming in C programming language and MS Visual Studio environment.

Data Structures and Algorithms

VSITE123

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Programming strategies. Data structure. Arrays, list, vector, set, stack, tree, priority queue, graph, recursion. Ordered and unordered containers. Searching: sequential, binary, trees. Queues. Sorting: bubble, heap, quick, binary, radix. Dynamic algorithms: Fibonacci heap, binomial coefficients, optimal binary tree, multiplication of series of matrix. Graphs: minimum tree, Dijkstra's algorithm. Algorithm complexity basics. Solving more difficult problems: "Traveling salesman problem", "Chinese postman problem". Game theory: simpler solutions, alpha-beta algorithm.
Learning objectives	1. Understand the concept of abstract data type and its application in software development. Understand the basic data structure. Understand the methods of implementation of abstract data types with the use of data structure. 2. Knowing basic ATP's and differences in their behavior, way of application and performances in various scenarios. 3. Understanding and knowing how to describe the meaning of algorithm complexity. Finding complexity of more difficult algorithms. 4. Understanding algorithms' processes during the course, being able to describe algorithms, but also the course of executing those algorithms in concrete data. 5. Being able to choose and use algorithms, data structure and abstract data types independently, in given conditions and regarding the practical requirements of the developing software.
Learning outcomes	This course provides fundamental knowledge about using and features of often used data structures in C, about the performance of well-known algorithms, analysis of the performance time and the efficiency of algorithms, and the implementation of the given algorithms.
Skills	This course provides specialized knowledge from the field of programming as an upgrade to the computing science core, and it trains the attendant for efficient use of more complex data structures and the algorithms of a process.

Object-Oriented Programming

VSITE124

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Content	Structure and implementation of programs in C++ language: form, functions and primitive data types. Classes and objects. Arrays, streams and operators. Class interface, abstraction and implementation. Iterators and templates. Polymorphism and inheritance. Abstract classes. Generic classes. Handling exceptions. Fundamental dynamic data structures. Interaction with Windows operating system. Access to creating larger projects. Request analysis, creating tasks, system and object model, creating, testing and analysis of program use. Introduction to MFC classes.
Learning objectives	General. Principles of object and generic programming. Analysis of existing code. Running minor projects. Writing secure, simple and understandable code. Specific. Programming language C++: definition of classes and member functions; inheritance; polymorphism; templates; exceptions; standard library.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1.Understand the distinctions, foundations and principles of object programming. 2. Read, understand and analyze the existing code- examples, modules or projects. 3. Follow modern tendencies, standards and tools in object programming. 4. Design and run minor projects - problem analysis, specification, planning, documentation. 5. Perform minor projects independently - from definition of modules, libraries, classes and functions up to implementation. 6. To fit into larger (new or existing) projects within the developing team without any problems.
Skills	This course provides specialized knowledge from the field of programming as an upgrade to the core competencies and it enables attendants to program in C++ programming language.

UNIX Programming Tools
VSITE125

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Unix – multitasking and multi-user operating system. Historical development of Unix. Unix versions in use today. Linux and Open Source. Typical Unix session. Unix file system: characteristics, data types, naming, access permissions, Unix directory. File system hierarchy. Standard directory structure in Unix. Managing files and directories. Types of programming tools under Unix: Basic philosophy of Unix programming tools. Tools for manipulating files. Text editors. Tools for system administrating. Awk. Interpreters (Tcl/Tk). Shell: Definition. Types. Shell work. Basics of working with shell. Variables, expressions. Managing files. Standard files, input and output redirection, connecting processes via pipes. Basics of process managing. Scripts. Text editing: Text editor review in Unix. Vi editor. Basic work with vi and emacs editors. Regular expressions and their use. Basics of Unix administration: Process-definition, types, life cycle, attributes. Programming tools for tracking and managing processes. Programming in Unix: Source code editing. C, C++ programming translator for Unix. Gcc. Linker. Debuger. Typical project structure in C programming language. Make programming tool and its use. Basics of X-windows programming system: Client-server architecture, X -server. Display manager. Window manager. X-terminal. Graphical environments.
Learning objectives	GENERAL: Students will become familiar with the development cycle of writing applications which includes planning, writing, translating, connecting, testing and correcting errors. Students will come to know the basic roles that an operating system has. Students will become familiar with the formation, features and the role of TCP/IP. SPECIAL: Students will become familiar with features and roles: UNIX file system, user shells, writing and using scripts. They will learn about the importance and the ways of profiling programs. They will learn how to use, change and process textual files as basic units of data storage in script, in UNIX/Linux environment. They will come to know the anatomy of a graphical environment in UNIX/Linux systems, X-windows system, graphical environment, desktop. They will learn how to write, start and use UNIX/Linux system services. They will learn how to automatize the building of complex projects with the use of make/gmake tools. They will become familiar with the term of version repository and how it is used in developing versions of complex projects.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Log in to a UNIX/Linux system. Properly use a file

	system. Productively use and administrate his/her user account and shell. 2. To assemble and successfully use shell and awk scripts. 3. To write, translate, test and correct programs and program libraries in a UNIX/Linux environment with the help of gcc and gdb. 4. To productively use X-windows environment, graphical environments and desktop environments. 5. To successfully use TCP/IP stack in everyday work and in writing programs.
Skills	This course provides specialized knowledge in the field of programming as an upgrade to the computing core and it enables the attendant for using and developing programs for operating systems in the UNIX system family.

Advanced Windows Programming

VSITE131

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Content	Win32 architecture: Windows operating system, DLL's, Win32 API, Kernel, Win32 memory management. Win32 programming: Win32 program flow, SDK Windows programs, Windows versions, MFC. Dynamically loaded libraries: difference between dynamical and static linking, explicit and implicit linking. Threads: Win32 processes and threads, encapsulation of thread, thread synchronization, thread security. Win 32 processes: creating, synchronization, process termination. Standard windows controls: Win32 standard controls, MFC classes for standard controls. Windows system registry, Win32 registry API. Advanced Document/View architecture. Document templates, multiple document and view classes. Advanced menus and toolbars: dynamic menus and toolbars. Advanced GDI: transformation of coordinates, scrolling, print, metafiles, bitmaps.
Learning objectives	General. Event driven programming. Multilingual programming, Unicode. GUI. MDI applications. Database access. Specific. Win32: creating applications; communication towards OS and other applications; resources; GDI. MFC: basics of work and use; code generators, support in MS Visual Studio; print support.
Learning outcomes	It is expected that after the obligations defined by the curriculum the student will be able to: 1. Understand and explain the working principles of Windows OS and Win32 platform; the difference between console and Win32 application; the way of working and the communication of application under Windows; principles of event driven programming in relation to procedural programming. 2. Use the key parts of Win32 platforms with and without code generator; including basic modules for creating and controlling the window and dialog and advanced modules for GUI, printing or ODBC database access. 3. To design, implement and test minor to middle Win32 projects, independently- including the definition of the appearance and the application behaviour in more languages.
Skills	This course provides specialized knowledge from the field of programming as an upgrade to the computing science core and it enables the attendant for generating a complex user programs for Windows operating system.

