Transilvania University of Braşov, Romania
Study program: Applied Informatics

Faculty: Mathematics and Computer Science
Study period: 3 years (bachelor)

1st year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mathematical Analysis	AP01	6	3	2		

Course description (Syllabus): Relations (properties of a relation, equivalence relations, order relations, function as an example of a relation); Using axiomatic properties of the set of real number; Sequences and series (sequences and series of real numbers, sequences and series of functions);Determining the radius of convergence and interval of convergence of power series; Using the Taylor series expansions of function; First order and higher order partial derivatives of real-valued functions of several variables, the Schwarz theorem, the first order differential and the partial derivatives of a composite real function; Study extremes of the real differentiable functions of several variable; Constrained extrema, the method of Lagrange multiplier; Establish the nature and calculation of improper integrals; Calculation of integrals depending on a parameter; Calculation of line integral; Calculation of multiple integrals.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Basic algebra for computer science	AG13	5	2	2		

Course description (Syllabus): Functions and relations, Binary operations, Free semigroups, Groups, Permutations, Rings and fields, Tropical geometry, Matrices, Vector spaces, Linear codes.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Basic algorithms	IT11	6	2	1	2	

Course description (Syllabus) Introductory elements. Components of an algorithm. Pseudocode and conventions. Variables; Constants. Instructions. Visibility of variables in an algorithm, global / local variables. Subprograms. Recursion; Analysis of Algorithm Efficiency. Computing complexity on various issues; Algorithms of Elementary Data Structures (List, Stack. Queue - Implementations and Complexity); Search and sort algorithms; Divide et Impera algorithms; Greedy algorithms; Dynamic programming algorithms; Text Processing algorithms; Comparative analysis of implementations and programming methods; Intelligent Algorithms with discussion of the basic notions of Artificial Intelligence - research / case study on several chosen issues. In the seminar: solving different types of problems. In the laboratory: implementation of the discussed algorithms.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Basic Programming	IT12	6	2		2	

Course description (Syllabus): Getting familiar with the C language; Generic programming using macros; Understanding procedural programming; Pointers. Memory allocation and management; Developing function-oriented C applications.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mathematical computational Logic	IT13	5	2	1		

Course description (Syllabus): Binary, decimal, octal, hexadecimal number systems; Conversions among bases; Addition, subtraction, multiplication and division of base *b* numbers, Representation of integer numbers (Sign and magnitude, One's complement, Two's complement); Addition, subtraction and multiplication of two's complement numbers; Fixed point numbers; Floating Point Numbers. The IEEE 754 Floating Point Standard (Formats and Rounding), Properties of Boolean Algebra; Truth Table; Boolean Functions. The disjunctive normal form and conjunctive normal form; Minimization of Boolean functions: Veitch-Karnaugh Maps, Quine McCluskey's method; Combinatorial circuits; The Algebra of GF(2). The operational and function domains; Reed-Müller expansions; Generalized Reed-Müller expansions.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
English Language (1)	MIE1	2	1	1		
French Language (1)						
Spanish Language (1)						
German Language (1)						

Course description (Syllabus): The English/French/Spanish/German language course attempts at revising, consolidating and improving grammar points at advanced level. It also provides opportunities for students to practice grammar structures and express themselves during the seminars. To this end, each lecture presents a theoretical issue which synthesizes essential information from outstanding books in English/French/Spanish/German morphology, followed by a wide range of exercises which will be approached during the following seminar. The exercises are designed in such a way so that students can solve them both individually and in pairs, during the seminars. The aim of this course is to provide students with comprehensive grammar structures linked to the following issues: problem verbs, modal verbs, passive voice, determiners and pronouns and relative clauses.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Linear Algebra, Analytical and Differential Geometry	AG03	5	2	2		

