Federal University of Alagoas
Computer Science Institute

Computer Science Program
Pedagogical Project
2011

Maceió, June 2010

Federal University of Alagoas
Computer Science Institute

Computer Science Program
Pedagogical Project

Development:

Faculty and staff of the Computer Science Institute of the Federal University of Alagoas

Coordinator of the Project:

Fábio Cunha de Albuquerque

Maceió, June 2010

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Program Overview

Name of the Program: Computer Science

Title Awarded:	Computer Science Bachelor
Accreditation:	Administrative Rule number

1,121/95 of Ministry of Education and Culture (MEC

Course shift	Day time classes
Load:	3,110 hours
Length:	Minimum: 4 years Maximum 7 years
Vacancies:	80 yearly admissions of 40 students per semester.
Profile:	Bachelor in Computer Science with authorization to the exercise of the professions in the Informatics area: Systems and Computing Engineering; Software Engineering, System Analysis; Analysis of Information Technology and Information Systems.
Field of Action:	Software Development, Consulting, and Information Technology Management, Computer Networks, Databases, Artificial Intelligence, Graphic Computing and other correlates.

1. Introduction

The Computer Science Program of the Federal University of Alagoas UFAL was authorized in the second semester of 1987, and it was recognized by the Ministry of Education and Culture (MEC) in 1995, by its Administrative Rule number 1121/95. The program was founded by initiative of the Department of Applied Mathematics (MAP), whose denomination was then altered to Department of Information Technology (TCI). Due to the structural change of the Federal University of Alagoas, implemented in 2006, the Department of Information Technology was redefined to be an Academic Unit called Computer Science Institute (IC), which came to be responsible for that course.

The Computer Science Program of UFAL meets the guidelines for human resources formation in Computer Sciences as established by MEC/SESu, which specify the formation requisites aiming at meeting the needs of the Brazilian Society. The Computer Science courses, according the curricular guidelines of MEC, have as its objective the formation of human resources aiming at the scientific and technological development of the Computer Science field.

Bachelors from these programmes should be in the state-of-the-art of science and computer science technology, in such manner that they are able to continue their research activities, so as to promote scientific development, or applying scientific knowledge in order to promote the scientific progress of the country.

This project brings with it a description of what is intended to be its bachelor profile as someone equipped with the main competencies and skills required, reflex of an appropriate curriculum framework which is also in keeping with such goals. This project has been coherently developed with the curricular guidelines of MEC for the Computer Science Course.

The objective of this bachelor's program in Computer Science is to provide a theoretical and practical training in computing, in order to adequately prepare its students to act professionally in a diversity of fields of computer science, keeping up with its advances as well as to get into graduate and research programs.

The student's formation will encompass the scientific field of computer science, seeking for its application in solving society's problems; as well as in the development of knowledge and technology contributing to computer science to progress.

The program will guarantee a basic training which will enable students to acquire skills to effectively continue their studies in the specific areas of knowledge in computer science according to the profile chosen by the student. The training will also involve the study of professional, ethical and social of computer science and from other areas as well, such as mathematics, physics, administration, law et cetera; as it has been recommended in the guidelines proposed by the Committee of Experts in Education and Computer Science and Informatics (CEEInf) of the Education Ministry.

2. Bachelor's Profile

The program was conceived aiming at providing a basic and solid training enabling students for a competent professional acting; as well as to solve real world problems, by means of the construction of computational models and their implementation.

Such training will make possible to the bachelor the appropriate conditions to face the frequent technological changes, typical of the dynamic Computer Science field.

2.1. Characteristics of the Professional

The fundamental characteristics of this professional are:

- Knowledge and mastering of processes of project and complex computing systems construction for solving problems with scientific basis.
- Ability to apply their knowledge in an independent and innovative manner, keeping up with the field's evolution and contributing to the search of creative solutions in the different areas of professional acting;
- Humanistic training enabling the comprehension and professional acting amidst society's decision, becoming a citizen who is more aware of his/her social role, of human existence and of the respect for life and the other person.
- Entrepreneurial training which provides a market view of Information Technology and of organizational dynamics in a globalized market;
- Ethical and professional sense associated with social responsibility, with the understanding of the causality and finality of computing practice as well as the ceaseless search for the optimization of human work and society's improvement.

3. Abilities/Competencies/Attitudes

The Computer Science program offers to the bachelor a solid training with variety of competencies and abilities which will make it possible to act professionally in partnership with a number of professions requiring computing knowledge. Besides, such bachelor will be prepared to deal with frequent changes that occur in his/her working field, either academic or market-related.

3.1. Competencies

Based on the intended profile of its bachelor, the program sets out to develop in the student, among others, the following competencies:

- Modeling real world systems searching for systematised solutions through the resources available in the fields of Computing, Informatics and Communications;
- Projecting and constructing computational models, with scientific basis, for problem solutions;
- Projecting and implementing complex systems of high quality, which require complex computational solutions by algorithms;
- Managing projects of computing system development in general;
- Providing advice in decision making in the field of Information Technology (TI);
- Being able to develop, implement and manage systems of technological basis such as: computer network; databases; artificial intelligence; distributed systems and scientific computing;
- Continuing the studies at graduate level in Computer Science or correlate areas.
- Engage in research aiming at an academic/scientific career.

3.2. Areas of Professional Acting

The competencies above mentioned will enable the bachelor to professionally act:

- In the development of Information Systems. The information systems encompass a set of hardware and software which process, store and output information of an organization the development of these models requires analysis of business models being used by the organization and development of a technical computational and economically feasible solution. Such training enables the future professional to act in any organization that uses Information Technology. In these organizations, he/she may take up the position and function of Software Engineer; Systems Analyst; Project Manager; Information Technology Manager; and the like.

- In the development of Basic and Application Software. Basic and application software are denominations given to computer programs of general use, which are not restricted to a single organization. Text editors, spreadsheets, browsers, compilers, parses, etc, are examples of basic software. Document management software, workflow, etc, are examples of applications. The broad and solid training in programming and software engineering offered by the course enables the bachelor to act professionally in the design, implementation and evaluation of these products. The job offers for such competencies are in the organizations in general, but especially in the companies of the so-called “software industry”.

- In computer networks. The installation of computer systems in companies requires project, implementation and management of a computer network. Such activity is essential today in almost every company that utilizes Information Technology, which guarantees a broad labour market. The activity of permanent network management in order to ensure its full functioning and the safety and integrity of its components requires a professional who is differentiated highly qualified with good remuneration in the labour market.

- In solving problems related to the interaction between user and systems. The focus on the development of computational systems shouldn't be restricted to the system itself. It should be broad and centred in the persons who will used it and in the context where is inserted. The course covers the theoretical aspects related to the interaction human-computer and the solutions to improve the usability and accessibility of such systems. This competence enables the bachelor to act professionally in companies which produce hardware and software or utilise computational systems in the accomplishment of their activities.

- In developing mathematical models and algorithms in order to solve problems. In many cases, the development of a mathematical model and the construction of na algorithm which makes possible its implementation on a computer. In this process lies the essence of computing as science. The mastering of this competence on the part of the professional is fundamental. This training program enables the bachelor to work in companies whose end-activity is not computing, but which need developing systems to meet their specific needs. Systems developed for engineering, science, petroleum, meteorology, etc.

- In education, research and graduate programs in computing or in areas which apply it. The bachelor from this course is also prepared to act professionally in teaching, research or carry out graduate studies in this area so that he/she may be perfect and expand his/her knowledge. In this professional acting, it is possible to work in universities or research centers so as to contribute with new theoretical and technological findings in computer science.

3.3 Abilities

Among the abilities the student acquires in his training, we may cite:

- Self-learning. It is a characteristic motivated by the rapid evolution of computing, leading the professional of this field to get involved in a continuous learning process upon completion of his studies. Thus, it is fundamental that the student acquires from an early stage the capacity to learn how to learn. He/she will need to be always learning in order to maintain himself/herself updated and competent. The ability in research significantly leads to self-learning. This ability is developed throughout the program by means of research work and development in various subjects, by participating in research projects and carrying out the end-of-course paper (undergraduate thesis);
- Teamwork. An important indicator to motivating the development of this ability is that the development of computing systems is almost always carried out by a work team, with professionals performing different functions. The ability to work in group is fundamental to the computing professional and is encouraged and developed during the course as the students develop research projects and produces papers as part of the subjects requirements;
- Creativity. Problem analysis and modeling of creative solutions with their consequent implementations. The analysis of a problem and the creative capacity of developing a model to solve it is an essential ability for a computing professional. Such ability is introduced since the beginning of the program by the programming activities and it is widely developed in a number of subjects and curricular activities.
- Entrepreneurial capacity. It is an important ability for a professional, even for those not willing to become entrepreneurs. Such ability may be developed and aims at enabling the professional to assume a proactive attitude, to develop a network of relations and to lead projects in his/her professional activities. It is introduced in the program in two moments: in the third semester, with the Entrepreneurship in Informatics course and in the penultimate semester of the program with the Introduction to Administration course. Besides, it is developed during the program by means of practical activities in which the students are encouraged to present and lead system projects;

In addition to theses abilities, the student has the opportunity of improving his/her skills of oral and written communication, through the development and presentation of projects in seminars and debates, and by many paper works and essays evaluations, group work and individual reports along the program.

The student should also develop competence and skills in the english language by means of the support of the Instrumental English subject and reading books and articles of computing written in english.

4. Contents/Curriculum Framework

The Computer Science Program has a minimum of 4 and a maximum of 7 years length. Its curriculum is structured in 8 semesters, where the first 6 are turned to the basic training subjects; and the final 2 semesters are focused on the subjects related to the bachelor specific training in Computer Science. The program has a total of 2,820 class-hours corresponding to 48 mandatory courses (2460 class-hours) and a minimum of 360 class-hours in elective courses. The content of the Basic Training in Computing is composed by the set of mandatory subjects. This set of mandatory subjects aims at guaranteeing the minimum competency needed by bachelor degree professional, with basic as well as some specific knowledge of the main areas of computing which enable them to exercise their profession.

The curriculum framework also displays a second group of elective courses turned to the professional training. Each course builds up one or more competencies contributing to the professional profile of the computer science professional.

Upon completion of mandatory contents, it is required the development and presentation of an individual undergraduate thesis (end-of-course paper) whose theme is related to the professional practice which will be done with the support of a professor adviser. This undergraduate thesis is a mandatory activity which is equivalent to a load of 90 class-hours.

