SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Automation and Computer Science
1.3	Department	Computer Science
1.4	Field of study	Computer Science and Information Technology
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Computer Science/ Engineer
1.7	Form of education	Full time
1.8	Subject code	37.

2. Data about the subject

2.1	Subject name					Structure of Computer Systems					
2.2	Subject area					Computer Science and Information Technology					
2.3	Course responsible/lecturer					Prof. dr. eng. Gheorghe Sebestyen – Gheorghe.Sebestyen@cs.utcluj.ro					
2.4	Teachers in charge of applications					As.dr.eng. Anca Hangan, As.dr.eng. Madalin Neagu					
2.5	Year of study	III	2.6	Semester	6	2.7	Assessment	exam	2.8	Subject category	DID/OB

3. Estimated total time

Sem.	Subject name	Lecture	Applications			Lecture	Applications			Individual study	TOTAL	Credit
		[hours / week.]				[hours / semester]						
			S	L	P		S	L	P			
6	**Structure of Computer Systems**	**2**	**-**	**2**	**1**	**28**	**-**	**28**	**14**	**34**	**104**	**4**

3.1	Number of hours per week	5	3.2	of which, course	2	3.3	applications	3
3.4	Total hours in the teaching plan	70	3.5	of which, course	28	3.6	applications	42

Individual study	Hours
Manual, lecture material and notes, bibliography	14
Supplementary study in the library, online and in the field	4
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	13
Tutoring	0
Exams and tests	3
Other activities	0

3.7	Total hours of individual study	34
3.8	Total hours per semester	104
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Digital system design, Computer architecture
4.2	Competence	Understand and operate with basic concepts regarding computer system's hardware

5. Requirements (where appropriate)

5.1	For the course	
5.2	For the applications	

6. Specific competences

Professional competences	**C2** – Designing hardware, software and communication components (5 credits) **C2.1** – Describing the structure and functioning of computational, communication and software components and systems **C2.2** – Explaining the role, interaction and functioning of hardware, software and communication components **C2.3** – Building the hardware and software components of some computing systems using algorithms, design methods, protocols, languages, data structures, and technologies **C2.4** – Evaluating the functional and non-functional characteristics of the computing systems using specific metrics **C2.5** – Implementing hardware, software and communication systems
Cross competences	N/A

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	The main goal of the course is to present in an accessible way advanced design methods and techniques used in today's microprocessors and computer systems
7.2	Specific objectives	To study: Methods and metrics for computer performance assessment Advanced CPU designs (pipelining, multicore, parallele and distributed computing) Memory hierarchies: cache memory, virtual memory, new DRAM technologies RISC architecture Parallel computers architectures – hardware issues and solutions

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Introduction. Computer Performance Parameters and Methods of Improvement	Lecture based on slides	
2	Computer performance and optimality, Benchmarking		
3	The Arithmetical and Logical Unit (ALU)		
4	The Central Processing Unit (CPU) – MIPS architecture, pipeline, hazard cases		
5	The Central Processing Unit – advance techniques: Scoreboard method, Tomasulo's algorithm, Branch prediction techniques		
6	The Central Processing Unit – multi-core systems		
7	Microprocessors – basic components and advanced implementations		
8	Memory System – memory technologies (SRAM, DRAM) and design principles		
9	Memory Hierarchies – cache and virtual memory		
10	Interconnection Systems – serial and parallel synchronous and asynchronous buses, multipoint interconnections		
11	Parallel Computer Architectures - different levels of parallel execution		
12	RISC Architectures – principles and implementation examples		
13	Distributed Computing – GRID and Cloud Systems		
14	Technological Perspectives in Computer Architectures		

Bibliography

1. Gorgan Dorian, Sebestyen Gheorghe, Structura Calculatoarelor, Editura albastra, Cluj-Napoca 2005
2. Hennessy John, Patterson David, Computer architecture, a Quantitative Approach, Ed. Elsevier, 2007
3. Baruch, Z. F., Structure of Computer Systems, U.T.PRES, Cluj-Napoca, 2002, ISBN 973-8335-44-2.

8.2. Applications (Laboratory)		Teaching methods	Notes
1	Measuring the performance of computer systems with benchmarks	Practical designs, experiments and results assesment	
2	CPU performance monitoring using the Time-Stamp Counter register		
3	Programming elements in VHDL		
4	Design of ALU components		
5	FPGA Synthesis		
6	Introduction to using PicoBlaze microcontroller with the Nexys3 board		
7	Implementation of a MIPS processor in VHDL - 1		

8	Implementation of a MIPS processor in VHDL - 2		
9	Implementation of a pipelined MIPS processor in VHDL		
10	Memory design - 1		
11	Memory design - 2		
12	Advanced Hardware Design Techniques		
13	Design implementations on NEXYS 3 board		
14	Laboratory Colloquy		
Topics for Project Assignments: Implementation of arithmetic circuits; Design and implementation of processors and controllers; Signal Processing; Hardware implementation of DSP and image processing algorithms; Design of I/O interfaces.			
Bibliography 1. Laboratory works at http://users.utcluj.ro/~ancapop/scs.html			

