A - General description

Programme Title – Computer Engineering (AKA Computer Science, AKA IS/IT Engineering).

Qualification awarded – BSc, 1st cycle of Bologna Process (*Licenciatura*) (180 ECTS credits)

Admission requirements – 12th grade national exam on Mathematics, or Physics, or Descriptive Geometry; alternatively, special admission procedures for candidates older than 23; alternatively, special admission procedures for candidates holding a specific or recognized professional course of technological specialized studies.

Educational and Professional goals – Deliver engineers with professional skills in ICT (Information and Communication Technologies) particularly in Software Development, Specification, Installation and Management of Computer-based Systems, Information Systems Management and ICT Projects, in general.

Access to further studies – Any graduate can apply to Master Programs (2nd cycle of Bologna Process), offered by other colleges, in similar or related areas.

Course structure diagram with credits (60 per year) – 30 ECTS credits throughout 6 semesters (3 years):

Course Title	Year	Semester	Number of credits
Mathematical Analysis I	1	1	6
Álgebra	1	1	6
Introduction to Computer Programming	1	1	6
Digital Systems	1	1	6
Introduction to Technology	1	1	6
Mathematical Analysis II	1	2	6
Logic and Computing	1	2	6
Introduction to Digital Electronics	1	2	6
Object-Oriented Programming	1	2	6
Internet Technology I	1	2	6
Probability and Statistics	2	1	6
Data Structures and Algorithms	2	1	6

Introduction to Telecommunications	2	1	6
Computer Architecture I	2	1	6
Databases I	2	1	6
Operating Systems	2	2	6
Computer Data Networks I	2	2	6
Databases II	2	2	6
Microprocessors	2	2	6
Internet Technology II	2	2	6
Systems Analysis	3	1	6
Computer Data Networks II	3	1	6
Computer Architecture II	3	1	6
Management and Security of Computer Networks	3	1	6
Distributed Systems	3	1	6
Entrepreneurship	3	2	6
Information Systems on Organizations	3	2	6
Networking Project	3	2	6
Information Systems Project	3	2	6
Final Project	3	2	6

Final examination, if any – none

Examination and assessment regulations – specific rules for each course.

ECTS departmental co-ordinator – Prof. José M. P. R. Ramos

B - Description of individual course units

Course title	Mathematical Analysis I
Course code	91191
Type of course	One-semester course
Level of Course	I
Year of study	First
Semester/trimester	First
Number of credits	6
Name of lecturer	Luís Merca, Manuela Fernandes, Cristina Costa
Objectives of the course (preferably expressed in terms of learning outcomes competences)	1- To give the basic concepts and mathematical methods usually used in this engineering bachelor. 2- To provide students, skills to work with differential and integral calculus in functions of one real variable.
Prerequisites	NA
Course contents	1- Preliminaries. 2- Real functions of a real variable. 3- Limits and continuity. 4- Differential calculus 5- Integral calculus.
Recommended reading	Texts and support material available in the course webpage. Jaime Carvalho e Silva; "Princípios de Análise Matemática Aplicada". Mc Graw-Hill. Swokowski, E. W.; "Cálculo com Geometria Analítica". Mc Graw-Hill. Piskounov, N.; "Cálculo Diferencial e Integral". Edições Lopes da Silva, Porto. Simmons, G. F.; "Cálculo com Geometria Analítica". Mc Graw-Hill. Anton, Howard; "Cálculo um novo horizonte. Volume I". Bookman. Stewart, James; "Cálculo. Volume I". Pioneira. Larson, Ron; "Cálculo. Volume I". 8ª Edição. McGraw Hill.
Teaching methods	Theoretical lectures, with presentation and exemplification of the proposed subjects. Theoretical-practical lectures to propose and solve exercises.
Assessment methods	Continuous assessment: two written tests. Exam assessment: one written test.
Language of instruction	Portuguese