The student has also the option of studying other elective courses offered in the curriculum as well as carry out complementary activities along the program.

Complementary activities should have a minimum load of 200 hours and may be accomplished via Supervised Internship, involving practical experiences in a professional environment, within the university or outside of it, or by means of other activities ruled by CONSUNI/UFAL and by Resolutions of The Program's Collegiate Body.

Thus the minimum load of the program will be composed of 2,460 class-hours of mandatory courses; 360 class-hours of elective courses; 90 hours of undergraduate thesis and 200 hours of complementary activities, summing up a total of 3,110 hours.

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The class-hours from elective course attended and/or from complementary activities carried out which exceed the total load of class-hours will be credited to the student's college transcript, adding to his/her curricular fulfilment.

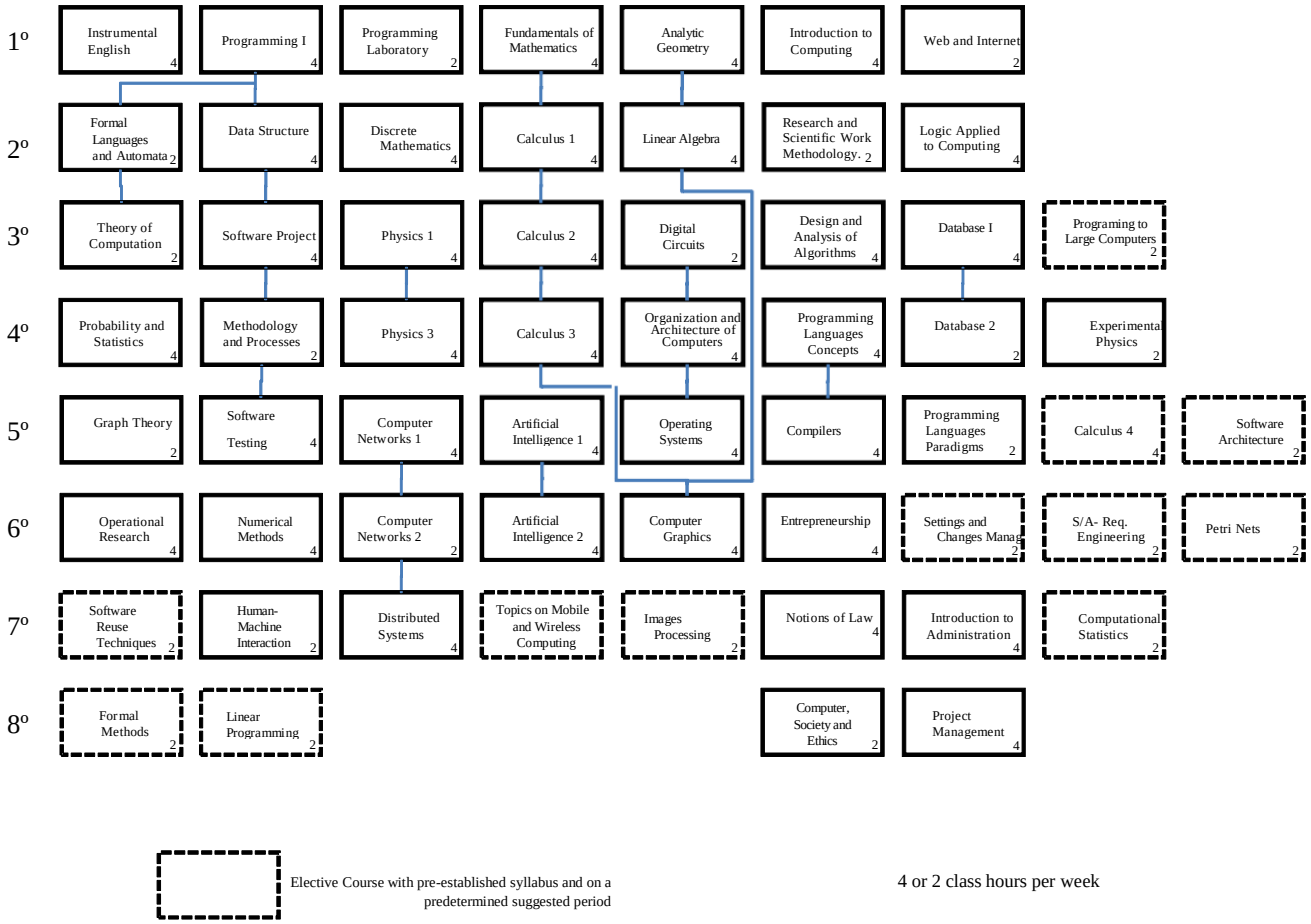
The Computer Science Program aims not only at a technical training. Its curricular framework displays subjects which enable students to enter teaching, research and extension groups, as well as enable him/her to enter into graduate programs. Research and extension activities have notably the support of the following subjects: Programing; Software Engineering; Databasis; Computer Networks and Artificial Intelligence. As from the 4th semester, the student will be able to join research projects and scientific initiation currently available in the Computing Institute or to enter projects external to the Institute.

The extension activities, whether by course ministering to the external or internal community; whether by initiatives requiring computerized services, may be accomplished with student's participation since the 3rd academic semester.

It is important to emphasize, regarding students participation in graduate programs, that most academic activities of the Master's Course in Computational Modeling of Knowledge such as seminars, lectures, mini-courses and other events, it is always open to the undergraduate students, aiming at encouraging those who are interested in the academic career. The current curriculum framework displays a variety of subjects propitiating a theoretical mathematical and computational foundation aiming at enabling the student to enter into graduate programs in Computer Science now available in the country.

4.1. Curriculum Framework

Curriculum Framework 2011 of the Computer Science Program of the UFAL Computer Science Institute



The curriculum framework of the Computer Science Program displays the relation between the various groups of subjects existing in it.

During the first semester, it is noticed the importance of the courses which introduce notions of computer programming as well as laboratory activities, with the support of the Instrumental English course. Still during the first semester, the student starts the study of courses that provide him/her with the mathematical basis needed to his/her success throughout the program; notably the series Calculus and Algebra which enable them to the graduate studies and will be applied in Computer Graphics.

The Programming courses, together with Software Engineering and Human-Machine Interaction, make up the spinal cord of the Computer Science Program.

In the second semester, the student starts his/her studies of the Physics series which serves as a foundation to the study of Computer Networks and Distributed System, together with Digital Circuits which enables the understanding of Computers Architecture and, afterwards, of its Operational Systems. The courses of Discrete Mathematics, Logic Applied to Computing, and then Probability and Statistics establish the necessary concepts to the series of Databases and Artificial Intelligence. Still in the second semester, the student initiates his steps in Formal Languages and Automata which precede the studies of Computing and Graph Theory, which will then be applied to his/her training in Artificial Intelligence.

In the third semester the student finishes his/her training in programming and starts his/her studies of courses in the area of Human Sciences through the study of Entrepreneurship which go forward with the courses of Computer, Society and Ethics, Introduction to Law, Introduction to Administration and, finally, Project Management. The course of Research and of Scientific Work Methodology aims at enabling him/her for the activities of Scientific Initiation and for the Undergraduate Thesis in the eighth semester.

In the fourth semester, with the Theory and Paradigms of Programming Languages course, the student initiate his/her studies of a new series to be completed in the fifth semester with the Compilers course, which provides a foothold to his/her studies to the completion of the series Software Engineering and Human-machine Interaction.

In the fifth semester, the student goes on with the many series he/she started in previous semesters and initiates the studies of the following series: Databases; Computer Networks and Artificial Intelligence.

In the sixth semester, the series Software Engineering; Computer Networks; Databases are finished. It is when the student also finishes the series initiated with Linear Algebra and Analytical Geometry, taking the Computer Graphics course. In the sixth semester, the student starts studying a new series of elective courses enabling him/her to move forward and complement his/her studies in his interest areas.

In the seventh semester, the student finishes the other series initiated in previous semesters and has the opportunity, through the elective courses, to continue the studies in the interest areas of his/her choice. The series of courses continue until the final semester of the program.

In the final semester, the student has the opportunity to intensely dedicate to the development of the Undergraduate Thesis (TCC) and finalize the studies.

According to MEC Ordinance number 4,059 of December the 10th, 2004, the professor may devote up to 20% of the teaching hours of his/her subject to distant learning pedagogical activities.

5. Curricular Planning

The Curricular Planning of the Computer Science Program is formed by the following courses per semester:

Mandatory Courses

1st SEMESTER COURSES						
	CODE	COURSE NAME	COURSE LOAD			
			WEEKLY	SEMESTER		
				Theory	Practice	Total
1°	CCOM001	Instrumental English	4	40	20	60
	CCOM002	Programming 1	4	40	20	60
	CCOM003	Programming Laboratory	2	10	20	30
	CCOM004	Fundamentals of Mathematics	4	40	20	60
	CCOM005	Analytic Geometry	4	40	20	60
	CCOM006	Introduction to Computing	4	40	20	60
	CCOM007	Web and Internet	2	20	10	30
	Total Courseload		**24**			**360**

2nd SEMESTER COURSES						
	CODE	COURSE NAME	COURSELOAD			
			WEEKLY	SEMESTER		
				Theory	Practice	Total
2°	CCOM008	Formal Languages and Automata	2	20	10	30
	CCOM009	Data Structure	4	40	20	60
	CCOM010	Discrete Mathematics	4	40	20	60
	CCOM011	Calculus 1	4	40	20	60
	CCOM012	Linear Algebra	4	40	20	60
	CCOM013	Research and Scientific Work Methodology	2	20	10	30
	CCOM014	Logic Applied to Computing	4	40	20	60
	Total Courseload		**24**			**360**

3rd SEMESTER COURSES						
	CODE	COURSE NAME	COURSELOAD			
			WEEKLY	SEMESTER		
				Theory	Practice	Total
3°	CCOM015	Theory of Computation	2	20	10	30
	CCOM016	Software Project	4	40	20	60
	CCOM017	Physics 1	4	40	20	60
	CCOM018	Calculus 2	4	40	20	60
	CCOM019	Digital Circuits	2	20	10	30
	CCOM020	Design and Analysis of Algorithms	4	40	20	60
	CCOM021	Database 1	4	40	20	60
	Total Courseload		**24**			**360**