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

10. Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		Theoretical knowledge level		Written exam		60%
Applications		Hardware Design skills		Practical evaluation		40%
10.4 Minimum standard of performance						
Minimum 5 for the Course and for the Application assesment						

Course responsible
Prof.dr.eng. Gheorghe Sebestyen

Head of department
Prof.dr.eng. Rodica Potolea

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Automation and Computer Science
1.3	Department	Computer Science
1.4	Field of study	Computer Science and Information Technology
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Computer Science/ Engineer
1.7	Form of education	Full time
1.8	Subject code	38.

2. Data about the subject

2.1	Subject name					Formal Languages and Translators					
2.2	Subject area					Computer Science and Information Technology					
2.3	Course responsible/lecturer					Assoc.prof. dr.eng. Emil Șt. Chifu – emil.chifu@cs.utcluj.ro					
2.4	Teachers in charge of applications										
2.5	Year of study	III	2.6	Semester	6	2.7	Assessment	exam	2.8	Subject category	DID/OB

3. Estimated total time

Sem.	Subject name	Lecture	Applications			Lecture	Applications			Individual study	TOTAL	Credit
		[hours / week.]				[hours / semester]						
			S	L	P		S	L	P			
6	**Formal Languages and Translators**	**2**	**-**	**2**	**-**	**28**	**-**	**28**	**-**	**48**	**104**	**4**

3.1	Number of hours per week	4	3.2	of which, course	2	3.3	applications	2
3.4	Total hours in the teaching plan	56	3.5	of which, course	28	3.6	applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	17
Supplementary study in the library, online and in the field	7
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	16
Tutoring	5
Exams and tests	3
Other activities	0

3.7	Total hours of individual study	48
3.8	Total hours per semester	104
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Computer Programming, Data Structures and Algorithms
4.2	Competence	Basic knowledge of programming and data structures (preferably in the C language)

5. Requirements (where appropriate)

5.1	For the course	Blackboard, overhead projector, computer
5.2	For the applications	Computers, specific software

6. Specific competences

Professional competences	**C1 –** Operating with basic Mathematical, Engineering and Computer Science concepts (2 credits) **C1.1 –** Recognizing and describing concepts that are specific to the fields of calculability, complexity, programming paradigms, and modeling computational and communication systems **C1.2 –** Using specific theories and tools (algorithms, schemes, models, protocols, etc.) for explaining the structure and the functioning of hardware, software and communication systems **C1.3 –** Building models for various components of computing systems **C1.5 –** Providing a theoretical background for the characteristics of the designed systems **C3** – Problems solving using specific Computer Science and Computer Engineering tools (2 credits) **C3.1 –** Identifying classes of problems and solving methods that are specific to computing systems **C3.2 –** Using interdisciplinary knowledge, solution patterns and tools, making experiments and interpreting their results **C3.3 –** Applying solution patterns using specific engineering tools and mehods **C3.5 –** Developing and implementing informatic solutions for concrete problems
Cross competences	N/A

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	• To know the phases, components, and algorithms used by typical language translators. ♦ To provide a formal basis for the development of concepts relating to lexical and syntactic processors in translators.
7.2	Specific objectives	• To know the underlying formal models such as finite state automata and push-down automata, and to understand their connection to language definition through regular expressions and grammars. • To understand the relationships between formal descriptions of the automata in the formal language theory and their practical implementations as lexical and syntactic analyzers in translators. • To know the classes of languages for which a deterministic parser can be implemented. • To describe the syntax of languages to be implemented by using grammars and regular expressions. • To design, develop and test a software project, by utilizing specialized software tools (parser generators), in order to arrive at a translator for an artificial language. • To master and control the phenomena of ambiguity and nondeterminism (conflicts) which occur when using parser generators and lexical analyzer generators.

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Descriptive tools: strings and rewriting systems, grammars.	- The main ideas with multimedia tehniques - Details and examples at the blackboard, in interaction with the students - There are consultation hours - Students are invited to collaborate in	N/A
2	Descriptive tools: derivations and parse trees, extended Backus-Naur form.		
3	Regular grammars and finite automata: finite automata.		
4	Regular grammars and finite automata: state diagrams and regular expressions.		
5	Context-free grammars and push-down automata.		
6	Lexical analysis: decomposition of the grammar, lexical analyzer interface, construction of the lexical analyzer (state diagrams, reserved words method).		
7	Top-down analysis and LL(k) grammars: LL(k) grammars, the LL(k) algorithm.		
8	Top-down analysis and LL(k) grammars: elimination of left recursion, left factoring.		
9	LL parsers: strong LL(k) grammars, the LL(1) parsing algorithm.		
10	LL parsers: LL(1) parser in the interpretive variant, computation of FIRST and FOLLOW sets.		