Java Programming
VSITE132

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Introduction to JAVA programming. Object - oriented programming in Java. Basics of JAVA language. Working with objects. Fields, conditions, loops. Basic Java classes. Modifiers and access control. Writing Java applets. Working with graphics in Java. Using fonts and colors. Animations and sounds. Managing events and interactivity. Packages and interfaces. Java program and Web page. Basics of Java Servlet. Basics of Java Server Pages (JSP). Java Virtual Machine. Java development platforms.
Learning outcomes	General: Object-oriented programming. Understanding the sense and the relation of programming objects and classes with the real world. Specific: Introduction to JAVA platform: Java virtual machine and JAVA API. Understanding the importance of processing unexpected entries and program behavior. Using SWING package in creating applications with graphical interface. Distinguishing and implementing JAVA application and applet.
Learning outcomes	It is expected that after the obligations defined by the curriculum the student will be able to: 1.Implement JAVA applet. 2. Implement JAVA application. 3. Design structure of classes with interdependence. 4. Create graphical interface using SWING. 5. Understand processes in JAVA applications.
Skills	This course provides specialized knowledge in the field of programming as an upgrade to the computing science core and it enables the attendant to create programming support in Java programming language.

C# Programming
VSITE133

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Characteristics of structural and object oriented programming. Variables, operators, flow control statements. Polymorphism and inheritance. Structures and fields. .NET Framework. XML documentation in C#. Classes and objects. Exception handling. Inheritance, abstract classes. Interfaces, events and their processing. Creating Windows forms. Creating Windows applications. Developing application in web environment. Web services, web forms. Basics of ASP.NET applications. SOAP. Comparing C# to C/C++, Java, Visual Basic 6, and other .NET languages. Decomposing problems in larger projects. Problem analysis and creating software support. Testing a module and the entire application. Launching web application into working environment.
Learning objectives	It is expected that after the obligations defined by the curriculum the student will be able to: 1.Comprehend the C# language keywords and to write and understand program code written in C#. 2. Use most of the features provided by C# language and .NET framework. 3. Write simple and mid-complex programs in C# language using technologies available in .NET environment: Windows Forms, ASP.NET, WPF. 4. Use Visual Studio development environment to locate and fix errors in code.
Learning outcomes	Writing code in object oriented language. Using software development tools. Understanding how .NET framework works. Defining, using and understanding characteristics of particular types. Understanding principles of polymorphism, virtual methods, passing arguments to methods. Defining and using properties, interfaces, delegates and events. Handling exceptions. Using user defined attributes and generic types. Understanding how automatic memory management (garbage collector) works.
Skills	This course provides specialized knowledge from the field of programming as an upgrade to the computing science core and it enables the attendant to create software support in C# programming language.

Project Management and Documentation

VSITE134

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Project decomposition. Resource allocation. Resource load monitoring. Calculation of project costs. Linked tasks. Control points. Umbrella project design for workgroup monitoring. Workgroup definition and definition of their members' tasks. Comparison of the plan with its realization. Team organization and documentation. Reports on project progress. Reports on elapsed time. Risk control. Preparation of team meeting. Report on team meeting. Software modification monitoring. Software error registration. Analysis of change request. Testing of documentation and its importance for high quality software. Project delivery. Online customer support.
Learning objectives	General. Recognizing terms and requirements while defining and creating IT projects. Specific. Introduction to issues of creating and leading IT projects. Understanding and defining necessary requirements for successful creation and leading IT projects, and maintaining necessary documentation. Understanding required elements for creating EU projects. Knowledge necessary for working with MS Project.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Define component parts of the project while creating project charter. 2. Define necessary project resources with assigning required time. 3. Efficient managing of all types of resources for the project. 4. Efficiently manage the project using the MS Project software product. 5. Recognize the tasks of the project manager on IT projects as the assumption of the successful project completion and 6. Recognize project risks and treat them according to the selected approach.
Skills	The course provides students with professional knowledge of programming as an addition to the information technology core and trains a student to become a leader or member of a project team and to create documentation.

Object-Oriented Modeling

VSITE135

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	General modeling techniques. Object oriented modeling. Introduction to UML (Unified Modeling Language). Developing process overview. Use cases. Class diagrams (attributes, association, aggregation, composition, generalization, parameterized classes). Direct and reverse design. Interaction diagrams: sequence diagrams, collaboration diagrams. State diagrams and activity diagrams. Introduction to object oriented design (inheritance, encapsulation, polymorphism, abstract interfaces, parameterized types). Design patterns. Interfaces, types and roles. Processes and threads. Modeling the source code. Modeling the executable.
Learning objectives	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1.Master basic principles related to object oriented technology. 2. Understand main methodologies of the object oriented development. 3. Understand and be able to create UML diagrams independently. 4. Understand and be able to apply the most common design patterns.
Learning outcomes	Being familiar with basic characteristics and terms related to object oriented modeling. Understanding the object model and its use in software development. Knowledge of iterative and incremental methodology of development. Ability to define use cases, modeling systems using various types of UML diagrams like: sequence diagrams, class and object diagrams, collaboration diagrams, activity diagrams. Recognizing and proper use of design patterns.
Skills	This course provides specialized knowledge from the field of programming as an upgrade to the computing science core, and it enables the attendant to model a prototype of a software system based on the user's requirement.