B - Description of individual course units

Course title	Algebra
Course code	91192
Type of course	One-semester course
Level of Course	NA
Year of study	First
Semester/trimester	First
Number of credits	6
Name of lecturer	Carlos Perquilhas; Pedro Carrasqueira
Objectives of the course (preferably expressed in terms of learning outcomes competences)	To provide insight on Matrix Linear Algebra, placing special emphasis on the discussion and the exact and approximate computation of the solution of linear systems of equations. Furthermore, Vector Spaces, Determinants and Matrix Eigenvectors and Eigenvectors are studied. These are topics of utmost interest in many Engineering applications.
Prerequisites	NA
Course contents	1 - Complex numbers 2 - Matrices and systems of linear equations. 3 - Vector spaces. 4 - Determinants. 5 - Eigenvalues and eigenvectors of square matrices.
Recommended reading	Lecture notes available at the IPT *e-learning* platform. F. Dias Agudo, Introdução à Álgebra Linear e Geometria Analítica, Escolar Editora, Lisboa,1978. E. Giraldes, P. Smith, Curso de Àlgebra Linear e Geometria Analítica, Mcgraw-Hill, Lisboa, 1995. L. T. Magalhães, Álgebra Linear como Introdução à Matemática Aplicada, Texto Editora, 1989. W. Nicholson, Linear Algebra with Applications, PWS Publishing Company, Boston, 1995. M. Heath, Scientific Computing: an Introductory Survey, McGraw-Hill, 2007. R. Burden e J. Faires, Numerical Analysis, John Wiley & Sons, 1993.
Teaching methods	Theoretical and theoretical-practical lectures, with presentation and exemplification of the proposed subjects.
Assessment methods	Continuous assessment: two written tests and a computational work, developed with the software Maple. Exam assessment: one written test.
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Introduction to Computer Programming
Course code	91193
Type of course	One-semester course
Level of Course	NA
Year of study	First
Semester/trimester	First
Number of credits	6
Name of lecturer	Luís Oliveira
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Solving problems using algorithms. Using a programming language to express an algorithm. Using 'C' programming language to construct a computer program.
Prerequisites	NA
Course contents	1- Introduction to Computers and Programming. 2- Introduction to Algorithms and programming languages. 3- Data processing and manipulation. 4- Control flow: Statements and blocks; IF-Else; Switch; While; For; Do. 5- Functions and program Structure. 6- Pointers and arrays. 7- Structures. 8- Dynamic memory allocation. 9- Files: input and output.
Recommended reading	"C Programming Language", Ritchie and Kernighan, Prentice Hall, May 1, 1990, ISBN 978-0131108592 "Linguagem C", Luís Damas. FCA, 1999
Teaching methods	Lectures: Oral exposition. Laboratory sessions: Laboratorial classes with practical experiments.
Assessment methods	Practice (40%): Assignments and homework. Reports and presentations. Theory (60%): Exam assessment
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Digital Systems
Course code	91124
Type of course	One-semester course
Level of Course	NA
Year of study	First
Semester/trimester	First
Number of credits	6
Name of lecturer	Manuel Barros
Objectives of the course (preferably expressed in terms of learning outcomes competences)	This course was designed as an introductory course in digital electronics. It focuses on analytical reasoning and basic digital design using the standard integrated circuits (ICs) that are used in industry today. Basic notions of digital circuit analysis and design synthesis are introduced, supported by modern CAD software.
Prerequisites	NA
Course contents	1 – Introduction to the laws and postulates of Boolean Algebra. 2 – Simplification of logic networks with Karnaugh Maps. 3 – Study of logic design with integrated circuit (IC) gates. 4 – Numeric system fundamentals. 5 – Introduction to combinatorial circuits, mux, demux, decoders. 6 – Study of encoders, comparators and arithmetic components. 7 – Introduction to sequential logic, flip-flops, counters, RAMs. 8 – Synthesis and analysis of digital circuits with CAD software. 9 – Study of ICs logic families, properties and main characteristics 10–Introduction to Programmable Logic design with HDLs.
Recommended reading	Text and support materials are available in the web page of course unit and the Moodle system. 1. John Wakerly, *Digital Design Principles and Practices*, 3rd edition, Prentice Hall (2000) 2. Cuesta, L. E Padilla, G., *Electrónica Digital*, Mc Graw Hill 3. Nelson, Victor P., Nagle, H. Troy, Carrol, Bill D., e Irwin, J. David., *Digital Logic Circuit Analysis and Design*, Prentice Hall.
Teaching methods	Theoretical classes in which digital system design methods and techniques will be described and demonstrated and practical laboratory classes involving application of the concepts learned.
Assessment methods	Written test during regular examination period and practical works carried out during the laboratory classes (7 practical works approx.)
Language of instruction	Portuguese.