Course description (Syllabus): Basic notions of linear algebra (vectors, calculus with vectors, dependence and independence linearity, bases, dimensions, linear applications, bilinear forms, and quadratic forms, scalar products and other products); Matrix representation from linear algebra (of vectors, linear applications, bilinear forms and quadratic forms, of vectors products); Basic notions of analytical geometry (point, line, conic, plane, quadric and its equations, frame, relative positions, angles, distances); To apply techniques from linear algebra in analytical geometry, the knowledge of basic elements from differential geometry of curves and surfaces; Explain the necessity for use specific techniques of linear algebra and analytical geometry in mathematics, physics, technique and informatics; Explain the use of specific techniques of linear algebra and analytical geometry (in particular and in details); Matrix interpreting the abstract definitions from linear algebra; Mathematics significations interpreting of some calculated elements; Use theoretical knowledge for problem solving; Interpreting algebraic and geometric some notions related to informatics.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Architecture of computer systems	IT21	5	2	1	1	

Course description (Syllabus): The Computer Architecture content attempts at using theoretical computer science fundamentals for describing the modern computers' structure and organization, in order to efficient value the hardware characteristics in the software programming solutions; introducing the main concepts in computer architecture; understanding the basic concepts in modern computer architecture; identifying and distinguishing between the hardware and software components of a given computer system; understanding the inner-workings of modern computer systems, their evolution and the present aspects about the hardware-software interface; enabling students to design and recognize the structure of a basic computer system, including the design of the I/O subsystem, the memory system and the processor data path and control; presenting how a personal computer system operates. Appropriate working with the specific concepts of the computer architecture are focused and specific set of basic assembly language programs for the specific model of processor in use are developed.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Object Oriented Programming 1	IT22	6	2		2	

Course description (Syllabus): Getting familiar with the C++ language; Understanding OOP concepts; Developing OOP applications in C++.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Data Structures	IT23	6	2		2	

Course description (Syllabus): Data structures used for efficiently storing and manipulating data in computer programs: linear structures like stacks, queues, linked lists; hash tables; binary search trees, balanced trees, heaps; advanced data structures: quadtrees, point-region trees, kd-trees, persitent trees. The data structures are described in the context of their applicability, together with the main operations and their complexity. Description of some data structures from the STL C++ library. In the laboratory: implementation of the data structures, using the data structures for solving problems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Operating Systems	IA21	6	2		2	

Course description (Syllabus): Assimilating the basic concepts of operating systems; Knowledge of theoretical concepts of operating systems Windows and Linux; Knowledge of interface elements of operating systems; Developing the skills to use resources provided by operating systems in applications development; To use MSDOS, Windows and Linux Interfaces; To write command files / scripts under MSDOS / Linux; To develop applications in C that use the resources offered by operating systems; To use specific algorithms of operating system.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
English Language (2)	MIE2	2		2		
French Language (2)						
Spanish Language (2)						
German Language (2)						

Course description (Syllabus): The main objective of English/French/Spanish/German language seminars from the second semester is that of consolidating and improving the English/French /Spanish/German language knowledge acquired by students up to that point. This time the focus is no longer grammar but students' ability to express

themselves as fluently and as accurately as possible by means of using a wide range of vocabulary items. To this end special material providing them with texts and exercises covering various artistic, cultural, political and social issues will be used. Apart from the emphasis placed on developing students speaking skills, the seminars will also focus on students' ability to communicate in writing. They will be taught to develop and organize their ideas logically and coherently, while at the same time using the language correctly.

2nd Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Differential equations and dynamical systems	AG14	5	2	2		

Course description (Syllabus): Linear differential equations first order; Linear differential equations of superior order; Systems of differential equations; dynamic systems; Partial differential equations of first order; linear, quasi- linear and non-linear; Symmetric systems; prime integrals, field's lines; Qualitative theory; existence and uniqueness of solutions; Differential inequality; linear case and non-linear case; Continuous dependence and stability theory; Integral equations of Volterra type; Integral equations of Fredholm type.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Graph algorithms	IT31	6	2	1	1	