Distributed Object Programming
VSITE136

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Introduction. Object model. Component model. Three-layer architecture. Thin client. Independence of location and language. Scalability, reliability, security. Defining interface (IDL). CORBA, ORB, IIOP. COM/Distributed COM/COM+. Remote Procedure Call (RPC), Remote Method Invocation (RMI). Skeleton/proxy, proxy/stub. Interception, events. .NET architecture. Development platforms and languages.
Learning objectives	GENERAL: The student will gain detailed insight into characteristics and division of work in multi-layered applications. He/she will learn which safety and business requirements need to be fulfilled for applications that support large and complex business systems. SPECIFIC: The student will become familiar with CORBA object model and COM/DCOM system for MS Windows platforms. He/she will learn to write IDL definitions and translate them into a desired programming language. He/she will get to know JAVA Beans object model. He/she will learn to invoke objects from the distance through a network with the help of Java RMI and .NET remote technology. The student will become familiar with features and requirements of application framework for development of complex business systems, such as J2EE and .NET Enterprise. He/she will learn about ways to serialize objects for storing states and sending objects across the network. He/she will learn to process large amounts of non-structured data with the help of Hadoop MapReduce system.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Describe and properly use multi-layered structure of complex applications. 2. To set a communication structure within a multi-layered distributed object application in IDL. 3. To properly set the conditions and borders of transactions in different program models of multi-layered distributed object application. 4. To properly separate roles of different users according to their roles and rights within different objects of multi-layered distributed object application. 5. To successfully connect multi-layered distributed object application with data sources and databases.
Skills	This course provides specialized knowledge from the field of programming as an upgrade to the core of computing science, and it enables the attendant for programming of distributed user programs.

Computer and Program Usage

VSITE141

ECTS	3
ECTS lectures	0.5
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	1.5

Lectures	15
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	45

Contents	Fundamentals of IT. Hardware, software, computer networks, Internet. Basics of using computer and operating system (MS Windows). PC. Operating systems and applications. Adjusting desktop. Windows. Starting programs. Windows Explorer: managing directories and files. Recycle bin. Using Internet: Internet services: WWW, E-mail, FTP, News, Chat. Internet Explorer. Sending and receiving e-mail messages, attaching files to messages. Writing and processing text (MS Word). . Adding toolbars, working with documents, text formatting, printing, searching and replacing, page numbering, header and footer page formatting, inserting symbols and pictures, lists, tables, writing mathematical formulas. Using templates. Multiple recipients E-mail. Table calculations (MS Excel): Spreadsheet. Workbook, worksheets, cells. Data entry and formatting, elementary accounting operations, functions and formula entry, data sorting and filtering, printing, graph creating and formatting. Basics of vector computer graphics (Corel Draw): content of window. Creating basic graphic elements. Basic object formatting. Presentation order. Aligning. Text formatting. Multimedia presentations (MS Power Point): Different document views. Working with "wizards" and templates. Background formatting. Working with animations: applying animation to text, pictures and graphs. Sound effects.
Learning objectives	General. Recognizing terms and requirements related to basic computer components, Windows operating system and parts of MS Office package. Specific. Deep insight into specificities of working in Word, Excel, Outlook, Internet and e-mail, and also basics of computer hardware.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Efficiently use Internet and e-mail. 2. Efficiently use MS Windows operating system. 3. Efficiently use MS Office programs: Word, Excel, Power Point and Outlook.
Skills	Students gain basic IT knowledge and skills from the following fields: Basics of IT, basics of computer usage and operating system (MS Windows), using Internet and e-mails, word-processor (MS Word), spreadsheets (MS Excel), and multimedia presentations (MS PowerPoint).

Operating Systems
VSITE142

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0.5
ECTS laboratory exercises	0.5
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	15
Laboratory exercises	15
Seminars	0
Individual work	90

Contents	Operating system structure. System core. System calls, context switching. Processes. Communication between processes, signals, synchronization. Process sequencing, connecting processes. Interrupts. Managing memory, pages, virtual memory, segmentation. File system. Files. Directory. Allocation procedures. Network file systems. Security and protection. Distributed operating systems. Synchronization, latency, semaphores and indicators. Network operating systems. UNIX, WinNT.
Learning objectives	Operation modes of operating system and its subsystems. Recognizing potential problems in designing computer system regarding operating system operation mode. Knowledge of MS Windows API and its use in practice (C programming language). Knowledge of dynamic libraries operation (dll files) on MS Windows and their use in practice.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Define basic characteristics of an operating system (which computer parts are managed by an operating system and how) 2. Define basic terms related to operating systems (tasks, threads, mutual excluding, mutex, semaphores, indicators, etc.) 3. Defining programming solutions related to problems of multitasking and multithreading. 4. Recognize potential problems which may appear in programming solutions that use multitasking and multithreading. 5. Define initial parameters in designing system (hardware), regarding physical features and working mode of hardware parts managed by an operating system). 6. Knowledge of API functions and dynamic libraries (DLL) operation mode in operating system environment.
Skills	This course provides basic knowledge from the field of operating systems which is the fundament of the computing science core, and it trains a student to use standard operating system services with application programs.

Computer Networks
VSITE143

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0.5
ECTS laboratory exercises	0.5
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	15
Laboratory exercises	15
Seminars	0
Individual work	90

Contents	Development of data communication networks. Basic characteristics. Switching methods. Importance of standardization. Network elements. Channels, nodes, terminals. Computer and terminal network architecture. Hierarchical layered structures. ISO model. Protocols. Protocol mechanisms: synchronization, addressing, flow control and error control. Traffic control, congestion. PHYSICAL LEVEL: DTE-DCE, RS232, X.24 interface. Modem connections, intelligent modems. Signal codes. Local area networks. Access methods. Ethernet. Digital subscriber networks: ISDN, xDSL. ATM. DATA LINK LEVEL: Error control. Character and bit oriented protocols. Formal protocol specification. Local area networks: MAC, LLC, ATM networks. Frame-relay networks. NETWORK LEVEL: Packet networks. Traffic routing. Flow control. X.25. Internet. IP protocol (v4, v6), addressing, intranet, VOIP, IPsec. TRANSPORT LEVEL: TCP and UDP internet protocols. APPLICATION LEVELS: application and network services. Client-server concept. WWW, FTP, TELNET, e-mail, ping, trace route, ethereal. Quality of service. Network management. Basic security concepts. User accounts, passwords, access rights.
Learning objectives	Identifying basic features and computer network architectures. Explaining the way computer networks work. Recognizing ISO/OSI reference model and defining functions at each layer in detail. Identifying and explaining the TCP/IP group of protocols. Describing the way LAN and WAN technology works. Discussing trends in computer network technology development.
Learning results	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Define basic terms and computer network architectures. 2. Define the ISO/OSI reference model. Define the TCP/IP protocol group and compare to the OSI model. 3. Explain the work of the TCP/IP protocol group on the application layer. 4. Explain the work of TCP and UDP protocol on the transport layer. 5. Explain the work of IP protocols, IP addressing and routing. 7. Define LAN protocols and their work on the data link and physical layer. 8. Define WAN protocols and their work on the data link and physical layer. 9. Define addressing on the physical, data link and transport layer. 10. Define basics in computer network security.
Skills	This course provides basic concepts of computer networks which are the core of computing science.