11	Bottom-up analysis and LR(k) grammars: situations and nonterminal closure, LR(k) algorithm.	research projects	
12	LR parsers: the LR(0) parsing algorithm, LR(0) states, SLR(1) grammars.		
13	LR parsers: LALR(1) grammars, the LALR(1) algorithm, shift-reduce transitions, chain production elimination, LR table compression.		
14	Basic concepts of attribute grammars.		

Bibliography

1. W.M. Waite, G. Goos, Compiler Construction, Springer-Verlag, 1984.
2. The Lex & Yacc Page, http://www.combo.org/lex_yacc_page/
3. I.A. Leţia, E.Şt. Chifu, Limbaje formale şi translatoare, Ed. Casa cărţii de ştiinţă, 1998.

8.2. Applications (Seminars, Laboratory, Projects)		Teaching methods	Notes
1	Symbol tables.	Brief presentation at the blackboard, implementing and testing homeworks on the computer, individual assignment on the computer	N/A
2	Lexical analyzer for C.		
3	The generator of lexical analyzers Lex: Lex source, Lex regular expressions, Lex actions, ambiguous rules, Lex source definitions.		
4	Lex generator: left context sensitivity, examples, Lex applications.		
5	The bottom-up parser generator Yacc: basic specifications, Yacc syntax, actions, lexical analysis, how the parser works.		
6	Yacc generator: ambiguity and conflicts, precedence and associativity, error handling, the Yacc environment, hints for preparing specifications.		
7	Yacc generator: support for arbitrary value types, examples, Yacc applications. Review of using Yacc and Lex, in preparation for the lab test.		
8	Lab test (Using Yacc and Lex).		
9	Definition of individual assignment (Translator implementation using Yacc and Lex generators).		
10	Definition of individual assignment design (regular expressions and grammar of the language).		
11	Assessment of the formal definition of the design for the assignment.		
12	Implementation of the assignment.		
13	Implementation of the assignment.		
14	Final assessment of the individual assignment.		

Bibliography

1. I.A. Leţia, D. Marcu, B. Ungureanu, Procesoare de limbaje. Îndrumător de laborator, lito. Universitatea Tehnică din Cluj-Napoca, 1995.

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

It is a specialty course in Computer Science, its syllabus being both classical and modern. It teaches the students with the basic principles in the design of interpreters and translators for artificial languages. The syllabus of the course has been discussed with other important universities and companies from Romania, Europe, and USA. This syllabus has been evaluated by Romanian governmental agencies (CNEAA and ARAIS).

10. Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		- Problem-solving skills - Attendance, Activity		- Written exam		60%
Applications		- Problem-solving skills - Attendance, Activity		- Lab test - Assesement of the individual assignment		20% 20%

10.4 Minimum standard of performance

Modeling a typical engineering problems using the domain specific formal apparatus
Obtaining final grade 5

Course responsible
Assoc.prof.dr.eng. Emil Chifu

Head of department
Prof.dr.eng. Rodica Potolea

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Automation and Computer Science
1.3	Department	Computer Science
1.4	Field of study	Computer Science and Information Technology
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Computer Science/ Engineer
1.7	Form of education	Full time
1.8	Subject code	39.

2. Data about the subject

2.1	Subject name					Management and communication					
2.2	Subject area					Computer Science and Information Technology					
2.3	Course responsible/lecturer					Prof. dr. Doina Catana					
2.4	Teachers in charge of applications										
2.5	Year of study	III	2.6	Semester	6	2.7	Assessment	Colloquium	2.8	Subject category	DC/OB

3. Estimated total time

Sem.	Subject name	Lecture	Applications			Lecture	Applications			Individual study	TOTAL	Credit
		[hours / week.]				[hours / semester]						
			S	L	P		S	L	P			
6	**Management and communication**	**2**	**-**	**-**	**-**	**28**	**-**	**-**	**-**	**24**	**52**	**2**

3.1	Number of hours per week	2	3.2	of which, course	2	3.3	applications	-
3.4	Total hours in the teaching plan	28	3.5	of which, course	28	3.6	applications	-

Individual study	Hours
Manual, lecture material and notes, bibliography	6
Supplementary study in the library, online and in the field	7
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	6
Tutoring	3
Exams and tests	2
Other activities	

3.7	Total hours of individual study	24
3.8	Total hours per semester	52
3.9	Number of credit points	2

4. Pre-requisites (where appropriate)

4.1	Curriculum	Microeconomics
4.2	Competence	Being acquainted with economic language, understanding and using it

5. Requirements (where appropriate)

5.1	For the course	Presence of multimedia technology
5.2	For the applications	Not the case

6. Specific competences

Professional competences	**C5 –** Designing, managing the lifetime cycle, integrating and ensuring the integrity of hardware, software and communication systems (1 credit) **C5.2 –** Using interdisciplinary knowledge for adapting the computing system to the specifc requirements of the application field