Course description (Syllabus): The students must learn how to use the basic knowledge about graph algorithms that are necessary for studying other disciplines and practical applying after graduation; Modelling practical problems using graph algorithms.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Formal Languages and Automata Theory	IT32	6	2	1	1	

Course description (Syllabus): Learning topics about theory of formalization and automata for understanding the compilation of the programming languages, for construction of a text editor, for modeling of the neural nets, etc.; Development of the skills regarding the work with formal elements typical for theoretical computer science.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Object Oriented Programming 2	IA31	6	2		2	

Course description (Syllabus): Understanding the contents and the importance of the object oriented programming, as a method to realize quality software systems; The presentation of the concepts and principles of the object oriented programming considering the perspective of the Java programming language; The exemplification of the manner through which important statements of the object oriented programming can be used; Gathering the state-of-the-art knowledge from the field of object oriented programming; Formation of the skills that are required to use the Java language in order to realize object oriented software systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Databases	IT33	5	2		2	

Course description (Syllabus): Differences between logical and physical views of data, Data Modelling, Logical Database Design, ANSI / X3 / SPARC model, Entity Relationship Model, Design Rules for Data Modelling, Main steps in the logical program design, Modes of operation and their symbolic presentation, Case Study: Manage Owners Association, SQL commands, Database implementation Examples: Library management, restaurant management, employee management, management of a medical cabinet, management of a CD collection, resource management of a computer network, etc.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
English Language (3)	MIE3	2	1	1		
French Language (3)	MIF3					
German Language (3)	MIG3					
Spanish Language (3)	MIP3					

Course description (Syllabus): The English/French/German/Spanish language course attempts at revising, consolidating and improving grammar points at advanced level. It also provides opportunities for students to practice grammar structures and express themselves during the seminars. To this end, each lecture presents a theoretical issue which synthesizes essential information from outstanding books in English morphology, followed by a wide range of exercises which will be approached during the following seminar. The exercises are designed in such a way so that students can solve them both individually and in pairs, during the seminars. The aim of this course is to provide students with comprehensive grammar structures linked to the following issues: subjunctives and conditional, reported speech, adjectives and adverbs, nouns and articles, non-finite moods, linking clauses and emphasis.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computational Intelligence	IA41	5	2		2	

Course description (Syllabus): Creating data-driven models; Introducing heuristic models for solving specific classes of problems; Building classifiers and regression models; Machine learning models based on artificial neural networks; Genetic algorithms for optimization; Uncertainty management based on fuzzy logic and fuzzy sets.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer Graphics and Image Processing	IA42	5	2		2	

Course description (Syllabus): Students get familiar with computer graphics; Students get familiar with image processing; Students get familiar with computer graphics in Visual C++; Students get familiar with OpenCV.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Visual programming	IA43	5	2		2	

Course description (Syllabus): .NET framework architecture; Object oriented programming in C#; Collections and generic data types; Developing applications with database systems; Using LINQ to objects; Working with threads and streams

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer networks	IA44	5	2		2	

Course description (Syllabus): Assimilating the basic concepts on which the computer networks; Learning some basic notions on current network technologies; Acquisition of necessary knowledge for distributed programming; Formation of required skills for computers network administration; Using Windows commands to manage computer networks; IP and MAC addresses; Using and programming various algorithms for computer networks; To establish a local network and an inter-network.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
English Language (4)	MIE4	2		2		
French Language (4)	MIF4					
German Language (4)	MIG4					
Spanish Language (4)	MIS4					

Course description (Syllabus): The main objective of English/French/German/Spanish language seminars from the second semester is that of consolidating and improving the English language knowledge acquired by students up to that point. This time the focus is no longer grammar but students' ability to express themselves as fluently and as accurately as possible by means of using a wide range of vocabulary items especially from the field of computer science. To this end special material providing them with texts and exercises covering various issues of interest from their future professional activity will be used. Topics such as operating systems, computer programming, viruses, modern gadgets, etc will be approached.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Optional (1)	IA45	4	2		2	

Course description (Syllabus): Various courses are proposed by members from the Department; after an election process, the most popular choice is taught.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Optional (2)	IA46	4	2		2	

Course description (Syllabus): Various courses are proposed by members from the Department; after an election process, the most popular choice is taught.