Personal Computer Architecture
VSITE144

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Introduction. Basics of 80x86 architecture. Interrupts and DMA mechanism. 2. Bus. PC bus development: PC, ISA, EISA, MCA, VLB, PCI. 3. Processor. CISC and RISC processor. Development from Intel 8086 to Pentium IV. Using cache. Basic instruction set and MMX instruction set. Comparison with AMD processors. AMD 3D. 4. Memory systems. Organizing working memory. Static and dynamic memory. Data flow. Memory development: FP, EDO, SDRAM, DDR, RDRAM. 5. Mother board. BIOS, CMOS and RTC. Chipset. North and south bridge. Plug and Play technology. PC power supply. AT and ATX form. 6. Image presentation system. Image generating. Pixel and resolution. Video processor, video memory, DAC. Video standard development: MGA, CGA, EGA, VGA, SuperVGA. AGP bus. Monitors. Working principle: cathode ray tube, pixel resolution, horizontal and vertical frequency. Trinitron, LCD. 7. Data storage. Hard disks. Magnetizing materials. Data organization on hard disk. CHS. Data transfer. External buses: IDE and SCSI. Optical media. CD-ROM. ATAPI. CD-RW. Removable media. 8. I/O communication. Serial and parallel interface, devices and transfer. Modems, ISDN. USB bus. Local network connection. 9. Input devices. Keyboard, Mouse, PS2. Joystick. 10. Sound. Generating sound, analog and digital technique. Modulation, wave tables, PCM. Midi standard. 11. Printers. Paper printing techniques. Printer types: matrix, laser, ink. Connecting printer with computer. Communication languages: PostScript, PCL, ESCP2.
Learning objectives	General. Recognizing working mode of key components of PC and data flow through it. Specific: Deep insight into each of the key PC components. Understanding and defining importance of each component in overall hardware definition.
Learning outcomes	It is expected that after obligations defined by the curriculum are fulfilled, student will be able to: 1. Define key modules of PC processor architecture. 2. Define tasks and functioning of a memory system. 3. Define tasks of PC bus system. 4. Define role and tasks of PC chipset. 5. Define video system tasks. 6. Define role of PC peripherals. 7. Define computer configuration regarding user needs and 8. Recognize key problems in PC work.
Skills	This course provides specialized knowledge in the field of computer systems and networks which represents an upgrade to the computing science core and it enables the attendant for designing, assembly and maintenance of PCs.

Computer Networks Design and Management

VSITE145

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Computer network elements: computers, nodes, channels. Local area networks, Ethernet. Local networks topology development. Cabling development. Structured cabling. Campus cabling, building (vertical distribution) and floor cabling (horizontal distribution). Installation elements: cables, connectors, patch panels. Characteristics and categories of copper (UTP, STP) and optical cables. Standardization: ISO/IEC 11801, EIA/TIA 569. Creating project documentation: contents, organization, labeling system. Standardization: IEC 750, IEC 1082. Setting up installations. Identifying and testing lines. Labeling lines and connectors. Measurements. Documenting measurements. Network delivery. Identifying user requirements. Workgroups. Choosing and setup of active gear. Integration of computer network subsystems. Installing and adjusting modem connections. Installing and adjusting local network ports. Network architecture of TCP/IP (Internet). Addressing and domain names. Installing and adjusting TCP/IP programs. Non-connected and hidden networks (intranet). Reserved addresses. Installing and adjusting intranet networks. Basics of computer and data security. Traffic filtering. Firewall.
Learning objectives	General: The course enables students to gain knowledge in the field of design, construction, management and usage of computer networks as the central element of the information system infrastructure. Specific: Insight into the computer network design, construction and maintenance issues. Definition of parameters for the active and passive communications equipment, needed for a successful computer network construction. Defining and configuration of basic network services needed for the computer network operation.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Define basic parts of a computer network project. 2. Carry out a computer network project according to investors' requirements. 3. According to the project, install and test structured cabling for computer networks. 4. According to the project, define, install, configure and maintain passive/active network equipment. 5. According to the project, configure and maintain basic network services. 6. Manage a computer network. 7. Successfully identify and solve computer network problems.
Skills	This course provides specialized knowledge from the field of computer systems and networks which represents an upgrade to computing science core and it enables the candidate for designing, building and measuring structured cabling systems, and setting, initiating and maintaining active network gear.