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B - Description of individual course units

Course title	Introduction to Technology
Course code	91195
Type of course	One-semester course
Level of Course	NA
Year of study	First
Semester/trimester	First
Number of credits	6
Name of lecturer	José Ramos; Jorge Mascarenhas.
Objectives of the course (preferably expressed in terms of learning outcomes competences)	To understand the main topics of digital image processing (2D); To perform solid modelling (3D) practices at an elementary level; To adopt fundamental ICT terminology at all communication and argumentation levels; To perform basic research on ICT subjects;
Prerequisites	NA
Course contents	1. Digital Image Processing (2D); 2. 3D CAD (Computer-Aided Design) practice: solid primitives, CSG (constructive solid geometry), B-Rep (boundary representation) and scenario rendering. 3. Solid Modelling Practice; 4. The Socio-Technical Dimensions of the Informatics Engineer: ICT (Information and Communication Technology) Professional Skills; 5. Computing and Internet History: Computing Generations, Moore Law; Computing Architectures; Architectures of Networks and Supported Services; Internet Services; The World Wide Web; Web 1.0 and Web 2.0; 6. Information and Knowledge Management: research and interpersonal communication; 7. Computer Systems Concepts for Information in Organizations: devices and services, back-office and front-office, e-Commerce and e-Business;
Recommended reading	Digital resources supplied by lecturers
Teaching methods	Solid modelling practice in computer 3D laboratory and presentations of ICT topics and subjects
Assessment methods	Practical works assessment
Language of instruction	Portuguese

B - Description of individual course units

Course title	Mathematical Analysis II
Course code	91196
Type of course	One-semester course
Level of Course	II
Year of study	First
Semester/trimester	Second
Number of credits	6
Name of lecturer	Carlos Perquilhas, Luís Merca, Manuela Fernandes
Objectives of the course (preferably expressed in terms of learning outcomes competences)	1- To provide the basic concepts and mathematical methods usually used in this engineering course. 2- To provide the students with skills to work with differential and integral calculus in functions of several real variables.
Prerequisites	NA
Course contents	1- Numerical and Functions Series. 2- Real functions of several real variables. 3- Multiple Integrals.
Recommended reading	Texts and support material available in the course webpage. Jaime Carvalho e Silva; "Princípios de Análise Matemática Aplicada". Mc Graw-Hill. Swokowski, E. W.; "Cálculo com Geometria Analítica". Mc Graw-Hill. Piskounov, N.; "Cálculo Diferencial e Integral". Edições Lopes da Silva, Porto. Simmons, G. F.; "Cálculo com Geometria Analítica". Mc Graw-Hill. Anton, Howard; "Cálculo um novo horizonte. Volume II". Bookman. Stewart, James; "Cálculo. Volume II". Pioneira. Larson, Ron; "Cálculo. Volume II". 8ª Edição. McGraw Hill. Zill D., Cullen M.; "Advanced Engineering Mathematics".PWS Azenha A., Jerónimo M., "Cálculo Diferencial e Integral em R e R^n " Mac Graw-Hill.
Teaching methods	Theoretical lectures, with presentation and exemplification of the proposed subjects. Theoretical-practical lectures to propose and solve exercises.
Assessment methods	Continuous assessment: two written tests. Exam assessment: one written test.
Language of instruction	Portuguese