4th SEMESTER COURSES						
	CODE	COURSE NAME	COURSELOAD			
			WEEKLY	SEMESTER		
				Theory	Practice	Total
4°	CCOM022	Probability and Statistics	4	40	20	60
	CCOM023	Methodology and Processes	2	20	10	30
	CCOM024	Physics 3	4	40	20	60
	CCOM025	Calculus 3	4	40	20	60
	CCOM026	Organization and Architecture of Computers	4	40	20	60
	CCOM027	Programming Languages Concepts	4	40	20	60
	CCOM028	Database 2	2	20	10	30
	CCOM029	Experimental Physics	2	10	20	30
	Total Courseload		**26**			**390**

5th SEMESTER COURSES						
SEMESTER	CODE	COURSE NAME	COURSELOAD			
			WEEKLY	SEMESTER		
				Theory	Practice	Total
5°	CCOM030	Graph Theory	2	20	10	30
	CCOM031	Software Test	4	40	20	60
	CCOM032	Computer Networks 1	4	40	20	60
	CCOM033	Artificial Intelligence	4	40	20	60
	CCOM034	Operating Systems	4	40	20	60
	CCOM035	Compilers	4	40	20	60
	CCOM036	Programming Languages Paradigms	2	20	10	30
	Total Courseload		**24**			**360**

6th SEMESTER COURSES						
SEMESTER	CODE	COURSENAME	COURSELOAD			
			WEEKLY	SEMESTER		
				Theory	Practice	Total
6°	CCOM037	Operational Research	4	40	20	60
	CCOM038	Numerical Methods	4	40	20	60
	CCOM039	Computer Networks 2	2	20	10	30
	CCOM040	Artificial Intelligence 2	4	40	20	60
	CCOM041	Computer Graphics	4	40	20	60
	CCOM042	Entrepreneurship	4	40	20	60
	---	Elective Courses	-	-	-	-
	Total Courseload		**22**			**330**

7th SEMESTER COURSES						
SEMESTER	CODE	COURSE NAME	COURSELOAD			
			WEEKLY	SEMESTER		
				Theory	Practice	Total
7o	CCOM043	Human-Machine Interaction	2	20	10	30
	CCOM044	Distributed Systems	4	40	20	60
	CCOM045	Notions of Law	4	40	20	60
	CCOM046	Introduction to Administration	4	40	20	60
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	Total Courseload		**14**			**210**

8th SEMESTER COURSES						
SEMESTER	CODE	COURSE NAME	COURSELOAD			
			WEEKLY	SEMESTER		
				Theory	Practice	Total
8o	CCOM047	Computer, Society and Ethics	2	20	10	30
	CCOM048	Project Management	4	40	20	60
	---	Elective Courses	-	-	-	-
	Total Courseload		**6**			**90**

Elective Courses

ELECTIVE COURSES			
CODE	**COURSE NAME**	**WEEKLY CL**	**SEMESTER CL**
CCOM101	System Analysis- Requirements Engineering	2	30
CCOM102	Software Architecture	2	30
CCOM103	Settings and Changes Management	2	30
CCOM104	Calculus 4	4	60
CCOM105	Formal Methods	2	30
CCOM106	Computational Statistics	2	30
CCOM107	Images Processing	2	30
CCOM108	Wireless and Mobile Computing	2	30
CCOM109	Linear Programming	2	30
CCOM110	Software Quality	2	30
CCOM111	Programming for Large Computers	2	30
CCOM112	Petri nets	2	30
CCOM113	Software Reuse Techniques	2	30
CCOM114	Libras Fundamentals	2	60

ELECTIVE COURSES – Special Courses			
CODE	**COURSE NAME**	**WEEKLY CL**	**SEMESTER CL**
CCOM201	Topics on Humanities	-	-
CCOM202	Topics on Scientific Computing	-	-
CCOM203	Topics on Parallel Computing	-	-
CCOM204	Topics on Databases	-	-
CCOM205	Topics on Basic Software	-	-
CCOM206	Topics on Software Engineering	-	-
CCOM207	Topics on Computers Architecture	-	-
CCOM208	Topics on Data communication	-	-
CCOM209	Topics on Computer Networks	-	-
CCOM210	Topics on Artificial Intelligence	-	-
CCOM211	Special Topics on Computing	-	-
CCOM212	Topics on Computational Modelling of Knowledge	-	-
CCOM213	Special Topics on Programming	-	-
CCOM214	Topics on Informatics in Education	-	-

5.1. Courses Syllabi

Mandatory Courses

Code	Course Name	CL
CCOM001	Instrumental English	60

Syllabus:

Studying texts from the IT area seeking for comprehension.Important morphological and grammar aspects for understanding. Extending and Developing strategies of reading. Awareness of the reading process. Exploring non-linear information, cognates and context. Selectivity of the reading type (Skimming and Scanning). Hypothesis survey about the text (Title and subtitle). Pointing grammar issues for reading. Using the dictionary as a strategic support for reading: types, resources, practice.

Bibliography:

PINTO, Dilce. **Compreensão Inteligente de Textos. Grasping the Meaning.** Vol 1 e 2. Rio de Janeiro:LTC, 1991.

DUBIN, F. **Reading by All Means**. USA: Addison-Wesley, 1990. EDIGER,

A. **Reading for Meaning**. USA: Longman, 1989.

MICHAELIS. **Dicionário Inglês-Português**. São Paulo: Melhoramentos, 2003.

Code	Course Name	CL
CCOM002	Programming 1	60

Syllabus:

Problem solving and algorithms development. Problem Analysis. Solution strategies. Documentation and representation. Algorithms programming with a programming language. Programs structuring. Notions on types and data elementary structures. Concept of recursion and application.

Bibliography:

EVARISTO, Jaime. **Aprendendo a Programar – Programando na Linguagem C**. Rio de Janeiro: Book Express, 2004.

ASCENCIO, Ana F. G. e Campos, Edilene A. V. **Fundamentos de Programação de Computadores**. Prentice Hall, 2002.

FORBELLONE, André L.V. Ebesrpacher, Henri F. **Lógica de programação - a construção de algoritmos e estruturas de dados**, 2ª ed. São Paulo: Makron Books, 2000.

MIZRAHI, Victorine V. **Treinamento em Linguagem C**. Módulo 1. McGraw Hill, 1990.

MIZRAHI, Victorine V. **Treinamento em Linguagem C**. Módulo 2. McGraw Hill, 1990.

Code	Course Name	CL
CCOM003	Programming Laboratory	30

Syllabus:

Practical activities on a programming language supported by a computers laboratory

Bibliography:

EVARISTO, Jaime. **Aprendendo a Programar – Programando na Linguagem C**. Rio de Janeiro: Book Express, 2004.

ASCENCIO, Ana F. G. e Campos, Edilene A. V. **Fundamentos de Programação de Computadores**. Prentice Hall, 2002.

FORBELLONE, André L.V.; Ebesrpacher, Henri F. **Lógica de programação - a construção de algoritmos e estruturas de dados**, 2a.ed. São Paulo: Makron Books, 2000.

MIZRAHI, Victorine V. **Treinamento em Linguagem C**. Módulo 1. McGraw Hill, 1990.

MIZRAHI, Victorine V. **Treinamento em Linguagem C**. Módulo 2. McGraw Hill, 1990.

Code	Course Name	CL
CCOM004	Fundamentals of Mathematics	60

Syllabus:

Notions of logic, sets and demonstration techniques. Basic properties of real numbers: operations, special products and factorization, power and roots, order relation, absolute value, the real axis. Real functions: graph of a function, limited functions, even and odd functions, limited functions. Linear function: equations and inequalities of the first degree. Quadratic function: equations and inequalities of the second degree. Polynomial functions. Trigonometric functions. Exponential functions. Logarithmic functions.

Bibliography:

DO CARMO, M. P. **Trigonometria e Números Complexos**. Coleção do Professor de Matemática. SBM, 2005.

LIMA, E. L.; CARVALHO, P. C.; WAGNER, E. & MORGADO, A. C. **A Matemática do Ensino Médio**. Vol. 1 e Vol. 3. Coleção do Professor de Matemática. SBM, 2004.

LIMA, E. L.; CARVALHO, P. C.; WAGNER, E. & MORGADO, A. C. **Temas e Problemas Elemenatres**. Coleção do Professor de Matemática. SBM, 2006.

Code	Course Name	CL
CCOM05	Analytic Geometry	60

Syllabus:

Geometry on three dimensions: Vectors. Inner products. Vector products. Lines and planes. Conics and quadrics. Euclidean spaces and subspaces. Matrices and determinants. Linear equations systems.

Bibliography:

BOULOS, Paulo. **Vetores e Geometria Analítica: Um Tratamento Vetorial**. São Paulo: Makron Books, 2005.

REIS, Genésio. **Geometria Analítica**. Rio de Janeiro: LTC, 1996.

Code	Course Name	CL
CCOM006	Introduction to Computing	60

Syllabus:

Basic components of a computing system. Programming Language: Conceptualization and classification. Notions of basic software: Operating system, compiler, interpreter, assembler, linker and loader. Internal data representation and numbering system. Seminars on computer science subjects.

Bibliography:

CAPRON, Harriet L.; JOHNSON, J. A. **Introdução a Informática**. Prentice Hall Brasil, 2004.

SETZER, V. **Introdução à Computação e à Construção de Algoritmos**. São Paulo: McGraw-Hill, 1991.

FORBELLONE, André. **Lógica de Programação**. São Paulo: Makron Books, 2000.

Code	Course Name	CL
COMP007	Web and Internet	30

Syllabus:

Internet and Web History. Basic Architecture of a Web Environment. Understanding HTML and XML.

Bibliography:

COMER, D. E. **Interligação em Redes com TCP/IP**. Vol. 1, 5edn. Campus.

FOROUZAN, B. A. (2006). **Data Communications and Networking**. 4 edn. Mc-Graw Hill.

KUROSE, J. & Ross, K. (2006). **Redes de Computadores e a Internet: Uma Abordagem Top-down** . 3 edn. Addison-Wesley.

TANENBAUM, A. S. (2003). **Redes de Computadores**. 4 edn. Campus.

WORLD WIDE WEB CONSORTIUM (2006).URL: http://www.w3c.org

Code	Course Name	CL
CCOM008	Formal Languages and Automata	30

Syllabus:

Alphabet. Languages and Operations with Languages. Formal grammar and automata. Types of Languages and the Chomsky Hierarchy. Finite and Stack Automata. Turing machines.