Cross competences	**CT3 –** Demonstrating the spirit of initiative and action for updating professional, economical and organizational culture knowledge (1 credit)

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	To understand the general framework of managerial functions and the role of communication in performing them
7.2	Specific objectives	-To understand the basic roles, skills and functions of management in the open system of an organization - To understand the role of ethics and organizational culture in achieving the organizational goals in efficient and effective ways - To understand the basics of designing organizational strategies in the more and more complex and dynamic general and task environment - To understand and use of effective communication in group, organization and business negotiation, as potential leaders or/and group/organizational members

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Introduction in management: management concept, managerial functions, the managers, challenges confronting contemporary management	Interactive lecturing, ppt./prezi support/short movies related to the interest topic/in class exercises-	2
2	Organization's internal environment : culture and business ethics		2
3	External environment (general and task environments components)		4
4	Planning		2
5	Organizing		2
6	Coordinating and motivating people		2
7	Controlling and performance assessment		2
8	Organizational communication (content, functions, types, networks); interpersonal and group communications		2
9	Communication barriers		2
10	Increasing communications effectiveness in group and organization		2
11	Conflict and conflict management		2
12	Negotiation and assertive communication		2
13	Leadership and communication		2

Bibliography

1. Catana, D., 2014, Management and communication, Lecture support, available at www.management.utcluj.ro (password needed)
2. Baterman, T.S., Snell, S. A., 2013, Management : Leading&Collaborating in the Competitive World, 10th Ed., Mc Graw Hill
3. Becker, E.F., Wortmann, J., Mastering communication at work: how to lead, manage and influence, McGraw Hill Professional, 2009, available at: http://books.google.ro/books/about/Mastering_Communication_at_Work.html?id=0G6LuTp6XhsC&redir_esc=y
4. Nicolescu, O., Verboncu, I (2008), Fundamentele managementului organizatiei, Editura Universitara, Bucuresti
5. Catana D., Dobra Constantinescu A. (2004), Management in Power Point, UTPRES
6. Hynes, G. E. (2005), Managerial communication, Strategies and applications, 3rd ed. McGraw Hill

8.2. Applications (Seminars, Laboratory, Projects)		Teaching methods	Notes
1	Not the case	-	-
Bibliography			

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The syllabus is set up based upon the feedback got from employers of UTCN alumni, as well as on trends in the business

and general environment

10. Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		Exam score (E); Class involvement (I)		- on-line examination (closed and open ended questions) - presenting team projects on communication topics		N = 0,6E+0,4 I;
Applications		-		-		-
10.4 Minimum standard of performance						
N>5						

Course responsible
Prof.dr. Doina Catana

Head of department
Prof.dr.eng. Rodica Potolea

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Automation and Computer Science
1.3	Department	Computer Science
1.4	Field of study	Computer Science and Information Technology
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Computer Science/ Engineer
1.7	Form of education	Full time
1.8	Subject code	40.

2. Data about the subject

2.1	Subject name					Image Processing					
2.2	Subject area					Computer Science and Information Technology					
2.3	Course responsible/lecturer					Prof dr. eng. Sergiu Nedevschi (sergiu.nedevschi@cs.utcluj.ro)					
2.4	Teachers in charge of applications					Sl. dr. eng. Florin Oniga, JAs. dr. eng. Raluca Brehar, Dr. eng. Ion Giosan, Sl.dr. eng. Cristian Vicas { Florin.Oniga, Raluca.Borca, Ion.Giosan, Cristian.Vicas}@cs.utcluj.ro					
2.5	Year of study	III	2.6	Semester	6	2.7	Assessment	exam	2.8	Subject category	DID/OB

3. Estimated total time

Sem.	Subject name	Lecture	Applications			Lecture	Applications			Individual study	TOTAL	Credit
		[hours / week.]				[hours / semester]						
			S	L	P		S	L	P			
6	**Image Processing**	**2**	**-**	**2**	**1**	**28**	**-**	**28**	**14**	**34**	**104**	**4**

3.1	Number of hours per week	5	3.2	of which, course	2	3.3	applications	3
3.4	Total hours in the teaching plan	70	3.5	of which, course	28	3.6	applications	42

Individual study	Hours
Manual, lecture material and notes, bibliography	14
Supplementary study in the library, online and in the field	3
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
Tutoring	0
Exams and tests	3
Other activities	0

3.7	Total hours of individual study	34
3.8	Total hours per semester	104
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	N/A
4.2	Competence	Computer programming (C++), Data structures and algorithms, Linear Algebra, Numerical methods, Special mathematics.