B - Description of individual course units

Course title	Logic and Computing
Course code	91197
Type of course	One-semester course
Level of Course	NA
Year of study	First
Semester/trimester	Second
Number of credits	6
Name of lecturer	João Patrício
Objectives of the course (preferably expressed in terms of learning outcomes competences)	To provide insight on the main concepts of Logics, Set Theory, Graphs and Numerical Methods - topics that are essential in areas such as Networks, System Analysis and Formal Verification.
Prerequisites	NA
Course contents	1 –Logic and Set Theory fundamentals 2 – Graphs and diagraphs. Application to Trees and Minimum Cost Path problems. 3 – Nonlinear equations and Systems of Nonlinear Equations 4 – Polynomial Interpolation 5 – Numerical Integration 6 – Numerical Methods for Ordinary First Order Differential Equations
Recommended reading	Lecture notes available at the IPT *e-learning* platform. • K. Rosen, Discrete Mathematics and its Applications, Mc Graw–Hill, 1995 • Burden R., Faires J.,"Numerical Analysis". PWS Publishing Company (1993)
Teaching methods	Theoretical and theoretical-practical classes, with presentation and exemplification of the proposed subjects, as well as laboratorial sessions for computer implementation and analysis.
Assessment methods	Continuous assessment: two written tests and computational projects. Exam assessment: one written test.
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Introduction to Digital Electronics
Course code	91198
Type of course	One-semester course
Level of Course	NA
Year of study	First
Semester/trimester	Second
Number of credits	6
Name of lecturer	Pedro Daniel Frazão Correia
Objectives of the course (preferably expressed in terms of learning outcomes competences)	1 To analyse DC electrical circuits using the fundamental laws. 2 To know the main characteristics of the semiconductor devices used in analogue and digital electronics. 3 To analyse and design basic digital circuits. 4 To use development tools to synthesize digital circuits in programmable logic devices.
Prerequisites	Digital Systems
Course contents	1 Circuit Analysis: Definitions and conventions; Unit systems; materials characterization; Kirchhoff laws; Fundamental Theorems of Electrical circuits. 2 Semiconductor Devices: diode; bipolar transistor; MOS transistor. 3 Digital Electronics: CMOS digital circuits; Bipolar digital circuits; logic families; Memories; Programmable logic devices. 4 Descriptive Hardware Languages: Digital systems project using VHDL language.
Recommended reading	1 Jaime Santos, Análise de Circuitos Circuitos Eléctricos, Minerva, 1997; 2 William H. Hayt Jr. , Jack E. Kemmerly, Engineering Circuit Analysis, McGraw Hill, 5ª Edição, 1993; 3 Manuel de Medeiros Silva, "Introdução aos Circuitos Eléctricos e Electrónicos", F.C. Gulbenkian, 1996; 4 Manuel de Medeiros Silva, "Circuitos com Transístores Bipolares e MOS", F.C. Gulbenkian, 1999; 5 Sedra/Smith, Microelectronic Circuits, Oxford University Press, 1998; 6 James O. Hamblen, "Rapid Prototyping of Digital Systems", Kluwer Academic Publishers, 2000; 7 Peter J. Ashenden, "The Student'd Guide to VHDL", Morgan Kaufmann Publishers, 1998; 8 Andrew Rushton,"VHDL for Logic Synthesis", John Wiley and Sons, 1998;
Teaching methods	- Lectures; - Problem solving classes; - Laboratory works
Assessment methods	Exam (70%) (a minimum of 45% required) Laboratory (30%) (a minimum of 45% required)
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Object-Oriented Programming
Course code	91199
Type of course	One-semester course
Level of Course	NA
Year of study	First
Semester/trimester	Second
Number of credits	6
Name of lecturer	António Manso
Objectives of the course (preferably expressed in terms of learning outcomes competences)	1 - Apply the basic principles of problem solving using Object-Oriented programming; 2 - Develop functional code through the C++ language, and its class libraries; 3 - Manage situations of error and exception in the software development; 4 - Develop applications with graphical interfaces directed by events.
Prerequisites	Basic knowledge of programming.
Course contents	1 - Introduction to Object-Oriented Programming 2 - Visual programming. 3 - Programming with classes. 4 - Definition of library classes.
Recommended reading	1 -Texts and other materials available on the e-learning platform: 2 - Guerreiro, Pedro João Valente Dias: Programação com Classes em C++, FCA, 2000 3 - Stroustroup, Bjarne: The C++ Programming Language, Addison-Wesley, 1997 4 - Eckel, Bruce: Thinking in C++ , 2003
Teaching methods	1- Lectures focusing on content presentation. 2 - Practical classes for problem solving and consolidation of knowledge using the computer. 3 - Individual guidance of students during project execution.