Bibliography:

MENEZES, P. **Linguagens Formais e Autômatos**. São Paulo: Sagra-Luzzatto. 2005.

HOPCROFT, J. **Introdução a Teoria dos Autômatos, Linguagens e Computação**. Campus, 2001.

LEWIS, H., Papadimitriou, C. **Elements of the Theory of Computation**. Prentice-Hall, 1981.

Code	Course Name	CL
CCOM009	Data Structure	60

Syllabus:

Introduction to object-oriented programming. Containers classes: arrays, sorted arrays, lists and its variants (dynamic allocation). Abstract data types: stacks, queues, priority queues, trees, graph. Complexity order notation. Algorithms of sorting and ordering.

Bibliography:

LAFORE, R. **Aprenda em 24 horas – Estruturas de Dados e Algoritmos**. Campus, 1999.

KRUSE, Robert L; RYBA, Alexander J. **Data Structures and Program Design in C++**. Prentice Hall, 1999.

LEISERSON, Charles; CORMEN, Thomas. **Algoritmos: Teoria e Prática**. Campus, Rio de Janeiro, 2002.

Code	Course Name	CL
CCOM010	Discrete Mathematics	60

Syllabus:

Sets and Functions. Axiomatic Construction of the Set of Natural Numbers: Peano Postulates. Algebraic structures: Rings, Integral domain , Well-ordered Domains, Axiomatic construction of the Set of Integer Numbers. Representation of the Integer Numbers: Numbering systems. Factoring of Integer Numbers: Greatest common divisor, prime numbers. Modular Arithmetic: Congruences, Zn Rings, RSA cryptography. Notions on the Graph Theory. Elementary combinatorics.

Bibliography:

EVARISTO, Jaime. **Introdução à Álgebra Abstrata**. Maceió: EDUFAL, 2002.

ALBERTSON, M. O. **Discrete Mathematic with Algorithms**. USA: Wiley & Sons, 1998.

KNUTH, D. E. **The Art of Computer Programming**, Volume 2. USA: Addison-Wesley, 1988.

GRAHAM, R.; KNUTH, D; PATASCHINK, O. **Matemática Concreta**. Rio de Janeiro: LTC, 1995.

SZWARCFILER, Jaime. L. **Grafos e Algoritmos Computacionais**. Campus, 1984.

Code	Course Name	CL
CCOM011	Calculus 1	60

Syllabus:

Functions and graphs. Limit and continuity. A derivative and a derivation. Extreme Values of Functions. Graphic plotting techniques. A differential. Integration and the definite integral.

Bibliography:

ÁVILA, Geraldo. **Cálculo 1, Funções de uma Variável Real**. Rio de Janeiro: LTC, 2004.

STEWART, James. **Cálculo 1.** São Paulo: Thomson Learning, 2005.

SWOKOWSKI, Earl. **Cálculo com Geometria Analítica.** São Paulo: Makron Books, 1994.

GUIDORIZZI, Hamilton. **Um Curso de Cálculo.** Rio de Janeiro: LTC, 2001.

LEITHOLD, Louis. **Cálculo com Geometria Analítica**. São Paulo: Harbra, 1994.

Code	Course Name	CL
CCOM12	Linear Algebra	60

Syllabus:

Linear Equations Systems. Gauss-Jordan Methods. Vector Spaces. Basis and Dimension. Spaces with Internal Product. Linear transformations. Eigenvalues and Eigenvectors. Operator diagonalization. Introduction to Jordan's form. Domestic product. Special types of linear operators. Linear, bilinear and quadratic forms. Applications.

Bibliography:

CALLIOLI, Carlos. **Álgebra Linear e Aplicações.** São Paulo: Editora Atual, 1990.

STEINBRUCH, Alfredo. **Álgebra Linear**. São Paulo: Makron Books, 1987.

Code	Course Name	CL
CCOM013	Research and scientific Work Methodology.	30

Syllabus:

Science and scientific knowledge. Difference between science and technology. The scientific research. Scientific theory and the research validation. The general research methodology. Research types. Researching methods and techniques. Problem and set of problems- Hypothesis Enhancement. Exploratory studies and theoretical reference. Development of a research project and of a research report. Auxiliary tools.

Bibliography:

CASTRO, C. M. **A Prática da Pesquisa**. Pearson, 2006.

VOLPATO, G. L. **Ciência: da filosofia à publicação**. Cultura Acadêmica, 2007

COSTA, Ana Rita. **Orientações Metodológicas para Produção de Trabalhos Acadêmicos**. Maceió: Edufal, 1997.

LAKATOS, E.M. **Fundamentos de Metodologia Científica**. São Paulo: Atlas, 2001.

Code	Course Name	CL
CCOM014	Logic Applied to Computing	60

Syllabus:

Evolutionary history. Logic Fundamentals. Propositional logic. First-Order Logic. Automated Theorem Proving. Seminars in complementary subjects.

Bibliography:

CHANG, C.: LEE, R. **Symbolic Logic and Mechanical Theorem Proving**. Academic Press, 1973.

VAN, Dalen D. **Logic and Structure.** Second Edition. Springer-Verlag, 1989.

SOUZA, J. N. **Lógica para Ciência da Computação**. Rio de Janeiro: Editora Campus, 2002.

ENDERTON, H. B. **A Mathematical Introduction to Logic**. USA: Academic Press, 1972.

Code	Course Name	CL
CCOM015	Theory of Computation	30

Syllabus:

Count and enumerability. Church-Turing Thesis. Computing models. Theory of recursive functions. Turing Machines. Decidability. Halting problem. Reducibility. Computational complexity.

Bibliography:

SIPSER, M. **Introduction to the Theory of Computation.** PSW Publishing Company, 1997.

DIVÉRIO, T ; MENEZES, P. B. **Teoria da Computação.** Sagra-Luzzatto, 2005.

LEWIS, H; PAPADIMITRIOU, C. **Elements of the Theory of Computation.** Prentice-Hall, 1981.

BREINERD, W. S. **Theory of Computation**. USA: John Wiley & Sons, 1974.

Code	Course Name	CL
CCOM016	Software Project	60

Syllabus:

Fundamentals of Data Abstraction, object orientation, generic programming and handling of exceptions. Fundamentals of a given object-oriented language, abstraction, inheritance, polymorphism. Advanced aspects: classes and instances, operator overload, templates, function objects, iterators, and object-oriented design patterns.

Bibliography:

STROUSTRUP, B. **An Overview of the C++ Programming Language, in The Handbook of Object Technology**. CRC Press, Boca Raton, 1999.

STROUSTRUP, B. **A Linguagem de Programação C++**. 3ª ed. Porto Alegre: Bookman, 2000.

DEITEL, D. **Java Como Programar**. 6ª ed. São Paulo: Pearson, 2005.

GAMMA, Erich; HELM, Richard; JOHNSON, Ralph; VLISSIDES, John M. **Design Patterns: Elements of Reusable Object-Oriented Software**. Addison Wesley, 1995.

Code	Course Name	CL
CCOM017	Physics 1	60

Syllabus:

Physical quantities. Vectors. Kinematics and particle dynamics. Work and energy. Dynamics of a particle system. Kinematic and rotational dynamics.

Bibliography:

HALLIDAY, Resnick. **Fundamentos de Física.** Volume 1. Rio de Janeiro: LTC, 2001.

Code	Course Name	CL
CCOM018	Calculus 2	60

Syllabus:

The indefinite integral. Logarithms and exponentials. Trigonometric functions and inverse trigonometric functions. Hyperbolic functions. Integration techniques. Applications of integration. Polar coordinates. Improper integrals. Taylor's formula. Infinite sequences and series.

Bibliography:

ÁVILA, Geraldo. **Cálculo 2**, **Funções de uma Variável Real**. Rio de Janeiro: LTC, 2004.

STEWART, James. **Cálculo 2**. São Paulo: Thomson Learning, 2005.

SWOKOWSKI, Earl. **Cálculo com Geometria Analítica**. São Paulo: Makron Books, 1994.

GUIDORIZZI, Hamilton. **Um Curso de Cálculo**, Rio de Janeiro: LTC, 2001.

LEITHOLD, Louis. **Cálculo com Geometria Analítica**. São Paulo: Harbra, 1994.

Code	Course Name	CL
CCOM019	Digital Circuits	30

Syllabus:

Numerical Systems and Codes. Logical Ports and Boolean Algebra. Combinational and Sequential Circuits. Binary Arithmetic: Operations and Circuits. Digital-analogue and analog-digital conversion.

Bibliography:

WAGNER, Flávio. **Fundamentos de Circuitos Digitais.** Porto Alegre: Sagra-Luzzatto, 2006.

TAUB, Hebert. **Circuitos Digitais e Microprocessadores.** São Paulo: McGraw Hill, 1984.

MALVINO, A. P. **Eletrônica Digital: Princípios e Aplicações**. São Paulo: McGraw-Hill, 1988.

TANENBAUM, A.S. **Organização Estruturada de Computadores**. Brasil: Prentice Hall, 2007.

STALLINGS, William. **Arquitetura e Organização de Computadores**. Brasil: Prentice Hall, 2002.

Code	Course Name	CL
CCOM020	Design and Analysis of Algorithms	60

Syllabus:

Design of Algorithms. Recursiveness. Analysis of algorithm complexity. Presentation of optimization problems. Dynamic programming. NP-complete problems. Special algorithms.

Bibliography:

CORMEN, T. H.; LEISERSON, C. E.; RIVEST, R. L.; STEIN, C. **Introduction to Algorithms**. 2ª ed.. Cambridge: MIT Press, 2001.

CORMEN, Leiserson; RIVEST. **Algotirmos: Teoria e Prática**. Rio de Janeiro: Campus, 2002.

PARBERRY, I. **Problems on Algorithms**. USA: Prentice Hall, 1995.

SZWARCFITER, J. **Estruturas de Dados e seus Algoritmos**. Rio de Janeiro: LTC, 1994.

Code	Course Name	CL
CCOM021	Database 1	60

Syllabus:

Primary and secondary access methods. Database architecture and data models. Conceptual design: entity-relationship model. Logical design. Relational model. Case studies in DBMS. Transactions, concurrency, recovery, security, and database integrity. SQL language.