5. Requirements (where appropriate)

5.1	For the course	Blackboard, video projector, computer
5.2	For the applications	Workstations, specific software (Visual Studio, Diblook)

6. Specific competences

Professional competences	**C6 -** Designing intelligent systems **C6.1 -** Describing the components of intelligent systems **C6.2 -** Using domain-specific tools for explaining and understanding the functioning of intelligent systems **C6.3 -** Applying the fundamental methods and principles for specifying solutions for typical problems using intelligent systems **C6.5 -** Developing and implementing professional projects for intelligent systems
Cross competences	N/A

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	Understanding the concepts related to digital images, computer vision and image processing. Learning and applying image processing methods, and designing specific applications.
7.2	Specific objectives	▪ Learning, evaluation and use of image processing specific concepts, algorithms and methods: digital image formats, camera model, statistical analysis, image filtering, image enhancing and restauration, segmentation, measurement. ▪ Acquiring the capacity of finding optimal solutions for image processing algorithm implementation, taking into consideration time and hardware constraints. ▪ Acquiring the capacity of quantitative and qualitative assessement of results, algorithms and systems for image processing. ▪ Learning the use of programming tools and image processing frameworks (Diblook, MS MFC)

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Computer vision and its applications. Structure and functionality of computer vision systems. Image acquisition systems.	Interactive teaching, using oral presentations supported by multimedia tools, consultations, involving students in research and development activities.	N/A
2	Camera model, the image formation process, coordinate transforms, calibration.		
3	Fundamentals of stereovision, stereo configurations, depth computation, epipolar geometry.		
4	Binary image processing. Morphological operations.		
5	Binary image processing. Object labeling, contour tracing.		
6	Binary image processing. Simple geometrical properties of binary objects.		
7	Grayscale image processing. Statistical properties. Image quality enhancement.		
8	The convolution operation. Fourier transform.		
9	Grayscale image processing: Modeling, detection and removal of image noise.		
10	Grayscale image processing: digital filtering.		
11	Grayscale image processing: Edge detection.		
12	Grayscale image processing: Advanced methods for edge extraction and linking.		
13	Grayscale image processing: Texture features.		
14	Image region segmentation using intensity, color and texture features.		

Bibliography

1. R.C.Gonzales, R.E.Woods, "Digital Image Processing-Second Edition", *Prentice Hall, 2002*.
2. G. X.Ritter, J.N. Wilson, “Handbook of computer vision algorithms în image algebra”, *CRC Press*, 2001.
3. E. Trucco, A. Verri, “Introductory Techniques for 3-D Computer Vision”, *Prentice Hall, 1998*.
4. S. Nedevschi, "Prelucrarea imaginilor şi recunoasterea formelor", *Ed. Microinformatica, 1997.*
5. R. Haralik, L. Shapiro, "Computer and Robot Vision", *Addison Wesley, 1993*.

Online

1. S. Nedevschi, T. Marita, “Prelucrarea imaginilor - Note de curs”, http://users.utcluj.ro/~nedevski/IP/index.html , http://users.utcluj.ro/~tmarita/IPL/IPCurs.htm

8.2. Applications (Laboratory)		Teaching methods	Notes
1	Image processing tools (Intel IPL, Photoshop). Diblook, basic concepts of MFC.	Presentation using the blackboard and multimedia tools. Experiments and implementation using specific software tools (MS Visual Studio, Diblook) Evaluation of the design and implementation phases.	N/A
2	Introduction to the DIBLook framework.		
3	Color spaces. Conversions from color to grayscale, and from grayscale to binary.		
4	Morphological operations applied on binary images.		
5	Object labeling on binary images.		
6	Geometrical properties of binary objects.		
7	Statistical properties of grayscale images.		
8	Image enhancement using spatial filters.		
9	Image filtering using convolution.		
10	Modeling and elimination of noise.		
11	Edge-based image segmentation (part 1)		
12	Edge-based image segmentation (part 2)		
13	Region-based image segmentation.		
14	Final evaluation.		
8.2. Applications (Projects)			
1	Choosing and discussing the project subject (weeks 1 and 2).		
2	Discussing the literature study and the work schedule (weeks 3 and 4).		
3	Algorithm design (weeks 5 and 6)		
4	Presentation of algorithm implementation. Intermediary evaluation (weeks 7 and 8).		
5	Algorithm testing and validation. Quantitative and qualitative evaluation (weeks 9 and 10).		
6	Algorithm optimization (weeks 11 and 12).		
7	Final project assessment (weeks 13 and 14).		
Bibliography 1. T.Marita, R.Danescu, F.Oniga, R.Borca, I.Giosan Lucrari de laborator, http://users.utcluj.ro/~tmarita/IPL/IPLAB.htm			

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The subject is part of the Computer Science and Information Technology curriculum, its contents combining fundamental and practical aspects used in the field of visual information processing (an ever growing domain). The subject content is correlated with the specific curricula of other Universities, in Romania and abroad, and is evaluated by government agencies (CNEAA and ARACIS). The subject's activities are meant to make the students familiar with the applications and the research directions of the image processing field, helped by the internationally renowned experience of the teachers.

10. Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		Testing the theoretical knowledge acquired, and the practical abilities of problem solving.		Written exam		50 %
Applications		Testing the practical abilities of designing and implementing solutions to specific problems. Attendance and activity.		Lab exam, project assessment		50 %
10.4 Minimum standard of performance						
Modeling and implementation of solutions to specific engineering problems, using the domain's formal apparatus.						

Course responsible
Prof.dr.eng. Sergiu Nedevschi

Head of department
Prof.dr.eng. Rodica Potolea

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Automation and Computer Science
1.3	Department	Computer Science
1.4	Field of study	Computer Science and Information Technology
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Computer Science/ Engineer
1.7	Form of education	Full time
1.8	Subject code	41.

2. Data about the subject

2.1	Subject name					Software Design					
2.2	Subject area					Computer Science and Information Technology					
2.3	Course responsible/lecturer					Assoc. prof. dr. eng. Mihaela Dinsoreanu – mihaela.dinsoreanu@cs.utcluj.ro					
2.4	Teachers in charge of applications										
2.5	Year of study	III	2.6	Semester	6	2.7	Assessment	exam	2.8	Subject category	DS/OB

3. Estimated total time

Sem.	Subject name	Lecture	Applications			Lecture	Applications			Individual study	TOTAL	Credit
		[hours / week.]				[hours / semester]						
			S	L	P		S	L	P			
6	**Software Design**	**2**	**-**	**2**	**1**	**28**	**-**	**28**	**14**	**34**	**104**	**4**

3.1	Number of hours per week	5	3.2	of which, course	2	3.3	applications	3
3.4	Total hours in the teaching plan	70	3.5	of which, course	28	3.6	applications	42

Individual study	Hours
Manual, lecture material and notes, bibliography	10
Supplementary study in the library, online and in the field	5
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	10
Tutoring	4
Exams and tests	5
Other activities	

3.7	Total hours of individual study	34
3.8	Total hours per semester	104
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Programming Techniques, Software Engineering
4.2	Competence	

5. Requirements (where appropriate)

5.1	For the course	
5.2	For the applications	

6. Specific competences

Professional competences	**C3** - Problems solving using specific Computer Science and Computer Engineering tools **C3.1** Identifying classes of problems and solving methods that are specific to computing systems **C3.2** Using interdisciplinary knowledge, solution patterns and tools, making experiments and interpreting their results **C3.3** Applying solution patterns using specific engineering tools and methods **C3.4** Evaluating, comparatively and experimentally, the available alternative solutions for performance optimization **C3.5** Developing and implementing informatic solutions for concrete problems
Cross competences	N/A

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	Understand and model requirements, analyse and design appropriate solutions
7.2	Specific objectives	• Identify the most relevant functional and non-functional requirements of a software system and to document them • Design and motivate software architecture for (large scale) software systems • Recognize and apply major software architectural styles, design patterns, and frameworks • Describe a software architecture using various documentation approaches and architectural description languages • Generate architectural alternatives for a problem and select among them

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Introduction to OO Programming and Methodologies	Face-to-Face lecture, Powerpoint slides	
2	Advanced UML (constraints modeling)		
3	Architectural Design (Architectural Styles)		
4	Business logic architectural patterns		
5	Data Access architectural patterns		
6	Midterm exam		
7	OO design		
8	Applying Design Patterns		
9	Applying Design Patterns		
10	Class Design Principles		
11	Package design Principles		
12	GRASP		
13	Service oriented architectures		
14	Software Design Quality metrics		

Bibliography

1. Craig Larman, *Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development* (3rd Edition), Prentice Hall, 2004, **ISBN**: 0131489062
2. Grady Booch, James Rumbaugh, Ivar Jacobson, Unified Modeling Language User Guide (2nd Edition), Addison-Wesley, 2005, ISBN: 0321267974
3. Martin Fowler, Scott Kendal. UML Distilled, Third Edition, Addison-Wesley, 2003. ISBN: 0321193687
4. Erich Gamma, et all, Design patterns : elements of reusable object-oriented software, Addison Wesley, 1995, ISBN: 0201633612
5. Course materials published at https://users.utcluj.ro/~dinso/PS2014

8.2. Applications (Seminars, Laboratory, Projects)		Teaching methods	Notes
1	Java Database Connectivity	Face-to-Face tutoring, additional	
2	Java Graphical Interfaces (Swing)		
3	Java Networking		

4	Java Applets	materials	
5	Design Patterns Implementation (Creational)		
6	Design Patterns Implementation (Structural)		
7	Design Patterns Implementation (Behavioral)		
8	UML – Use-Case Model		
9	Analysis Models		
10	Design Models		
11	Deployment Model		
12	Applying GRASP		
13	Applying GRASP		
14	Test		

Bibliography

Course materials published at https://users.utcluj.ro/~dinso/PS2014
Java tutorial - docs.oracle.com/javase/tutorial/
C# tutorial – msdn.microsoft.com

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

ACM Curriculum compliant course

10. Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		Ability to understand requirements, analyse alternative solutions and design an appropriate solution		Written exam		60%
Applications		Analyse requirements and alternative solutions, design an appropriate solution and implement it in either java or C#.		Periodic presentations of the required deliverables		40%

10.4 Minimum standard of performance
Grade of each lab assignment >= 5 Grade of each project deliverable >=5 Grade of the final exam >=5

Course responsible
Assoc.prof.dr.eng. Mihaela Dinsoreanu

Head of department
Prof.dr.eng. Rodica Potolea

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Automation and Computer Science
1.3	Department	Computer Science
1.4	Field of study	Computer Science and Information Technology
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Computer Science/ Engineer
1.7	Form of education	Full time
1.8	Subject code	42.