Assessment methods	Practical assignments and “closed book” examination.
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Internet Technology I
Course code	911910
Type of course	One-semester course
Level of Course	I
Year of study	First
Semester/trimester	Second
Number of credits	6
Name of lecturer	José Ramos
Objectives of the course (preferably expressed in terms of learning outcomes competences)	To use client-side programming techniques in order to produce dynamic Web contents, respecting recent standards and recommendations of the W3C Consortium, including: XHTML (Extensible Hype-rText Markup Language), CSS Language (Cascading Style Sheets), Hypermedia DOM (Document Object Model) and JavaScript Language.
Prerequisites	NA
Course contents	XHTML (Extensible HyperText Markup Language) e DHTML (Dynamic HyperText Markup Language): W3C standards, sintax, structure and practice; CSS (Cascading Style Sheets) fundamentals: external style sheets, embedded style and inline styles; CSS styling practice: box model, colour schemes, class and object modelling, block metrics; DOM (Document Object Model): class hierarchy, specification levels; properties and methods; JavaScript programming: syntax, dynamic interfaces, forms validating, object motion, event triggered actions, form validation, development of Web interfaces applications;
Recommended reading	Digital resources supplied by the lecturer and content reference Websites: www.w3schools.com and www.devguru.org;
Teaching methods	Presentation of theoretical topics and practices and development of practical works
Assessment methods	Practical works assessment
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Probability and Statistics
Course code	911911
Type of course	One-semester course
Level of Course	NA
Year of study	Second
Semester/trimester	First
Number of credits	6
Name of lecturer	Luís Miguel Grilo
Objectives of the course (preferably expressed in terms of learning outcomes competences)	To provide students with solid foundations of some of the main techniques and methodologies of Statistics, so that they develop analysis and reasoning skills that allow them to design and implement solutions to various problems. To provide the tools that facilitate decision-making.
Prerequisites	Fair knowledge of Mathematical Analysis and Linear Algebra.
Course contents	1 - Elements of probability. 2 - Random variables. Some probability distributions. 3 - Sampling and sample distributions. 4 - Estimation of parameters. 5 - Tests of hypotheses. 6 - Correlation and simple linear regression.
Recommended reading	Support material available on the course website. Guimarães, Rui C. e Cabral, José A. S. (2007). *Estatística*. 2.ª Edição, McGraw-Hill. Pedrosa, A. C. e Gama, S. M. A. (2004). *Introdução Computacional à Probabilidade e Estatística*. Porto Editora.
Teaching methods	Theoretical classes describing and exemplifying the concepts and methods taught. Theoretical-practical classes involving exercise solving. Laboratory and tutorial classes making use of statistical data processing software.
Assessment methods	Continuous assessment: two written tests Final assessment: examination on regular exam periods.
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Data Structures and Algorithms
Course code	911912
Type of course	One-semester course
Level of Course	NA
Year of study	Second
Semester/trimester	First
Number of credits	6
Name of lecturer	António Manso
Objectives of the course (preferably expressed in terms of learning outcomes competences)	1 - Describe the most common data structures and algorithms, as well as its advantages, limitations and application; 2 - Apply data structures in the resolution of concrete problems; 3 - Design, develop, and test programs for the resolution of medium and big problems.
Prerequisites	Object-oriented programming.
Course contents	1 - Introduction to Java language 2 - Algorithm development techniques 3 - Algorithms complexity analysis 4 - Sorting algorithms. 5 - Linear data structures 6 - Hierarchical data structures 7- Graphs
Recommended reading	1 -Texts and other materials available on the course e-learning platform. 2 - Weiss, Mark Allen - Data Structures and Algorithm Analysis in Java Addison Wesley . 3 - Bruno R. Preiss - Data Structures and Algorithms with Object-Oriented Design Patterns in Java .
Teaching methods	1- Theoretical classes including content presentation. 2 - Practical classes including problem solving and consolidation of knowledge using the computer. 3 - Individual guidance of students on project execution.
Assessment methods	Practical works and “closed book” examination.
Language of instruction	Portuguese