Bibliography:

NAVATHE, S; ELMASRI, R. E. **Sistemas de Banco de Dados**. Brasil: Addison Wesley, 2005.

SILBERSCHATZ, Abraham. **Sistemas de Banco de Dados**. Rio de Janeiro: Campus, 2006.

DATE, C. J. **Introdução a Sistemas de Banco de Dados**. Rio de Janeiro: Campus, 2004.

SETZER, Valdemar. **Banco de Dados.** São Paulo: Edgard Blucher, 2005.

HEUSER, C.A. **Projeto de Banco de Dados**. Porto Alegre: Sagra-Luzzatto, 2004.

Code	Course Name	CL
CCOM022	Probability and Statistics	60

Syllabus:

Exploratory analysis. Probability. Discrete and continuous distribution of random variables. Expected value and variance. Statistical inference: parameter estimation and hypothesis testing. Special topics. Use of computational tools.

Bibliography:

MAGALHÃES, M.T; LIMA, A.C. **Noções de Probabilidade e Estatística**. 6ª ed.. São Paulo: EDUSP, 2004.

BUSSAB, W; MORETTIN, P. **Estatística Básica**. 5ª ed.. São Paulo: Saraiva, 2004.

YATES, R.D; GOODMAN, D.J. **Probability and Stochastic Processes: A Friendly Introduction for Electrical and Computer Engineers**. New York: John Wiley & Sons, 2002.

DEKKING, F. M.; KRAAIKAMP, C.; LOPUHAÄ, H. P. & Meester, L. E. **A Modern Introduction to Probability and Statistics: Understanding Why and How**. Springer, 2005.

MAGALHÃES, M. N. **Probabilidade e Variáveis Aleatórias**. IME-USP, 2004.

VERZANI, J. **Using R for Introductory Statistics**. Chapman & Hall/CRC, 2004.

LAPPONI, J.C. **Estatística Usando Excel**. 2ª ed.. São Paulo: Lapponi, 2000.

DALGAARD, P. **Introductory Statistics with R**. Springer, 2002.

Code	Course Name	CL
CCOM023	Methodology and Processes	30

Syllabus:

Stages of software development. Models of software processes. Software specification requirements. Data collection techniques. Planning and software design. Project management. System models. Software testing.

Bibliography:

SOMMERVILLE, Ian. **Engenharia de Software**. São Paulo: Prentice-Hall, 2003.

PRESSMAN, Roger. **Engenharia de Software**. São Paulo: McGraw-Hill, 2002.

REZENDE, Denis. **Engenharia de Software**. Rio de Janeiro: Brasport, 2005.

PFLEEGER, Shari. **Engenharia de Software: Teoria e Prática**. São Paulo: Prentice-Hall, 2004.

FILHO, Wilson. **Engenharia de Software: Fundamentos, Métodos, Padrões**. São Paulo: LTC, 2003.

Code	Course Name	CL
CCOM024	Physics 3	60

Syllabus:

Introductory study of the Electricity and Magnetism theory.

Bibliography:

HALLIDAY, Resnick. **Fundamentos de Física**. Volume 3. Rio de Janeiro: LTC, 2001.

Code	Course Name	CL
CCOM025	Calculus 3	60

Syllabus:

Parameterized curves. Arc length. Curvature and Torsion. Frenet Trihedron. Functions of several variables. Limit and continuity. Partial derivatives. Differentiable applications. Jacobian Matrix. Directional derivatives. Gradient. Chain Rule. Implicit functions. Vector functions. Theorem of inverse function. Maximum and minimum. Lagrange multipliers. Taylor's formula.

Bibliography:

ÁVILA, Geraldo. **Cálculo 2, Funções de uma Variável Real**. Rio de Janeiro: LTC, 2004.

STEWART, James. **Cálculo 2, Thomson Learning**. São Paulo, 2005.

SWOKOWSKI, Earl. **Cálculo com Geometria Analítica**. São Paulo: Makron Books, 1994.

GUIDORIZZI, Hamilton. **Um Curso de Cálculo**. Rio de Janeiro: LTC, 2001.

LEITHOLD, Louis. **Cálculo com Geometria Analítica**. São Paulo: Harbra, 1994.

Code	Course Name	CL
CCOM026	Organization and Architecture of Computers	60

Syllabus:

Basic computer organization: processor, memory, Input-Output. Internal organization of the processor. Memory hierarchy. I/O devices. Buses. Microarchitecture and microprogramming. Instruction set architecture. Machine language and assembly language. Unconventional architectures.

Bibliography:

TANENBAUM, A.S. **Organização Estruturada de Computadores**. Brasil: Prentice Hall, 2007.

STALLINGS, William. **Arquitetura e Organização de Computadores**. Brasil: Prentice Hall, 2002.

WEBER, Raul. **Fundamentos de Arquitetura de Computadores**. Porto Alegre: Sagra Luzzato, 2001.

MURDOCCA, Miles. **Computer Organization and Architecture**. Ie-Wiley, 2007.

HENNESSY, John. **Arquitetura de Computadores: uma Abordagem Quantitativa**. Rio de Janeiro Campus, 2003.

Code	Course Name	CL
CCOM027	Programming Language Concepts	60

Syllabus:

Fundamentals of the analysis of programming languages. Names, linking, type checking and scopes. Types of data.Expressions, assignment, and control structures. Subprograms.

Bibliography:

SEBESTA, Robert. **Conceitos de Linguagens de Programação**. Porto Alegre: Bookman, 2000.

PRATT, T. **Programming Languages: Design and Implementation**. USA: Prentice Hall, 1996.

Code	Course Name	CL
CCOM028	Database 2	30

Syllabus:

Integration of databases. Data Warehouse. Distributed database concepts. Object-oriented database notions.

Bibliography:

NAVATHE, S.; ELMASRI, R.E. **Sistemas de Banco de Dados**. Brasil: Addison Wesley, 2005.

SILBERSCHATZ, Abraham. **Sistemas de Banco de Dados**. Rio de Janeiro: Campus, 2006.

DATE, C. J. **Introdução a Sistemas de Banco de Dados**. Rio de Janeiro: Campus, 2004.

SETZER, Valdemar. **Banco de Dados**. São Paulo: Edgard Blucher, 2005.

Code	Course Name	CL
CCOM029	Experimental physics	30

Syllabus:

Electricity and Magnetism Laboratory.

Bibliography:

HALLIDAY, Resnick. **Fundamentos de Física**. Volume 3. Rio de Janeiro: LTC, 2001.

Code	Course Name	CL
CCOM030	Graph Theory	30

Syllabus:

Introduction to graph theory. Basics: oriented, non-oriented, bipartite graphs. Paths in graphs. Weddings. Subgraphs, hypergraphs, matroids and clicks. Trees and generating trees. Connectivity. Path problems. Stability and color number. Planar graphs. Eulerian and Hamiltonian circuits. Graphs without circuits. Networks. Flows in network.

Bibliography:

SZWARCFITER, Jayme. **Grafos e Algoritmos Computacionais**. Rio de Janeiro: Campus, 1984.
NETTO, Paulo B. **Grafos: Teoria, Modelos e Algoritmos**. São Paulo: Edgard Blucher, 1996.

Code	Course Name	CL
CCOM031	Software Test	60

Syllabus:

This course addresses the subject of identifying and removing failures in software systems using automated testing strategies. The following topics are covered:
(1)Software testing fundamentals; (2)Testing planning; (3)Black box test; (4) White box test; (5) Gray box test(based on the architecture); (6) tools for test automation and support. The method used will have a theoretical-practical character, with theoretical concepts and real examples, followed by practical classes with exercises.

Bibliography:

BEIZER, B. **Software Testing Techniques**. International Thomson Computer Press, 2a ed, 1990.

BINDER, R. **Testing OO Systems**. Addison Wesley, 2000.

MARTINS, E. **Verificação e Validação de Software**. Notas de Curso, 2005.

J.MYERS, G. **The Art of Software Testing**. John Wiley & Sons, 1979.

PRESSMAN, Roger. **Software Engineering. A Practitiner's Approach**. 4ª edição, 1997.

SOMMERVILLE, Ian. **Engenharia de Software**. São Paulo: Prentice-Hall, 2003.

Code	Course Name	CL
CCOM032	Computer Networks 1	60

Syllabus:

Computer networks concepts. Data communication. Computer network architecture. Low-level protocols. High-level protocols. Local computer networks. Long-distance networks. Notions of interconnection of computer networks.

Bibliography:

KUROSE, James F. **Redes de Computadores e a Internet:Uma Abordagem *Top-down***. 3ª ed.. Pearson Education, 2006.
TANEMBAUM, Andrew. **Redes de Computadores**. 4ª ed. Rio de Janeiro: Campus, 2003.
PETERSON, Larry. **Computer Networks: a Systems Approach**. USA: Morgan Kaufmann, 2003.

Code	Course Name	CL
CCOM033	Artificial Intelligence 1	60

Syllabus:

Historical aspects and artificial intelligence conceptualization. Troubleshooting via search. Representation of knowledge and reasoning. Specialist systems. Acquisition of knowledge and automatic learning. Case-based reasoning. Treatment of uncertainty. Seminars on complementary topics.

Bibliography:

LUGER, George. **Inteligência Artificial: Estruturas e Estratégias para a Solução**. Porto Alegre: Bookman, 2004.

RUSSELL, Stuart; NORVIG, Peter. **Inteligência Artificial**. Rio de Janeiro: Campus, 2004.

RICH, Elaine; KNIGHT, Kevin. **Inteligência artificial**. 2ª ed. São Paulo: Makron Books, 1994.

Code	Course Name	CL
CCOM034	Operating Systems	60

Syllabus:

Basic concepts. The Operating Systems evolution. Operating systems structure and functions. Processes management. Memory management. Input/Output management. File Systems. Case studies on operating systems.

Bibliography:

TANENBAUM, Andrew. **Sistemas Operacionais Modernos**. São Paulo: Prentice-Hall, 2003.

SILBERSCHATZ, Abraham. **Fundamentos de Sistemas Operacionais**. Rio de Janeiro: LTC, 2004.

DEITEL, C. **Sistemas Operacionais**. São Paulo: Prentice-Hall, 2005.

TANENBAUM, Andrew S.; WOODHULL, Albert S. **Operating systems: Design and Implementation**. 3ª ed.. Upper Saddle River: Prentice-Hall, 2006.