2. Data about the subject

2.1	Subject name					Intelligent Systems					
2.2	Subject area					Computer Science and Information Technology					
2.3	Course responsible/lecturer					Prof. dr. eng. Leţia Ioan Alfred – Ioan.Alfred.Letia@cs.utcluj.ro					
2.4	Teachers in charge of applications					Lect. drd. eng. Razvan Slăvescu – Razvan.Slavescu@cs.utcluj.ro As. drd. eng. Anca Marginean – Anca.Marginean@cs.utcluj.ro					
2.5	Year of study	III	2.6	Semester	6	2.7	Assessment	exam	2.8	Subject category	DS/OB

3. Estimated total time

Sem.	Subject name	Lecture	Applications			Lecture	Applications			Individual study	TOTAL	Credit
		[hours / week.]				[hours / semester]						
			S	L	P		S	L	P			
6	**Intelligent Systems**	**2**	**-**	**2**	**-**	**28**	**-**	**28**	**-**	**48**	**104**	**4**

3.1	Number of hours per week	4	3.2	of which, course	2	3.3	applications	2
3.4	Total hours in the teaching plan	56	3.5	of which, course	28	3.6	applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	18
Supplementary study in the library, online and in the field	5
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	10
Tutoring	6
Exams and tests	9
Other activities	0

3.7	Total hours of individual study	48
3.8	Total hours per semester	104
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Logic Programming, Functional Programming
4.2	Competence	Fundamentals of Computer Programming

5. Requirements (where appropriate)

5.1	For the course	Projector, Computer
5.2	For the applications	Computers with Linux, Specific Software

6. Specific competences

Professional competences	**C6 –** Design of intelligent systems (4 credits) **C6.1 –** Describing the components of intelligent systems **C6.2 –** Usage of specific instruments of the domain for explaining and understanding the functioning of intelligent systems **C6.3 –** Application of principles and basic methods for the specification of solutions totypical problems using intelligent systems **C6.4 –** Choosing criteria and methods for the evaluation of quality, performance and limits of intelligent systems **C6.5 –** Development and implementation of professional designs for intelligent systems
Cross competences	N/A

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	Knowledge of representation and reasoning of fundamental problems of intelligent systems
7.2	Specific objectives	Fundamental methods for basic representations in intelligent systems: uncertainty, learning, communication

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Introduction.	Slides, Algorithms, Quality of solutions, Exceptions, Limits in the representation of the real world	
2	Uncertainty: inference using full joint distributions, Bayes' rule and its use.		
3	Probabilistic Reasoning: semantics of Bayesian networks, efficient representation, exact inference, approximate.		
4	Probabilistic Reasoning over Time: hidden Markov models, dynamic Bayesian networks.		
5	Making Simple Decisions: utility functions, decision networks, value of information.		
6	Making Complex Decisions: value iteration, policy iteration, partially observable MDPs, game theory.		
7	Learning from Observations: learning decision trees, ensemble learning.		
8	Knowledge in Learning: explanation-based, relevance information, inductive logic programming.		
9	Statistical Learning Methods: hidden variables, instance-based, neural networks, kernel machines.		
10	Reinforcement Learning.		
11	Association analysis: frequent itemset generation, rule generation, compact representation of frequent itemsets, alternative methods of generating frequent itemsets, FP-growth algorithm.		
12	Communication: syntactic analysis, semantic interpretation.		
13	Perception, representation and action in multi-agent systems.		
14	Overview on Intelligent Systems: Present and Future.		

Bibliography

1. Artificial Intelligence: A Modern Approach: Russell, Norvig, Prentice Hall, 2002
2. Tan, Steinbach, Kumar: Data Mining: Association Analysis, 2004

8.2. Applications (Seminars, Laboratory, Projects)		Teaching methods	Notes
1	Introduction to the documentation for the assignment	Platform, Documentation, Testing, Examples, New examples	
2	Studying the documentation for the assignment		
3	Studying the design of the tool		
4	Practicing the exercises provided in the archive		
5	Understanding the main parts of the software		
6	Running the system by tracing at high level		
7	Mastering the running of the system and the examples provided		
8	Conceptual design of new examples		
9	Code for the new examples		

10	Testing and debugging the new cases		
11	Measuring the performance of the system		
12	Documenting the new scenarios		
13	Comparison of the differences between the cases developed and those provided		
14	Final evaluation of the exercises developed		
Bibliography 1. Various Intelligent Systems Tools from the WWW.			