B - Description of individual course units

Course title	Introduction to Telecommunications
Course code	911913
Type of course	One-semester course
Level of Course	NA
Year of study	Second
Semester/trimester	First
Number of credits	6
Name of lecturer	Pedro Correia
Objectives of the course (preferably expressed in terms of learning outcomes competences)	1- To understand the frequency analysis of continuous signals using Fourier Transform;2- To understand the fundamentals of analogue-to-digital conversion; 3- To understand the physical impairments of transmission systems;4- To characterise the different transmission media;5- To understand modulation systems with continuous carrier applied to analogue and digital transmission.
Prerequisites	Mathematical Analysis.
Course contents	1-Introduction to telecommunications 2-Signals and Systems 3- Sampling and Pulse-Code Modulation 4-Transmission media 5- Analogue modulation with continuous carrier 6- Digital data transmission principles
Recommended reading	1- " Modern Digital and Analog Communication Systems", B. P. Lathi, Oxford University Press, 1998; 2- "Signal Processing and Linear Systems, B. P. Lathi – Oxford University Press,1998; 3- "Data and Computer Communications", William Stallings, Seventh Edition, Pearson Education International;
Teaching methods	- Lectures; - Problem solving classes; - Laboratory classes including two components: simulation works using MATLAB/SIMULINK and cable testing.
Assessment methods	Exam (70%) (a minimum of 45% required) Laboratory (30%) (a minimum of 45% required)
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Computer Architecture I
Course code	911914
Type of course	One-semester course
Level of Course	I
Year of study	Second
Semester/trimester	First
Number of credits	6
Name of lecturer	Carlos David Queiroz
Objectives of the course (preferably expressed in terms of learning outcomes competences)	To understand the general principles of Computer Architecture, its Internal Organization and the implications of the diverse components on its performance and functioning; To understand the impact of the Assembler Instructions on the different components of a Computer; To describe the different memory levels and information transfer forms between the various peripherals; To develop routines in Assembler Language with different passing parameters methods.
Prerequisites	NA
Course contents	1 - General knowledge of Computer Architecture; 2 - Organization of the Central Processing Unit - CPU (Units of Data processing; Control units; Forms of Implementation; Performance Analysis); 3 - Assembler Language (To develop Routines); 4 - Memory Organization (Technologies; Hierarchy and Cache); 5- Organization of Interfaces and Peripherals (Types; Characteristics; Interfaces).
Recommended reading	*Tecnologia dos Equipamentos Informáticos*, Rui Vasco Monteiro e outros, FCA Março 2004 *Computer Organization and Architecture 5th Edition*, William Stallings, Prentice Hall 1999 *The Intel Microprocessors – Architecture, Programming and Interfacing 6th Edition*, Barry B. Brey, Prentice Hall - Pearson Education International 2003 *Computer Systems – Organization & Architecture*, John D. Carpinelly, Prentice Hall - Pearson Education International 2001 *Computer Science – An Overview 8th Edition*, Brookshear, Prentice Hall - Pearson Education International 2005 *PCI Express – System Architecture*, Minishare, Inc., Prentice Hall - Pearson Education International 2004 *Operating Systems*, Gary Nutt, Prentice Hall - Pearson Education International 2004
Teaching methods	Lectures with resort to new technologies. Laboratory practical classes.
Assessment methods	Exam (12 points); Practical works (4 points); Laboratory Classes (4 points).
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Databases I
Course code	911915
Type of course	One-semester course
Level of Course	I
Year of study	Second
Semester/trimester	First
Number of credits	6
Name of lecturer	Casimiro Batista
Objectives of the course (preferably expressed in terms of learning outcomes competences)	This course will provide a thorough introduction to the theory and practice of database systems. The emphasis will be on theoretical considerations about modelling data and designing easy to use and effective database systems. The students will learn concepts such as Database, Data Structure, Data Models, various approaches to Database design, strengths of the relational model and Normalization.
Prerequisites	NA
Course contents	1 - Objectives and functions of Database Management Systems (DBMS). 2 - Hierarchical model. Network model. Relational model. 3 - Relationships. Instances and schemes. Data dictionary. Keys. Primary key, foreign key and indices. Integrity and rules. 4 - Functional dependencies and normalization. First normal form (1FN), second normal form (2FN), third normal form (3FN) and Boyce-Codd normal form. 5 - Entity-relationship method. Extended E-R. 6 - SQL. SQL's DDL commands. SQL's DML commands.
Recommended reading	1 – Texts and other material provided by the course lecturers. 2 – C. J. Date - An introduction to database systems".
Teaching methods	Theoretical classes involving description and exemplification of the study methods. Theoretical-practical classes with application exercises. Laboratory Practice.
Assessment methods	Theory test. Laboratory works/exercises as well as development and presentation of a Project.
Language of instruction	Portuguese

B - Description of individual course units

Course title	Operating Systems
Course code	911916
Type of course	One-semester course
Level of Course	NA
Year of study	Second
Semester/trimester	Second
Number of credits	6
Name of lecturer	Luís Almeida
Objectives of the course (preferably expressed in terms of learning outcomes competences)	To provide students with the fundamental understanding of what an operating system is. Students completing this course should be able to understand the function of an operating system as a resource manager and application interface; identify and describe the current operating systems and its components; know how an operating system and its components work and specify and manage an operating system.
Prerequisites	Basic knowledge of programming skills and computer architecture.
Course contents	1- Operating Systems Introduction; 2- Operating Systems Nucleus; 3- Processes and Threads Management; 4- Process Synchronization and Deadlocks; 5- Inter-process Communications; 6- Memory Mechanisms and Memory Management Algorithms; 7- File System; 8- Security and Protection; 9- Practical content: shell, unix and windows OS programming; Unix and Windows Server system installation and configuration.
Recommended reading	- Gary Nutt, Operating Systems: A Modern Perspective, Third Edition, Addison Wesley, 2004 - W. Stallings, Operating systems internals and design principles, 5ª edição, Prentice-Hall, 2005. - A. Silberschatz. P. B. Galvin, Operating System Concepts, 6th edition, Addison-Wesley, 2003.
Teaching methods	Lectures: oral exposition of course content Laboratory sessions: Laboratorial classes with computer experimental procedures
Assessment methods	End of semester closed book examination. The final mark (CF) is the weighted sum between the score obtained in the written exam (CE), the score in the laboratorial exam (CL) and a series of lab assignments and homework (CA), CF=0.4CE+0.3CL+0.3CA
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Computer Data Networks I
Course code	911917
Type of course	One-semester course
Level of Course	NA
Year of study	Second
Semester/trimester	Second
Number of credits	6
Name of lecturer	Carlos Queiroz
Objectives of the course (preferably expressed in terms of learning outcomes competences)	To plan LAN and WAN networks with unicast packets IP routing; To plan networks to support services that use communications multicast; To plan and to choose equipment; To materialize and to maintain services.
Prerequisites	NA
Course contents	1 - Application Layer (Principles of functioning of the network applications; Application layer Protocols: SMTP, DNS, FTP, HTTP); 2 - Presentation Layer (Principles of functioning; MIME, SSL, TLS); 3 - Session Layer (Principles of functioning; Sockets); 4 - Transport Layer (Introduction to the Transport layer Protocols - UDP and TCP; Used mechanisms of the transport layer to prevent the congestion); 5 - Network Layer (Virtual Circuits Networks; Packets commutation Networks; Internet Protocol; Routing Protocols unicast intra-domain and Inter-domain; Multicast IP; Routing multicast intra-domain and Inter-domain).
Recommended reading	*Data Communications and Networking*, Behrouz A. Forouzan; 4ª Edição; McGraw-Hill. *Computer Networking*, Kurose e Ross; 3ª Edition; Addison Wesley. *Engenharia de Redes Informáticas*, Edmundo Monteiro e Fernando Boavida; FCA. *Routing in the Internet*, Christian Huitema; Prentice Hall. TCP/IP em Redes Microsoft, Paulo Loureiro; FCA.
Teaching methods	Lectures with resort to new technologies. Laboratory practical classes.
Assessment methods	Exam (12 points); Practical works (4 points); Laboratory Classes (4 points).
Language of instruction	Portuguese