Code	Course Name	CL
CCOM035	Compilers	60

Syllabus:

Language processors: compiler and interpreter. Introduction to compiling. Compiling stages. Ambiguity. Grammar relations. Lexical Analysis. Ascending and descending syntax analysis. Syntactic and lexical analysis tools. Tables of symbols. Semantic analysis and code generation. Introduction to code optimization.

Bibliography:

PRICE, A. M. **Implementação de Linguagens de Programação: Compiladores**. Sagra Luzzato, 2001.

AHO, Sethi Ullman. **Compiladores: Princípios, Técnicas e Ferramentas**. Rio de Janeiro: LTC, 1986.

SETZER, Valdemar. **A Construção de um Compilador**. Rio de Janeiro: Campus, 1986.

Code	Course Name	CL
CCOM036	Programming Languages Paradigms	30

Syllabus:

Programming: Structured, Functional, Logic, Object-oriented, others.

Bibliography:

SEBESTA, Robert. **Conceitos de Linguagens de Programação**. Porto Alegre: Bookman, 2000.

PRATT, T. **Programming Languages: Design and Implementation**. USA: Prentice Hall, 1996.

Code	Course Name	CL
COMP037	Operational Research	60

Syllabus:

Operational research objectives. Linear Programming. Modeling. Simplex Method. Resources Allocation Problem. Duality. Optimal Resources Evaluation. Analysis of the linear programming model sensibility. Transportation problem. Analysis of the transportation model sensibility. Designation problem.

Bibliography:

GOLDBARD, M. C.; LUNA, H. P. L. **Otimização Combinatória e Programação Linear: Modelos e Algoritmos**. Campus, Rio de Janeiro, 2005.

PRADO, Darci Santos do. **Programação Linear.** Série Pesquisa Operacional Volume I. Belo Horizonte: Editora DG, 2003.

ARENALES, M.; ARMENTANO, V.; MORABITO, R.; YANASSE, H. **Pesquisa operacional para cursos de engenharia**. Editora Campus, 2007.

LACHTERMACHER, Gerson. **Pesquisa operacional na tomada de decisões**. 3. ed.; Editora Campus, 2006.

Code	Course Name	CL
CCOM038	Numerical Methods	60

Syllabus:

Computational Arithmetic. Numerical solution of nonlinear equations systems. Computational linear algebra. Functions approximation. Numerical Integration and differentiation.

Bibliography:

RUGGIERO, Márcia. **Cálculo Numérico: Aspectos Teóricos e Computacionais**. São Paulo: Makron Books, 1996.

KINCAID, D.; CHENEY, W. **Numerical Analysis: Mathematics of Scientific Computing**. USA: Brooks-Cole, 2002.

CLÁUDIO, Dalcidio M.; MARINS, Jussara M. **Cálculo numérico computacional: teoria e prática**. São Paulo: Atlas, 2000.

SPERANDIO, Décio; MENDES, João Teixeira; SILVA, Luiz Henry M. **Cálculo Numérico: Características Matemáticas e Computacionais dos Métodos Numéricos**. Prentice Hall, 2006.

PRESS, William H.; TEUKOLSKY, Saul A.; VETTERLING, William T.; FLANNERY, Brian P. Numerical Recipes in C. Cambridge University, 1996.

Code	Course Name	CL
CCOM039	Computer Networks 2	30

Syllabus:

Multimedia Networks. High speed networks. Wireless networks. Mobility. Network security. Network management.

Bibliography:

KUROSE, James F. **Redes de Computadores e a Internet:Uma Abordagem *Top-down***. 3ª ed.. Pearson Education, 2006.

TANEMBAUM, Andrew. **Redes de Computadores**. Rio de Janeiro: Campus, 2003.

SCHILLER, Jochen. **Mobile Communications**. USA: Addison Wesley, 2003.

Code	Course Name	CL
CCOM040	Artificial Intelligence 2	60

Syllabus:

Overview and Evolution of the Distributed Artificial Intelligence (DAI). Main approaches to DAI. Distributed resolution of problems. Intelligent agents. Multi-agents systems. Introduction to neural and evolutionary computing.

Bibliography:

REZENDE, S. O. **Sistemas Inteligentes: Fundamentos e Aplicações**. Manole, 2005.

WOOLDRIDGE, M. **An Introduction to MultiAgent Systems**. John Wiley & Sons, 2002.

FERBER, J. **Multi-Agent Systems: An Introduction to Distributed Artificial Intelligence**. Addison-Wesley, 1999.

WEISS, G. **Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence**. MIT Press, 1999.

LUGER, G. F. **Inteligência Artificial: Estruturas e Estratégias para a Solução de Problemas Complexos**. 4ª ed.. Porto Alegre: Bookman, 2004.

RICH, E.; KNIGHT, K. **Inteligência Artificial**. São Paulo: McGraw-Hill, 1988. RUSSELL,

Stuart; NORVIG, Peter. **Inteligência Artificial**. Rio de Janeiro: Campus, 2004.

Code	Course Name	CL
CCOM041	Computer Graphics	60

Syllabus:

3D and 2D Geometric transformations. Modelling. Visualization, Illumination. Virtual Reality. Tools and software environments.

Bibliography:

GOMES, Jonas e Cruz Velho. **Fundamentos da Computação Gráfica**. Rio de Janeiro: IMPA, 2003.

WATT, Alan. **3D Computer Graphics**. USA: Addison Wesley, 1999.

HEARN, Donald. **Computer Graphics with Open GL**, NJ: Pearson Education, 2004.

BORGES, José Antonio. **Introdução às técnicas de computação gráfica 3D**. Rio de Janeiro: SBC, 1988.

ANGEL, Edward. **Interactive computer graphics: a top-down approach with OpenGL.** 3rd ed. Reading. MA: Addison-Wesley, 2003.

AMES, A.L.; NADEAU, D.R.; MORELAND, J.L. **VRML 2.0 sourcebook**. 2. ed. New York: Wiley, 1997.

Code	Course Name	CL
CCOM042	Entrepreneurship	30

Syllabus:

The enterprise and the entrepreneur. Characteristics of entrepreneur. Simplified business plan. Visionary Theory. viability studies. Market Analysis. Marketing fundamentals. Creativity. Financial planning. Funding sources, incubators. Basic Concepts of Business Legislation. Entrepreneurs testimonials. Business simulation. Business plans analysis.

Bibliography:

DOLABELA, Fernando. **O Segredo de Luisa**. São Paulo: Cultura, 1999.

DOLABELA, Fernando. **Oficina do Empreendedor**, São Paulo: Cultura, 1999.

DORNELAS, J.C.A. **Empreendedorismo Transformando Idéias Em Negócios**. 2ª ed. Campus, 2005.

DORNELAS, J.C.A. **Empreendedorismo na Prática**. 1ª Edição. Editora Campus, 2008.

SALIM, César. **Construindo Planos de Negócios**. Rio de Janeiro: Elsevier, 2003.

COVEY, Sthephen. **Os 7 Hábitos das Pessoas Altamente Eficazes**. São Paulo: Best Seller, 2002.

CARLZON, Jan. **A Hora da Verdade**. Rio de Janeiro: Sextante, 2003.

Code	Course Name	CL
CCOM043	Human-Machine Interaction	30

Syllabus:

The concepts and fundamentals of interaction and human-machine interface. Interaction design techniques. Task analysis. Usability testing and interface evaluation tools. *Persona*.

Bibliography:

KRUG, S. **Don't Make Me Think! A Common Sense Approach to Web Usability**. 2 ª ed. Idianapolis: New Riders, 2005.

DUMAS, J. S.; REDISH, J. C.. **A Practical Guide to Usability Testing**. Ed. ver.. Intellect, Bristol, 1999.

HACKOS, J. T.; REDISH, J. C. **User and Task Analysis for Interface Design**. New York: John Wiley & Sons, 1998.

PRUITT, J.; ADLIN, T. **The Persona Lifecycle: Keeping People in Mind Throughout Product Design**. San Francisco: Morgan Kaufmann, 2006.

Code	Course Name	CL
CCOM044	Distributed systems	60

Syllabus:

Characterization of distributed computing systems. Models of distributed systems. Processes in distributed systems. Processes in distributed systems. Distributed objects. Synchronization and coordination. Distributed systems services. Security in distributed systems. New models of distributed systems. Distributed Algorithms. Replication and fault tolerance.

Bibliography:

COULOURIS, G. **Dollimore J. Distributed Systems: Concepts and Design**. USA: Addison Wesley, 2005.
TANENBAUM, A. **Steen M. Distributed Systems: Principles and Paradigms**. USA: Prentice Hall, 2002.

Code	Course Name	CL
CCOM045	Notions of Law	60

Syllabus:

General notions of law and civil law. Commercial law- general notions, debt securities, commercial companies. Industrial property and copyright. Labor law- concepts of employee and employer, duration of work, remuneration. Work justice. Tax law - active and passive subjects of the tax obligation, taxes. Administrative law- administrative acts, public competition. Specific legislation.

Bibliography:

NADER, Paulo. **Introdução ao Estudo do Direito**. Rio de Janeiro: Companhia Forense, 2006.

MACHADO, Hugo. **Introdução ao Estudo do Direito**. São Paulo: Atlas, 2004.

COELHO, Luiz. **Aulas de Introdução ao Direito**. São Paulo: Manole, 2004.
GROPPALI, Alessandro. **Introdução ao Estudo do Direito**. São Paulo: Âmbito Cultural, 2003.
POLETTI, Ronaldo. **Introdução ao Direito**. Campo Grande: Saraiva, 1996.

Code	Course Name	CL
CCOM046	Introduction to Administration	60

Syllabus:

Entrepreneurship, Business Choice, Economic Scenario, Strategic Planning, Organization of the Company, Marketing, Operations, People Management, Motivation and Leadership, Accounting and Finance for Entrepreneurs, Concepts of Project Management, Planning and Business Implementation.

Bibliography:

MAXIMINIANO, Antonio César. **Administração para Empreendedores**. São Paulo: Pearson Prentice Hall, 2006.

MAXIMINIANO, A. C. **Introdução à Administração**. São Paulo: Atlas, 2004.

FIALHO, Francisco. **Empreendedorismo na Era do Conhecimento**. Florianópolis: Visual Books, 2006.

SALIM, César. **Construindo Planos de Negócios**. Rio de Janeiro: Elsevier, 2003.