Server Computer Architecture

VSITE151

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Introduction. 1. Server computers. Purpose and development. Mainframe computer, distributed systems, client-server concept. 2. Server systematization by function. File and print servers. Communication, RAS, gateway, DHCP, WINS, DNS, Web, FTP and Mail servers. Database servers. Fax servers. Back-up servers. Firewalls. 3. Server hardware. Server processors. Multi-processor platforms. Scalability. Symmetrical multi-processing SMP. Clustering. Memory system. Parity, ECC memory. Bus organization, I/O structure. 4. Data storage system. RAID technology. Physical and logical capacity. Fibre channel. SAN-Storage Area Network. 5. Networking. Data flow requirements and network port selection. Two-Three-Four tier model. Computer cluster. 6. Creating safety copies- Backup. Tape systems. Magneto -optical devices. Planning backup strategy. Device selection. 7. Operational security. Physical level security. Data security. Anti-virus protection and firewall. User level security. Supervision. Operating system administration. 8. Power source. UPS- Uninterruptible power source. Shut down control. 9. Server installation. Desktop and rack housing. Environmental parameters Hot-Plug technology. Cables. KVM switch. Operating system compatibility testing. Server operating system installation. 10. Solving problems in server environment. Order of server boot up. Disc recognition problems. Network problem diagnostics. Maintenance and upgrade.
Learning objectives	General: Explaining working principles of server components. Tracking control and data flow through server systems and components. Specific: Detailed development of key server systems and components. Detailed development of hardware and software of essential parts of server systems.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Define the architecture, functions and working mode of individual elements of server computer processors. 2. Define tasks and operation of memory systems. 3. Define working principles and tasks of bus systems of server computers. 4. Define chipset role and tasks in server computers. 5. Define working principles, types and system functions for data storage. 6. Define redundant, uninterruptible AC, DC and hybrid systems of powering server computers. 7. Define working principles, types and functions of monitoring system for server computers and 8. Recognizing key problems in server computer operations.
Skills	This course provides specialized knowledge from the field of computer systems which is an upgrade to the computing science core and it enables a student to design, implement and maintain server computers and operating systems.

Server Management
VSITE153

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Server computer preparation. Load optimization. Selecting operating systems. Selecting server hardware. RAID. Operating system installation. Disc system initialization. UPS installation. Interactive or automatized installation. Detecting and tuning server interfaces. Documenting installation. Network access configuration. Protocol selection. Address setup. Workgroup, domain. Creating user accounts and groups. System login. Kerberos. User profiles. Roaming profile. Active directory. Resource balancing. DNS hierarchy. File server. Directory and file sharing. Accessibility setup. File server installation. Printing server. Printer installation. Sharing a printer. Printer traffic optimization. FAX server. Network services. DHCP, DNS, WINS. Remote server access. Setting up RAS. Routing services. VPN Server. Remote server operations. Terminal Server. Remote Desktop Connection. Web server. Application server. IIS server. Tuning. Web area definition. Access security. Mail server. Exchange server. User login. Distribution groups. POP3 server. Public directories. Database server. Microsoft SQL server. Installation. Database, tables and users creation. Query Analyzer. Backup. Replication. DTS service. Creating safety copies. Selecting tactics and devices. Monitoring. Monitoring tools. SNMP Reporting Services. Event Viewer. Performance Services. Windows Update. Setting up security. Anti-virus protection. Firewall. ISA server.
Learning objectives	General: Explaining basic principles of managing individual and networked server computers. Application support for supervision of computer server systems. Specific: Detailed development of hardware and software support for database systems, RAID and VRAID sets, primary and secondary data storage, support using virtualization techniques of the client, server and data storage techniques, and of firewall and security technology implementation in server computer systems.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Define basic principles and functions of database systems and OS of computer servers. 2. Define the operational principles of RAID and VRAID systems of data storage. 3. Define primary, secondary, internal and external data storage systems. 4. Define and describe the functions of AD, WINS, DNS and DHCP services of Windows OS of server computers. 5. Define the working principles, types and functions of data storage security. 6. Define the term virtualization and develop the principles and implementation of client, server and virtual storage system. 7. Define the working principles, types and functions of data security, and also the working principles of security systems and firewalls. 8. Define the principles and methods of software and hardware support for monitoring and managing computer server systems.
Skills	This course provides specialized knowledge from the field of computer systems as an upgrade to the core of computing science, and it enables the student to install and set up server operating systems and services.

Computer and Data Security
VSITE153

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Information system security and protection goals. Development of Internet and the role of intranet and extranet. Management level controls: data control, data administration, security control, management control. Software controls: Access control: cryptography, personal identification numbers, digital signature, security and card operations. Input data controls, communication control, data processing control, database control, output file control. Legal aspects of information system protection. Planning information system security: managing of the information system protection, reconstructing information system plan, ISO/IEC 17799: 2000. Information security standard. Security organizations. Network security threats: eavesdropping, scanning, denial of service, Web hacking, data manipulation, masquerade, session replay, session hijacking, rerouting, viruses, Trojan horses, worms. Defining security policies. Network and operating system protection. DNS, NIS, Proxy, e-mail, WWW, ftp, NFS, protection. Firewalls, NAT. Security services and procedures: one-time password, token cards/soft tokens, TACACS+, RADIUS, KERBEROS, VPN, IKE/IPSec. Safety data storage. Monitoring system operation. Systems for intrusion detection. Network system recovery.
Learning objectives	General: The course offers basic knowledge in the field of computer and data security. Specific: Familiarizing with network security technologies, network threats and defense through study of different types of attacks. Familiarizing with network security on small, medium and large network level. Familiarizing with computer data security, the encryption and protection.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Recognize and define security on the level of managing information systems and legal aspects, ergonomics, RAID systems, NAT, VPN, IP spoofing, DOS attacks and other types of attacks 2. Recognize and define security on the software support management level 3. Define and explain the architecture of network security.
Skills	This course provides students with professional knowledge from the field of computer system security as an upgrade to the computing science and it trains a student for technical and organizational protection of computers and data.

Multimedia Networks and Systems

VSITE154

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Multimedia. Videoconference and video telephony. Multimedia presentations. Characteristics of audio and video signals. Coding audio/video information. Integration of traffic and services in communication networks. Digital networks of integrated services (ISDN). Broadband ISDN-ATM. ATM networks' architecture. ATM networks' services: CBR, VBR, ABR and UBR. Models of service quality on Internet. Intserv, Diffserv. Protocols for multimedia flow. Multimedia network services. Radio and TV program transmission. Music and video clips' transmission and reproduction. Video and music on demand. Voice transmission. VoIP. Multimedia presentation system. PC multimedia elements. Sound reproduction. TV and HDTV signal reproduction. Integrated receiver. Signal reproduction from CD and DVD media. Installing and setting up computer multimedia equipment.
Learning objectives	General: The course offers familiarization with multimedia services and with their transmission through various networks. Specific: Familiarizing with codecs for video and voice communication transmission and their application in systems, the protocols used for the mentioned and the working principle of VoIP and video streaming through service provider networks.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Identify and define basic types of codecs for the audio and video signal transmission. 2. Recognize the principle of audio and video signal transmission through an IP network and the protocols used for it. 3. Configure basic parameters of a VoIP telephone and central switch office, and also of a video streaming system. 4. Recognize the system and infrastructure of a service provider and the separation procedure of different services inside a system.
Skills	This course provides students with professional knowledge from the field of computer systems as an upgrade to the core of computer science and it trains a student to design and maintain a system for processing and transferring multimedia information.