B - Description of individual course units

Course title	Databases II
Course code	911918
Type of course	One-semester course
Level of Course	II
Year of study	Second
Semester/trimester	Second
Number of credits	6
Name of lecturer	Casimiro Batista, José Casimiro Pereira
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students will acquire an understanding of database technology and become familiar with both the development of database applications and the administration of multi-user databases.
Prerequisites	Databases I
Course contents	1 – An introduction to the administration of Database Management Systems. 2 – Physical and logical administration of Database Management Systems. 3 – Competition and transactions. 4 – Security and recovery 5 - Query optimization.
Recommended reading	1 – Texts and other material provided by the course lecturers. 2 – C. J. Date - An introduction to database systems". 3 – MySQL – "MySQL Manual"
Teaching methods	Theoretical classes where the study methods are described and exemplified. Theoretical-practical classes where application exercises are solved. Laboratory Practice.
Assessment methods	Theory test. Laboratory works/exercises as well as development and presentation of a small Project.
Language of instruction	Portuguese

B - Description of individual course units

Course title	Microprocessors
Course code	911919
Type of course	One-semester course
Level of Course	NA
Year of study	Second
Semester/trimester	Second
Number of credits	6
Name of lecturer	Manuel Barros
Objectives of the course (preferably expressed in terms of learning outcomes competences)	This course is intended as an introductory course to microprocessor and microcontroller-based system design focused on the Intel MCS51, Motorola 69HCXX and PICs from Microchip Technology family of microcontrollers. The analysis and synthesis of microcontroller systems designs are introduced, supported by modern microcontroller development tools.
Prerequisites	NA
Course contents	1 – Introduction to microcontroller (□C) and microprocessor-based (□P) architectures – Importance and historical review. 2 – Introduction to the modern microcontroller-based systems architectures including MCS51, 69HCXX and PICs families. 3 – Study of memory structures, special registers and I/O ports. 4 – C-Programming languages and addressing modes. 5 – Study and use of □C interrupt mechanisms. 6 – Digital and analogue I/O interfaces, LCD, ADC, motor, keyboards. 7 – Study of USART, CAN, I2C, SPI, IR communication controllers. 8 – I/O addressing circuits, ports and memory upgrades. 9 – Analysis and synthesis microcontroller-based designs.
Recommended reading	Text and support materials are available in the web page of course unit and the Moodle system. 4. Sencer Yelralan e Ashutosh Ahluwalia ,"*Programming and Interfacing the 8051 microcontroller*" – Addson Wesley (1995) 5. Peatman, J.B., "*Design with PIC Microcontrolers*", Prentice Hall 6. "*MCS-51 Family of Single chip Microcomputers,User´s Manual*" – INTEL - http://www.intel.com
Teaching methods	Theoretical classes in which microcontroller-based design methods and techniques will be described and demonstrated. Practical laboratory classes involving exercise solving to apply learned concepts.
Assessment methods	Written test during regular examination period and practical works during the laboratory classes (7 practical works approx.)
Language of instruction	Portuguese.