Code	Course Name	CL
CCOM047	Computer, Society and Ethics	30

Syllabus:

Computerization and its economical consequences. Computerization and the educational aspect. Political effects. Social impacts. Computerization and privacy. Informatics and economic and social development. The Impact of Automation and the Labor Question. Digital inclusion. Current issues and considerations about the future.

Bibliography:

DYSON, Esther. **A Nova Sociedade Digital**. Rio de Janeiro: Campus, 1988.

FERNANDES, Aguinaldo. **Gerencia Estratégica da Tecnologia da Informação**. Rio de Janeiro: LTC, 1992.

NEGROPONTE, Nicholas. **A Vida Digital**. São Paulo: Companhia das Letras, 1995.

Code	Course Name	CL
CCOM048	Project Management	60

Syllabus:

Life cycle and project organization. Integration management. Scope management. Costs management. Quality management. Human resource management. Communication management. Risk management. Management of acquisitions. Software for project management.

Bibliography:

PMI INSTITUTE. **Um Guia do Conjunto de Conhecimentos em Gerenciamento de Projetos**. Pennsylvania, EUA: Project Management Institute, 2004.

HELDMAN, K. **Gerência de Projetos: Guia Para o Exame Oficial do PMI**. São Paulo: Campus, 2005.

PRADO, D. S. **Gerenciamento de Projetos nas Organizações**. Belo Horizonte: EDGerencial, 1999.

DINSMORE, C. **Como se Tornar Um Profissional em Gerenciamento de Projetos**. Rio de Janeiro: Qualitymark,, 2005.

Elective Courses- Predefined Syllabi

Code	Course Name	CL
CCOM1001	Systems Analysis- Requirements Engineering	30

Syllabus:

Object-oriented analysis. Techniques of elicitation and specification of requirements. Documentation of software requirements using UML. Requirements validation techniques. Models for software systems specification.

Bibliography:

SOMMERVILLE, Ian. **Engenharia de Software**. São Paulo: Prentice-Hall, 2003. PRESSMAN,

Roger. **Software Engineering: A practitioner's Approach**. McGraw-Hill, 2004. HULL, E.;

JACKSON, K.,Dick, J. **Requirements Engineering**. SpringerVerlag, 2004.

SOMMERVILLE, Ian; SAWYER, P. **Requirements Engineering: A Good Practice Guide**. John Wiley & Sons, 1997.

CHISTEL, M.G.; KANG, K.C. **Issues in Requirements Elicitation**. Software Engineering Institute, Technical Report CMU/SEI-92-Tr-12, Pittsburgh, PA.Carnegie Mellon University, Sep, 1992.

SCHNEIDER, G.; WINTERS, J. **Applying Use Cases- A practical guide**. Addison-Wesley, 1998.

Code	Course Name	CL
CCOM102	Software Architecture	30

Syllabus:

Introduction to the software architecture and indication of concepts. Architectural styles and reference architectures. Architectural views. Documentation of architectures. Development focused on architecture. Evaluation of software architectures.

Bibliography:

BASS, Len. CLEMENTS, Paul and KAZMAN, Rick. **Software Architecture in Practice**. Addison-Wesley Professional, 1st edition 1997.

FOWLER, Martin. **Patterns of Enterprise Application Architecture**. Addison-Wesley Professional, 2002.

CLEMENTS, Paul. Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Robert Nord, Judith Stafford. **Documenting Software Architecture: Views and Beyond.** Addison Wesley Professional,2002.

Code	Course Name	CL
COMP103	Settings and Changes Management	30

Syllabus:

Introduction to settings management and changes, their importance, their role in the software development process. Check-in and check-out procedures. Paper in GC. Change Control(RCMs). Standards in Configuration Management. Supporting tools. Processes for change control. Processes for environmental management.

Bibliography:

BAYS, M.E. **Software Release Methodology**. Prentice Hall, 1999.

Configuration Management Today - http://cmtoday.com

Code	Course Name	CL
CCOM104	Calculus 4	60

Syllabus:

Multiple Integrals. Line Integrals. Conservative vector fields. Change of variables in multiple integrals. Parameterized surfaces. Surface integrals. Theorem of Green. Gauss's theorem. Stoke's Theorem. Differential equations of first and second order. Elementary methods of solution. Linear Differential Equations.

Bibliography:

ÁVILA, Geraldo. **Cálculo 2, Funções de uma Variável Real**. Rio de Janeiro: LTC, 2004.

STEWART, James. **Cálculo 2, Thomson Learning**. São Paulo, 2005.

SWOKOWSKI, Earl. **Cálculo com Geometria Analítica**. São Paulo: Makron Books, 1994.

GUIDORIZZI, Hamilton. **Um Curso de Cálculo**. Rio de Janeiro: LTC, 2001.

LEITHOLD, Louis. **Cálculo com Geometria Analítica**. São Paulo: Harbra, 1994.

Code	Course Name	CL
CCOM105	Formal Methods	30

Syllabus:

Introduction to formal software development (motivation, development cycle, verification versus validation, classification of methods). Formalism in software development. Notations for formal specification. Modeling, verification and validation of software systems. Case studies.

Bibliography:

BJORNER, D. **Formal Specification and Software Development**. Prentice Hall, NJ, 1982.

CLARKE, Jr., Edmund M.;**Model checking**. Cambridge, MA : MIT Press, 1999.

EHRING, H. **Fundamentals of Algebraic Specification 1: Equations and Initial Semantics**. Springer-Verlag, USA, 1985.

EHRING, H. **Fundamentals of Algebraic Specification 2: Module Specification and Constraints.** Springer-Verlag, 1990.

Code	Course Name	CL
CCOM106	Computational Statistics	30

Syllabus:

Introduction to computational statistics. Replacement method. Maximum likelihood methods, Bayesian inference and nonlinear optimization. Monte Carlo essays. Computational platforms.

Bibliography:

GIVENS, G.H.; HOETING, J.A. **Computational Statistics**. 4ª ed. Wiley, New York, 2006.

GENTLE, J.E.; HARDLE, W.; MORI, Y. (Eds). **Handbook of Computional Statistics: Concepts and Methods**. 1ª ed., Springer. New York, 2004.

FRERY, A.C.; CRIBARI-NETO, F. **Elementos de Estatística Computacional usando Plataformas de Software Livre Gratuito**, IMPA, Rio de Janeiro, 2005.

DALGAARD, P. **Introductory Statistics with R**, Springer, New York, 2002.

MAMDONALD, J. ; BRANN, J. **Data Analysis and Graphics with R: an Example-based Approach**. Cambridge, 2003.

Code	Course Name	CL
CCOM107	Images Processing	30

Syllabus:

Images and digital processing. Scanning and viewing images. Transfer and storage of images. Image processing. Spectral analysis. Digital filtering. Image restoration techniques. Classification of images.

Bibliography:

BARRETT, H. H.; MYERS, K. J. **Foundations of Image Science**. Wiley-Interscience, 2004.

JAIN, A. K. **Fundamentals of Digital Image Processing.** Prentice-Hall International Editions, 1989.

RICHARDS, J. A.; JIA, X. **Remote Sensing Digital Image Analysis**. Springer, 1999.

Code	Course Name	CL
CCOM108	Wireless and Mobile Computing	30

Syllabus:

Mobile equipments. Operating Systems for mobile environment. Languages for mobile environment. Restrictions and limitations in mobile environments. Wireless data transmission. Applications.

Bibliography:

The bibliography will be defined according to the approach adopted by the professor responsible for the course..

Code	Course Name	CL
CCOM109	Linear Programming	30

Syllabus:

Formulation of linear programming models. Graphic solution. Simplex method. Geometry of the simplex method. Revised Simplex Algorithm. Duality. Sensitivity analysis and economic interpretation. Flows in networks.

Bibliography:

GOLDBARD, M. C.; LUNA, H. P. L. **Otimização Combinatória e Programação Linear: Modelos e Algoritmos**. Rio de Janeiro: Campus, 2005.

PRADO, Darci Santos do. **Programação Linear.** Série Pesquisa Operacional Volume I. Belo Horizonte: Editora DG, 2003.

Code	Course Name	CL
CCOM110	Software Quality	30

Syllabus:

The history and concept of quality. The concept of software quality. Software quality metrics. Software quality standards. Software quality assurance techniques. Software testing: concepts, types and application in the context of quality. Models of software process improvement. Planning of software quality systems. Standards: ISO, SEI, CMMi, MPS-BR.

Bibliography:

WEBER, Kival. **Qualidade de Software: Teoria e Prática.** Rio de Janeiro: Makron-Books, 2001.

KOCIANSKI, André. **Qualidade de Software**. São Paulo: Novatec, 2006.

BARTIE, Alexandre. **Garantia da Qualidade de Software**. Rio de Janeiro: Campus, 2002.

SILVA, Ivan. **Qualidade em Software**. São Paulo: Alta Books, 2005.

Code	Course Name	CL
COMP111	Programming for Large Computers	30

Syllabus:

Notions of architecture and large computer operating system. Programming for large computer: language, access to files, access to database.

Bibliography:

The bibliography will be defined according to the approach adopted by the professor responsible for the course.

Code	Course Name	CL
COMP112	Petri nets	30

Syllabus:

Introduction to Modeling of Petri Nets and Systems. Petri Nets Place Transition. Colored Petri nets. Timed Colored Petri nets. Hierarchical Colored Petri Nets. Analysis of Properties. Tools for editing and analysis of Petri nets. Applications with Petri nets.

Bibliography:

JENSEN, Kurt; KRISTENSEN, Lars M. **Coloured Petri Nets: Modelling and Validation of Concurrent Systems. Springer**, 2009.

MURATA, T. **Petri net: properties, analysis and application**. Proceedings of the IEEE 77(4):541-580, 1989.

JENSEN, Kurt; KRISTENSEN, Lars Michael; WELLS, Lisa. **Coloured Petri Nets and CPN Tools for Modelling and Validation of Concurrent Systems**. International Journal on Software Tools for Technology Transfer. Springer, 2007.

Code	Course Name	CL
COMP113	Software Reuse Techniques	30

Syllabus:

Software Engineering based on software reuse, Basic Concepts of Component Based Development. Component Based Development, Use of Frameworks in Component-based Development, Component Reuse based on Software Product Line approach, Reuse of software projects using Design Patterns. Development Processes for Software Reuse x Development Processes with Software Reuse.