Databases
VSITE161

ECTS	6
ECTS lectures	1
ECTS auditorium exercises	0.5
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3.5

Lectures	30
Auditorium exercises	15
Laboratory exercises	30
Seminars	0
Individual work	105

Contents	Database concepts. DBMS-Database management system. Hierarchical model. Entities and attributes. Relationships and cardinality. Relationship types. E-R model. Relational model. Relational algebra – operators, keys. Database integrity, referential integrity. Indexing. Normalization, normal forms. SQL. Transaction: processing requirements, blocking access, checkpoints, recovery from errors. Modeling events – triggers. Multi-user access control. Security and access privileges. Database design. Distributed databases. Client-server systems. Databases: Access, SQL server, ORACLE, fundamentals of use, access and processing data – forms, reports.
Learning objectives	General: This course provides knowledge about modeling and using relational databases as the central element of an information system. Special: Modelling database using the E-R model and relational data model. Eliminating anomalies through normalization. Introduction to indexing. Using SQL language for creating tables and working with data. Recognizing problems during multi-user work in database. Using MS Access system for managing database.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Design entity-relationship diagrams. 2. Transform E-R model into relational data model. 3. Set up rules of integrity in database. 4. Master operations of relation algebra. 5. Apply normalization of database. 6. Apply SQL commands for definition of elements in database. 7. Efficiently apply SQL commands for inserting, updating, deleting and searching database. 8. Learn about fundamentals of multi-user work.
Skills	This course provides basic knowledge from the field of databases as the fundament of the computer science core and it trains the attendants to design and to create databases in MS Access application.

Database Design

VSITE162

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Identifying user requests. Creating formal system specification. . Data modeling. Designing database structure. Transact SQL commands and functions. Database procedures. SQL query optimization. Creating base prototype. Selecting user interface. Selecting programming tools. Designing forms for entry and correcting data. Report criteria selection. Designing reports. Data security. Limitation of database access and authorization. Database backup copies. Database server systems. Data availability and protection. Database performance optimization. Multi-user access. Database networking.
Learning objectives	General: This course provides basic knowledge about database server systems functioning. Students learn basic administration and programming skills within the database servers .Mastering Transact-SQL language as well as Microsoft SQL Server Management Studio tools. Development and execution of stored procedures and triggers inside the database. Setting permissions and denying of access to data. Managing locking to optimize multi-user concurrency on the database server. Learn how to backup data, and restore in case of system crash.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled, the student will be able to: 1. Explain basic types and structures of databases. 2. Understand syntax and general rules of Transact-SQL language for database development. 3. Create stored procedures and triggers inside Microsoft SQL database. 4. Understand and apply error handling, performing various scripts within database. 5. Understand the basic elements of transactions and database locking mechanism. 6. Protect data from unauthorized use. 7. Apply basic procedures of data restoration in case of database crash. 8. Apply basic principles of optimization SQL queries.
Skills	This course provides specialized knowledge from the computing science area of database design and development systems. It enables the attendant to design, create and maintain databases in MS SQL Server.

Network Services and Programming
VSITE163

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Content	Network services: E-mail, Telnet, FTP, Web. Ways of publishing data. Web servers and clients. Selection of technologies and web tools. Preparation of web-pages. HTML language. Basic structure of HTML document, list, table, form. Programming in JavaScript, DOM. XML basics and syntax. Connecting HTML and XML. XSL elements, transformations from JavaScript. Web applications on client side, without server side script, like ASP, Cgi-bin, Perl, JSP support.
Learning objectives	General: Knowledge about web protocols. Using and setting up e-mail and FTP clients. Connecting and working on a remote computer with the use of SSH protocol. Understand the structure of HTML pages. Reading and writing XML. Recognizing poorly written (outdated) HTML pages and transforming them to XHTML standard. Using CSS in an efficient manner. Writing Javascript for improving accessibility of Web-pages. Comparing XML and JSON technologies and transforming one format into another.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Know and use basic network protocols: SMTP, POP, IMAP, Telnet, SSH, FTP. 2. Create a valid XHTML page. 3. Program in JavaScript for different browsers. 4. Style a page with the use of CSS. 5. Know the rules of XML and JSON.
Skills	This course provides knowledge for client side web programming, including creation of static and dynamic web pages, optimized for different browsers.

Internet Programming
VSITE164

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Developing dynamic web-applications. Creating data models for Internet applications. Server oriented script languages. Programming in ASP and ASP.NET, ADO and ADO.NET. Three-layer architecture of Internet applications. Data security and crypto-security with the use of XML on the client side. Creating web applications from data model to web front-end using MS SQL Server, HTML, JavaScript, ASP, XML technologies. Supporting various web-browsers.
Learning objectives	General: Understanding the entire path of generating web-page- from the point of the user's entering a URL address into browser to HTTP server, database and back to resulting page in client's browser. Specific: Mechanism of developing web applications: HTML, POST, GET, Cookies, Session, Application, ViewState. Programming on the server side. Working with MS SQL Server database.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Configure and start IIS and Apache servers. 2. Understand HTTP protocol. 3. Create ASP.NET web application which contains: a) user authentication, b) connect to database and display data upon user request c) changing data in the database, according to user's requests (adding, changing, deleting), 4. Understand security problems on the Internet.
Skills	This course provides knowledge of programming web sites, and it enables the attendant to create dynamic web pages with server side scripts.

Web Design
VSITE165

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Purpose of a Website. Design strategies. Interface design. Information access, navigation, connections. Page formatting, grid design, basic tables. Page length. Different environment (platform) problems. Comparative display of web-browser possibilities. Graphics, GIF, JPEG, maps. Multimedia and animation on the Web, AVI, MP3, MPEG, SWF. Using MS FrontPage, basics of using PaintShopPro. Macromedia DreamWeaver
Learning objectives	General: Optimum use of multimedia formats to keep all the information while taking up as little space as possible. Specific: Advanced use of CSS for positioning elements on a Webpage. Using AJAX technique. Using jQuery libraries. Using HTML5 in practice.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Create an entire web application with server and client side, which looks and functions well. 2. Know multimedia formats and their use in web applications. 3. To adjust a webpage that works just as good in various browsers and resolutions. 4. To use existing applications (e.g. Joomla or Wordpress) for building more complex systems.
Skills	This course provides specialized knowledge from the field of programming web pages as an upgrade to the core of computing science, and it enables the user to use advanced tools for creating and formatting Web pages.