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The course outline represents the most known and used one in the world methods for intelligent systems, continuously assessed by the research community in the world regarding its influence and use in software technology.

10. Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		Problems and theoretical concepts		Written exam		80%
Applications		Usage of specific tools on the examples developed and tested by the students		Evaluation in the laboratory		20%
10.4 Minimum standard of performance						
Representation of knowledge and its use in solving specific intelligent systems problems using specific tools						

Course responsible
Prof.dr.eng. Ioan Alfred Letia

Head of department
Prof.dr.eng. Rodica Potolea

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Automation and Computer Science
1.3	Department	Computer Science
1.4	Field of study	Computer Science and Information Technology
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Computer Science/ Engineer
1.7	Form of education	Full time
1.8	Subject code	43.

2. Data about the subject

2.1	Subject name					Practical Placement					
2.2	Subject area					Computer Science and Information Technology					
2.3	Course responsible/lecturer					Assoc. prof. dr. eng. Tiberiu Marita					
2.4	Teachers in charge of applications					As decided by the supervisor					
2.5	Year of study	III	2.6	Semester	6	2.7	Assessment	Verification	2.8	Subject category	DID/OB

3. Estimated total time

Sem.	Subject name	Lecture	Applications			Lecture	Applications			Individual study	TOTAL	Credit
		[hours / week.]				[hours / semester]						
			S	L	P		S	L	P			
6	**Practical Placement**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**240**	**240**	**8**

3.1	Number of hours per week	-	3.2	of which, course	-	3.3	applications	-
3.4	Total hours in the teaching plan	-	3.5	of which, course	-	3.6	applications	-

Individual study	Hours
Manual, lecture material and notes, bibliography	0
Supplementary study in the library, online and in the field	40
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	10
Tutoring	18
Exams and tests	2
Other activities	170

3.7	Total hours of individual study	240
3.8	Total hours per semester	240
3.9	Number of credit points	8

4. Pre-requisites (where appropriate)

4.1	Curriculum	N/A
4.2	Competence	N/A

5. Requirements (where appropriate)

5.1	For the course	N/A
5.2	For the applications	Compulsory attendance (minimum 240 h)

6. Specific competences

Professional competences	**C2** Designing hardware, software and communication components (2 credits) **C2.1** Describing the structure and functioning of computational, communication and software components and systems **C3** Problems solving using specific Computer Science and Computer Engineering tools (2 credits) **C3.1** Identifying classes of problems and solving methods that are specific to computing systems **C3.2** Using interdisciplinary knowledge, solution patterns and tools, making experiments and interpreting their results **C3.3** Applying solution patterns using specific engineering tools and mehods **C3.5** Developing and implementing informatic solutions for concrete problems

	C5 Designing, managing the lifetime cycle, integrating and ensuring the integrity of hardware, software and communication systems (2 credits) **C5.5** Creating a project including the problem's identification and analysis, its design and development, also proving an understanding of the basic quality requirements
Cross competence	**CT2** Identifying, describing and conducting processes in the projects management field, assuming different roles inside the team and clearly and concisely describing, verbally or in writing, in Romanian and in an international language, the results from the activity field. (2 credits)

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	Application of fundamental and applied knowledge gained in the projects development within a specialized company or research team (theme set by the project manager)
7.2	Specific objectives	Acquaintance and student involvement in every development stage of a hardware / software / communication project and connected aspects of design activities: - Analysis and documentation - Study and acquaintance with specific design tools - Design, implementation, testing and validation of the project - Preparation of documentations, technical reports - Team work and communication skills - Project management activities

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Not applicable	N/A	
Bibliography			
8.2. Applications		Teaching methods	Notes
1	• study of the product to be realized • analysis of the potential methodologies and/or technologies • preparation of the project specifications • implementation and deployment of the hardware or software system • product testing and validation • product documenting	N/A	
Bibliography For the project development, the draft bibliography is the one recommended by the project leader from the company or by the research team at which the implementation is performed and the one resulted in the documenting phase.			

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

This discipline provides education and training of the students at the workplace site, with benefits for both sides. Students are familiarized with the working and professional requirements needed to work in a company, and companies have the opportunity to shape students to facilitate their employment after graduation (to reduce training expenses / training). Also it aims to increase cohesion between academia and employment in a priority area in terms of national and European level in order to improve the skills of employees and to prepare and maintain them in the labor market in a particularly dynamic and competitive domain (mainly existing competition with Eastern European countries and Asia - India and China).

10. Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		N/A		N/A		N/A
Applications		Attendance, activity, tutor assessment		Colloquy		100%
10.4 Minimum standard of performance						
Development of a hardware / software / communication engineering project						

Course responsible
Assoc.prof.dr.eng. Tiberiu Marita

Head of department
Prof.dr.eng. Rodica Potolea