Bibliografia:

SOMMERVILLE, Ian. **Engenharia de Software**. São Paulo: Prentice-Hall, 2003.

PRESSMAN, Roger. **Engenharia de Software**. São Paulo: McGraw-Hill, 2002.

CHEESMAN, John; DANIELS, John. **UML Components: A Simple Process for Specifying Component-Based Software**, Addison Wesley, 2001.

FAYAD, Mohamed E.; JOHNSON, Ralph E.; SCHMIDT, Douglas C.. **Building Application Frameworks: Object-Oriented Foundations of Framework Design**, John Wiley and Sons, 1999.

CLEMENTS, Paul; NORTHROP, Linda. **Software Product Lines: Practices and Patterns**, Addison Wesley, 2001.

Code	Course Name	CL
COMP114	Libras Fundamentals	60

Syllabus:

Historical panorama of Brazilian sign language, its theoretical and methodological foundations; introduction to the basic skills and abilities required for satisfactory communicative performance in the processes of interaction and inclusion of the deaf in the educational system.

Bibliography:

The bibliography will be defined according to the approach adopted by the professor responsible for the course.

Elective Courses- Topics

Code	Course Name	CL
CCOM201	Topics on Humanities	-

Syllabus:

The topics will be defined by the professor in ministering the course, focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined in the function of the Humanities theme to be adopted by the professor responsible for the course.

Code	Course Name	CL
CCOM202	Topics on Scientific Computing	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the topic on Scientific Computing to be adopted by the professor responsible for the discipline.

Code	Course Name	CL
CCOM203	Topics on Parallel Computing	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the topic on Parallel Computing to be adopted by the professor responsible for the discipline.

Code	Course Name	CL
CCOM204	Topics on Databases	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the topic on Databases to be adopted by the professor responsible for the discipline.

Code	Course Name	CL
CCOM205	Topics on Basic Software	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the topic on Basic Software to be adopted by the professor responsible for the discipline.

Code	Course Name	CL
CCOM206	Topics on Software Engineering	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the topic on Software Engineering to be adopted by the professor responsible for the discipline.

Code	Course Name	CL
CCOM207	Topics on Computers Architecture	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the topic on Computers Architecture to be adopted by the professor responsible for the discipline.

Code	Course Name	CL
CCOM208	Topics on Data Communication	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the topic on Data communication to be adopted by the professor responsible for the discipline.

Code	Course Name	CL
CCOM209	Topics on Computer Networks	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the topic on Computer Networks to be adopted by the professor responsible for the discipline.

Code	Course Name	CL
CCOM210	Topics on Artificial Intelligence	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the topic on Artificial Intelligence to be adopted by the professor responsible for the discipline.

Code	Course Name	CL
CCOM211	Special Topics on Computing	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the special topics on Computer Networks to be adopted by the professor responsible for the discipline.

Code	Course Name	CL
CCOM212	Topics on Computational Modelling of Knowledge	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the topic on Computational Modelling of Knowledge to be adopted by the professor responsible for the discipline.

Code	Course Name	CL
CCOM213	Special Topics on Programming	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the topic on Programming to be adopted by the professor responsible for the discipline.

Code	Course Name	CL
CCOM214	Topics on Informatics in Education	-

Syllabus:

The topics will be defined by the professor in ministering the discipline focusing on the main current subjects of the area.

Bibliography:

The bibliography will be defined according to the topic on Programming to be adopted by the professor responsible for the discipline.

6. Supervised Internship

The non-obligatory Supervised Internship of the Computer Science Program has the articulation of theoretical and professional knowledge in its broader sense, for it promotes activities focused on the qualification of computer science professionals well-aware of the market various realities, either on scientific applications or business-related ones.

The Computer Science Supervised Internship is coordinated by the Program Collegiate and it is optional. It can be taken as from the third semester. The students have to develop practical activities in order to consolidate the knowledge acquired from studied courses as they have contact with the local reality, its difficulties and needs onto improving and automation.

The supervised internships should be monitored by a professor from the Computer Science Institute, who is responsible for the student's progress in their practical activities, providing him with guidance and support aiming at their good performance throughout the entire internship.

The Supervised Internship can be remunerated or not, in educational institutes or in private companies being mandatory that there is a Computer Science professional in either of those, who will be responsible for the student's activities and might be able to evaluate him/her at the end of the Internship.

7. Undergraduate Thesis

The conclusion of the program will depend on the individual elaboration of a final undergraduate thesis(TCC), presented to an examining board, under the coordination of the Collegiate of the Computer Science Program, as provided in Resolution No. 01-IC, 10.08.2006. The thesis is not considered a course despite having a 90-hour workload for curricular completion.

The undergraduate thesis represents the final course assignment established on the General Regiment of the University, being mandatory its deliver by paper and the proper individual presentation before a examining board constituted by a minimum of 2(two) professors who did not participate on the mentoring of this assignment.

The undergraduate thesis has the goal of develop the critic capacity and creative production of the student, demonstrating the acquired knowledge throughout the program. Therefore, in addition to the aid of a mentor, the student will have in the curricular structure a discipline of Methodology of Research and Scientific Work in the third semester of the Program, in order to assist him on the preparation of the thesis.

8. Complementary activities

The complementary activities should be addressed throughout the program, following the established workload, according to each student's individual planning. At the end of the program, the Coordination will register the students individual activities defining every activities correspondent workload, considering among others and all related to the course: research, extension, tutoring, cultural, scientific and student's events (congresses, seminars, meetings, conferences, lectures, courses), thematic nuclei, interdisciplinary subjects, extracurricular courses ministered outside the course or by other institutions, if compatible the Bachelor's Degree in Computer Science.

The complementary part of the UFAL Computer Science Program with a 200 (two hundred) hours workload, can be compound as it follows:

<table>
<tr><th colspan="3">Deployment of Activity groups UNECE
Resolution 113/95</th></tr>
<tr><td>GROUP 1</td><td>Tutoring</td><td colspan="2">Up to 100 hours per full year and in total</td></tr>
<tr><td rowspan="9">GROUP 2</td><td>Single courses, from other graduation courses.</td><td colspan="2">Total of the course timetable, up to 120 hours total.</td></tr>
<tr><td rowspan="6">Participating on events: seminars. Congresses, conferences, student's meetings, refresher courses.</td><td colspan="2">Inner-City</td></tr>
<tr><td>5 hours per non-workday</td><td>10 hours per workday</td></tr>
<tr><td colspan="2">Up to 50 hours a year and 150 hours total</td></tr>
<tr><td colspan="2">Out of City</td></tr>
<tr><td>10 hours per non-workday</td><td>20 hours per workday</td></tr>
<tr><td colspan="2">Up to 50 hours a year, 150 hours total</td></tr>
<tr><td>Thematic Nuclei.</td><td colspan="2">Up to 150 hours total.</td></tr>
<tr><td>Extension activities.</td><td colspan="2">Up to 100 hours a year, 150 hours total</td></tr>
<tr><td>Extracurricular Internships.</td><td colspan="2">Up to 100 hours a year, 150 hours total</td></tr>
<tr><td rowspan="2">GROUP 3</td><td>Research activities and scientific initiation.</td><td colspan="2">Up to 100 hours a year, 150 hours total</td></tr>
<tr><td>Works published</td><td colspan="2">30 hours each.</td></tr>
<tr><td rowspan="2">GROUP 4</td><td>Administration and representation in student activity.</td><td colspan="2">Up to 50 hours a year, 100 hours total</td></tr>
<tr><td>Representation in UFAL collegiates</td><td colspan="2">Up to 50 hours a year, 100 hours total</td></tr>
</table>

The activities must be relevant and useful to the Computer Science Bachelor's qualification and admitted by the Program's Collegiate, aware of the interdisciplinarity.

The supporting documents must remain under the custody of the student, in his own folder, after being addressed by the Program's Coordinator, with the respective computation of the workload.

In order to assist the students on the complementary activities, the Program's Coordination will promote a seminar, lecture or congress once a year within the scope of the University with partnership of other institutions or private companies to stimulate a diverse range of activities of the students.

In addition, the participation on research and extensions on the computer science and related areas will be promoted and consolidated in a connected manner with the education, seeking for the fundamental and practical qualification of the computer science bachelor with the due valuing as a complementary activity.

9. Assessment

9.1. Assessment of the Pedagogical Project

The permanent assessment of this Pedagogical Project to be implanted with the current proposal is of fundamental importance in assessing the success of the curriculum proposed for the Program, as well as to ensure the need for future changes that may improve the Project, aware of its dynamic nature and the need to adapt to the constant assessments it will have to face.

Mechanisms for institutional and for academic performance (teaching and learning) assessments should be inserted under the guidance of the UFAL High Councils in accordance with the current Institution norms to make possible a diagnostic and formative analysis during the entire process of implementation of the current Pedagogical Project.

This assessment should use strategies and tactics that allow a wide discussion, in order to detect the deficiencies that may exist.

The university extension activities carried out within the scope of the Program, in partnership with public institutions or private companies will also be evaluated by society through appropriate instruments, including in non-compulsory curricular stages.

In order to evaluate the Pedagogical Project of the program, the guidelines for the educational conditions proposed by INEP/MEC are going to be adopted as well as it follows:

1. Didactic-Pedagogical Organization: Academic Administration, Project of the Course, Academic Activities articulated to the teaching of graduation;
2. Faculty Members: Professional Qualification, Working Conditions, Professional and Academic Performance.
3. Infrastructure: General Facilities, Library, Facilities and Specific Laboratories

9.2. Faculty Members Assessment

The faculty members' performance assessment will be carried out by the students /disciplines by answering a proper form and obeying the institutional evaluation process criteria.

9.3. Students Assessment

The verification of learning will be validated by the student's regular attending to the classes and by the achievements on the studies, which should be achieved jointly. This verification will be applied according to the current resolutions.

9.4. Learning Assessment Final Considerations

It is indispensable that the evaluation be understood as a broad process of learning, thus involving the responsibilities of the teacher and the student. Thus, the evaluation proposed here should also be based on questions of behavioural assessment, humanistic assessment, cognitive evaluation and evaluation in the socio-cultural model. People are seen to learn differently and at different times.

In order to guarantee students' progress, the students will also be evaluated on their Scientific Initiation activities, internships and tutoring. The collegiate will guide the student's performance on ENADE, and on selections for graduate programs through POSCOMP which is one of the country's most important postgraduate selection programs.