Information Systems
VSITE171

ECTS	6
ECTS lectures	1.5
ECTS auditorium exercises	0
ECTS laboratory exercises	0
ECTS seminars	0.5
ECTS individual work	4

Lectures	45
Auditorium exercises	0
Laboratory exercises	0
Seminars	15
Individual work	120

Contents	Definition of a system, business system and its information system. Organization of business information system. Nolan's division of phases of company information development, IS life cycle phases, information engineering, elements of IS integrity. Planning IS development. Strategic analysis of business of an organizational system, business processes reengineering, determining fundamental IS architecture, determining priorities of developing information subsystems. Decomposition of goals, functions and processes, process model, data model, resource model. Process to data (CRUD) matrix, diagonalization of matrix and formatting subsystem, internal consistency and external relation of subsystem, defining basic architecture of IS. Process affinity analysis. Business subsystem analysis, diagram of document (data) flow, work diagram (work flow), requirements specification. Data administration. Cipher systems. IS implementation. Using CASE tools. Information system's quality and protection against violation. ISO standards.
Learning objectives	General: This class provides basic knowledge from the field of information systems as the fundamental core of computing science. Special: Communicating with all the participants in planning and development of information systems, analysis of a minor business system and creating process model and data model, defining subsystem development priority, planning and conducting testing, implementing and maintaining information systems.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to:1. Recognize sorts, types and models of information system organization. 2. Connect organizational maturity and planning development of information system. 3. Analyze a minor business system. 4. Draw diagrams of decomposition, document and data flow, work diagrams. 5. Create a requirement specification and matrix of business technology. 6. Connect tasks of data administration, data modeling and managing cipher systems. 7. Formulate criteria of information system quality. 8. Conceive testing, implementing and maintaining information systems.
Skills	This class provides basic knowledge from the information system field which is the fundament of the computing science core.

Information Systems Design
VSITE172

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Defining user requirements, defining information subsystem boundaries. The role of a user in information system development. Business processes reengineering. Modeling processes, program design. Data modeling, logical modeling of database. Modeling resources. Examining requirement validity with the help of a prototype. Data flow diagram: concepts of data flow diagram, process decomposition, context diagram, lower level data flow diagram, recommendations and limitations with drawing DFD. Program design: describing internal logic of a process, action diagrams, decision trees and decision tables, navigation diagrams. Examining requirement validity with the help of a prototype: system development with the prototype method, testing, implementation and maintenance of information systems. CASE tools. Reporting. Documenting.
Learning objectives	General: This course enables students to gain advanced knowledge in information system development and also to apply modern techniques for designing information systems. Special: Selecting the work method for the development of an information system. Understanding the role of a user. Creating process model and data model. Introduction to prototype method. Designing with the use of CASE tools. Knowledge of working with MS Visio.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to:1. Distinguish models of life cycle of an information system. 2. Define user requirements and set up sources of information in the development of information systems. 3. Create process models with the use of decomposition diagrams and data flow diagrams. 4. Model data with the entity-relationship model and map it into relational data model. 5. Create a description of entities and attributes, and the catalogue of input masks and reports. 6. Recognize the importance of making a prototype.
Skills	This course provides specialized knowledge from the field of information systems as an upgrade to the core of computing science and it enables the attendant to design information systems by modeling user requirements.

Informatization of Management

VSITE173

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	System definition, information system and informatization of business. Conducting office business: office system development, office business supported by computer, standard programme aids for conducting office business, organization and informatization of an office. Managing documents. Enterprise informatization: IPS reports about the market, marketing IPS, IPS sales, i.e. communication with costumers, production IPS, supply IPS, financial business IPS, accounting IPS, planning and analyzing business IPS, internal control and revision IPS, managing human resources IPS, managing information resources IPS, research and development IPS. Internet, intranet and extranet: development and use of the Internet, personal identification number, digital signature, electronic business conduct, virtual organization. Integration of technologies in business: call centres enterprise systems, multimedia systems. Ergonomics of work places with computers. Safety and protection of IT system.
Learning objectives	General. Knowledge of terms and requests used for describing enterprise information systems. Specific. Deep insight into issues during informatization of enterprise and customer business systems. Understanding and defining needed requests for successful implementation of more and more demanding IT systems which are used in business enterprises systems.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Define system, office business system, business communication and the office organization. Know programme aids for office business conduct. Understand terms such as: personal identification number, general card payment over the Internet, digital signature, etc. 2. Efficiently manage, process and store various types of documents. 3. Recognize to which group of enterprise informatization an individual application solution belongs to. 4. Recognize the upcoming trends in informatization of business, such as virtual organization, virtual reality, virtual scene, virtual networking, virtual people, integrational technology such as call centres from multimedia systems, etc. 5. Define required ergonomical preconditions for quality business conduct in an information environment. 6. Define needed requirements for safety and protection of an information system.
Skills	This course provides specialized knowledge from the field of information systems as an upgrade to the core of computing science and it enables the attendant for creating and maintaining business information systems.