3 rd Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Software Engineering	IA51	5	2		2	

Course description (Syllabus): Elements regarding the general theory of the system; Information systems. Information flows; Information systems with automated component; The notion of methodologies. The UML modeling language; Tools that assist the UML development of a problem's solution; The presentation of the tool Visual Paradigm for UML.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Technologies for web applications development using PHP	IA52	5	2		2	

Course description (Syllabus): Acquiring skills of this topic; Improving developing of web applications using PHP.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Linux Programming	IA53	5	2		2	

Course description (Syllabus): Assimilating the basic concepts of Linux operating systems; Acquiring skills needed for making scripts under Linux; Knowledge of system calls provided by the language C; Acquisition of software packages for writing scripts under Linux; Using Linux command in Bash; To develop applications in C that uses Linux features.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Distributed programming	IT53	5	2		2	

Course description (Syllabus): Acquiring specific theoretical aspects of programming in a distributed environment; Developing skills of using specific instruments of distributed programming.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practical Placement within Companies	IA54	5				

Course description (Syllabus): Improvement of the didactic activities and the students' vocational training by placing students in real situations of software development and by practicing the basic competences regarding human relations within working conditions; Placing students in real situations of software development; Qualified company personal attendance to student's practical training; Practicing the competences regarding human relations within working conditions; Increasing students' motivation regarding their theoretical and practical preparation by offering them a better knowledge about their future profession; Preparing young graduates for the work market, by acquiring practical experience during the period of university studies; Supervising and validation of the students activity both by the university mentor and the person appointed by the company; Providing detailed and reliable information regarding the future students profession.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Optional (3)	IA65	5	2		2	

Course description (Syllabus): Various courses are proposed by members from the Department; after an election process, the most popular choice is taught.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
IT Security	IA61	5	2		2	

Course description (Syllabus): Training skills needed to define security policies and security audit for IT systems; Develop of the ability to secure, manage and maintain software systems and computer networks.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
IT Project Management	IA62	5	2		2	

Course description (Syllabus): Elements regarding the general theory of the management; The management of the IT projects. Planning the IT projects; The management of the IT projects. Resource management; The management of the IT projects. Quality management; The management of the IT projects. Risk management; The management of the IT projects. The management of changes; The usage of the supporting tools for the projects management. Case study: Microsoft Project 2010.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practical Coordination for Bachelor Thesis	IA63	5				4

Course description (Syllabus): Improvement of the didactic activities and the students' vocational training by placing students in real situations of software development and by practicing the basic competences regarding human relations within working conditions; Placing students in real situations of software development; Qualified company personal attendance to student's practical training; Practicing the competences regarding human relations within working conditions; Increasing students' motivation regarding their theoretical and practical preparation by offering them a better knowledge about their future profession; Preparing young graduates for the work market, by acquiring practical experience during the period of university studies; Supervising and validation of the students activity both by the university mentor and the person appointed by the company; Providing detailed and reliable information regarding the future students profession

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Database Systems (MySQL, Oracle)	IA64	5	2		2	

Course description (Syllabus): Using SQL dialects: theory and hands-on work with: Relational Algebra constructions (select, project, join, set operations); SQL dialects for MySQL and Oracle; Relational Design Theory (relational design, functional dependencies, BCNF, 4NF); Unified Modelling Language for database design (modelling for relations); Indexes; Transactions; Isolation levels; Constraints; Triggers; Referential integrity; Design of a DBMS application project written in Python, using MySQL connector, as practical work.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Optional (4)	IA66	5	2		2	

Course description (Syllabus): Various courses are proposed by members from the Department; after an election process, the most popular choice is taught.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Optional (5)	IA67	5	2		2	

Course description (Syllabus): Various courses are proposed by members from the Department; after an election process, the most popular choice is taught.