E-Business
VSITE174

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	What is Internet and how was it created. Architecture and the way that Internet works. Internet services - e-mail, discussion groups, distribution lists, WWW, remote data transfer, using distant computers, browsers. Digital libraries. Publishing on the Internet. Access to Internet business applications over mobile devices. What is electronic business conduct and how was it created. Legal predispositions for electronic business. Types of electronic business. Security issues in electronic business systems. Electronic data exchange. Electronic marketing. Electronic markets, business models. Selling goods and services such as software, hardware and services. Trade from a distance: basic presumptions, some models of trade web places. Electronic auctions and electronic classifieds. Electronic capital trade (online investing). Trade between firms: basic presumptions, trading models. Conducting financial transactions- electronic payment and charging, digital (electronic) money and so-called smart cards, security problems with conducting financial transactions on the Internet.
Learning objectives	General. Ability to define conditions and requirements needed for successful implementation of an e-business system. Special: Detailed knowledge of all steps required for establishing system of electronic conducting business. Knowledge of technology, processes, laws and environments through which a quality and successfully formed electronic business will be achieved.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Understand the sense of terms appearing in electronic business, such as: WWW, URI, HTTP, XML, EDI, SOAP, SOA, WSDL, UDDI, ebXML, electronic agents, etc. 2. Know how to propose required architecture according to OSI layers dependent on gathered requests for desired electronic business system. 3. Know how to propose protection required for individual Internet layer for desired electronic business system. 4. Rough knowledge of laws and norms related to electronic business. 5. Know how cryptography functions, which algorithms exist and what is needed for successful implementation. 6. Recognize biometric signature and what it means, and define its level and weight parameters. 7. Recognize to which group of electronic business application belongs. 8. Know what is required for electronic trade. It is expected that a student is able to recognize and propose the use of a credit card, debit card, electronic money, electronic cheque, electronic wallet, etc., depending on set requirements. 9. Know how a trade with the use of mobile device works. 10. Being able to choose electronic business conduct model. 11. Recognize requirements when introducing electronic public administration. Apply such terms to achieve eDemocracy. 12. Each student will, in the end, be able to compose a short document in which all the requirements will be listed and also the solution by which a certain model of electronic business conduct will be presented.
Skills	This course provides specialized knowledge from the field of information systems as an upgrade to the core of computing science and it trains the attendant for

	organizing and maintaining information systems for conducting business through the Internet.

Public Information Systems

VSITE175

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	The design and life cycle of information systems. The relationship of business information system and social information systems. Laws and Regulations of the Republic of Croatia, the Official Gazette. Administrative bodies of the Republic of Croatia. Territorial organization structure of the government administration and self-government, county, city, municipality. Labeling territorial units and the relation to the business information systems. Citizens' records: citizenship, registry, national identification number (OIB) and logical control of unique identification number, ISO 7064 (MOD 11, 10). Fixed property records: cadastre, land registers. Geographic information systems (GIS). Chattel records. Car and vessel registration. Central Bureau of Statistics. Registry and classification of economical subjects, OIB, identification and tax number, logical control of a unique citizen number. Payment system. Croatian National Bank. Registry of business subjects' accounts. Structure and way of labeling, leading bank number and business subjects' accounts. Financial agency and banks. Tax system. Registry of the tax for added value, for income and gain. Court system in Croatia. Court jurisdiction. Registries in judiciary system. Trading courts. Court registrar of legal persons. Pension insurance, first, second and third pillar. Insured persons' registry (REGOS) and Croatian Agency for monitoring financial institutions. Health insurance, mandatory and voluntary insurance, insurance against injury at work and occupational diseases. Croatian Chamber of Economy. Databases of Croatian companies. Commission for Securities of the Republic of Croatia, Central depository agency, capital and money market. Role and meaning of Internet in social information systems. Social information systems and the relationship of Croatia with the world. ISO standards, GSI , RFID and other standards. Ciphers and state symbols, currencies, EAN code, customs administration of the Republic of Croatia, unique customs declaration, ways of labeling. EU projects: Semantic Interoperability Centre Europe (SEMIC), Open Source Observatory and Repository for European public administration.
Learning objectives	General: Student is introduced to the relation of the information system with the environment, laws, regulations, standards, and interaction of information systems especially in relation to social information systems in the widest sense. Special: This course provides specialized knowledge in the field of information systems as an upgrade to the computing science core and it trains users to design and maintain information systems according to administration laws and regulations, and international and other standards with the goal of achieving maximum interoperability between information systems.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Evaluate the relation of his/her information system with the surrounding information systems. 2. Discover possible sources (laws, regulations, standards, etc.) which internally affect information systems and also

	possible ways of their use. 3. Maintain development of information system according to the requirements and standards from the surrounding and to achieve maximum operability and interoperability through that. 5. Recommend further development of internal and external standards.
Skills	This course provides specialized knowledge of information system science as an upgrade to the core of computing science and it trains users to design and maintain information systems according to the regulations of the administration.

Informatization of Production

VSITE176

ECTS	5
ECTS lectures	1
ECTS auditorium exercises	0
ECTS laboratory exercises	1
ECTS seminars	0
ECTS individual work	3

Lectures	30
Auditorium exercises	0
Laboratory exercises	30
Seminars	0
Individual work	90

Contents	Definition of management iterative, project and hybrid type production; ERP philosophy- Enterprise resource planning; Stock management- including EOQ (Economic Order Quantity) model and ROP (Reorder Point) model, Statistical stock model; (MRP) Material requirements planning - The role of forecasting in manufacturing company, Needs and forecasting. Problems concerning different kinds of requirements. The major production plan- Theory of the major plan, Major plan management. Logical use of the main plan- creating main plan for the warehouse. The use of the major plan in logistics Procurement planning, Planning by order, The use of the major plan in logics concerning the basic product buyer; Rough capacity planning; Operation management - work centers, Plan technology, Order component, Order technology, Fine termination. Operation performance monitoring; Supply management; Sale management; Manufacturing costs management- (Direct Costing), (Activity Based Costing); Just-in-time philosophy, Kanban philosophy, OPT philosophy, CONWIP philosophy, project manufacturing monitoring - Gant diagrams, Perth diagrams. Resources. Costs.
Learning objectives	General. Recognizing terms and requests when defining and creating ERP information projects. Specific. Introduction to the issue of ERP philosophy. Understanding the importance of creating needs analysis of a company before entering software purchase. Recognizing optimum methods for software selection. Understanding the importance of a project team for informatization of production. Understanding the business process reengineering before ERP implementation. Recognizing appropriate software type of production informatization, regarding the production type.
Learning outcomes	It is expected that after the obligations defined by the curriculum are fulfilled the student will be able to: 1. Define basic terms of managing production of repetitive, project and hybrid type. 2. Define basic terms which are precondition of compatible preparation of master data of production firms. 3. Recognize the importance of ERP concept as the dominant philosophy of production informatization. 4. Recognize the importance of the appropriate software selection. 5. Recognize the importance of compatible implementing form of production firms. 6. Recognize the key success factors of ERP solution implementation in production firms.
Skills	This course provides students with professional knowledge of information systems as an upgrade to the IT core and trains students to design and maintain information systems of production organizations.