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B - Description of individual course units

Course title	Internet Technology II
Course code	911920
Type of course	One-semester course
Level of Course	II
Year of study	Second
Semester/trimester	Second
Number of credits	6
Name of lecturer	José Ramos; José Casimiro Pereira
Objectives of the course (preferably expressed in terms of learning outcomes competences)	To use client-side and server-side JavaScript and XML programming technologies, regarding to: represent information through the XML-tree; perform XHTML presentations for XML-coded information; develop and manipulate Active-X objects in order to navigate XML-trees; To develop middleware techniques, based on XML technology, on Web interfaces; To develop Web dynamic interfaces to remote databases, using ASP.NET/SQL programming technologies.
Prerequisites	Internet Technology I
Course contents	XML (Extensible Markup Language) fundamentals: standards, syntax and correctness; XSL (Extensible Stylesheet Language): XSLT (XSL Transformations), XSL-FO (XSL Formatting Objects), XPath (XML Path Language); XML-DOM and XML usage: Xlink (XML Linking Language), Xpointer and XInclude; COM (Component Object Model) / ADO (ActiveX Data Objects) / Recordset Objects; ASP.NET (Active Server Pages.NET): WEB interfaces to remote databases; usability fundamentals for developing human-machine interfaces.
Recommended reading	Digital resources supplied by the lecturer and content reference Websites: www.w3schools.com, www.devguru.org and www.devguru.org; Abreu, L.; *ASP.NET 3.5 - Curso completo*; FCA, 2008. Abreu, L.; *Ajax com ASP.Net - Curso Completo*; FCA, 2007.
Teaching methods	Theoretical classes involving considerations on course content. Execution of practical works.
Assessment methods	Practical works assessment
Language of instruction	Portuguese

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B – Description of individual course units

Course title	Systems Analysis
Course code	911921
Type of course	One-semester course
Level of Course	NA
Year of study	Third
Semester/trimester	First
Number of credits	6
Name of lecturer	José Ramos; José Casimiro Pereira
Objectives of the course	Development of skills for specification/implementation of Information Systems, with UML language and RUP method.
Prerequisites	Knowledge of object-oriented programming

Course contents	▪ Specification of systems requirements
	▪ UML - Unified Modelling Language
	  ▪ Why specification is important?
	  ▪ Introduction to the UML
	  ▪ The notation of UML language
	  ▪ Study of UML Diagrams
	▪ Definition of software tests
	▪ RUP – Rational Unified Process

Recommended reading	▪ Texts and other material available in the course webpage. ▪ Silva, A. and Videira, C.; *UML – Metodologias e Ferramentas CASE*, 2ª Ed; 989-615-009-5,Centro Atlântico (2005); ▪ Stevens, P.; *Using UML: Software Engineering with Objects and Components*, 2nd Ed; 9780321269676; Addison-Wesley(2006)
Teaching methods	Oral presentation of course content (UML) in theoretical classes and supervised problem solving in tutorial classes.
Assessment methods	▪ Written Test, (40% final mark); ▪ Practical Work (60% final mark)
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Computer Data Networks II
Course code	911922
Type of course	One-semester course
Level of Course	NA
Year of study	Third
Semester/trimester	First
Number of credits	6
Name of lecturer	Luís Oliveira
Objectives of the course (preferably expressed in terms of learning outcomes competences)	▪ Local area network project and design. ▪ Selecting appropriate LAN technology. ▪ LAN data management and traffic optimization.
Prerequisites	Data computer networking I
Course contents	1. The link layer and local area networks a. Link layer: Introduction and services. b. Error detection and correction techniques. c. Multiple access protocols. d. Link layer addressing. e. Ethernet. f. Spanning tree protocol (IEEE 802.1D). g. VLANs (IEEE 802.1Q) h. Link aggregation (IEEE 802.3ad). 2. LAN data management and traffic optimization. a. DiffServ model. b. Rate limiting. 3. PPP: point-to-point protocol. 4. Multiprotocol label switching. 5. LAN wireless protocols. 6. LAN physical layer technology.
Recommended reading	Interconnections: Bridges, Routers, Switchs, and Internet Protocols, 2nd ed., Addision-Wesley, 1999. Data Communications and Networking, Behrouz A. Forouzan; 4ª Edição; McGraw-Hill. ISBN – 007-125442-0, 2006. Computer Networking, Kurose e Ross; 3ª Edição; Addison Wesley. ISBN – 0-321-26976-4, 2005
Teaching methods	Lecture sessions including oral presentation of course content. Laboratory sessions: Laboratorial classes including practical experiments.
Assessment methods	Practice (40%): Assignments and homework; Reports and presentations; Theory (60%): Written Exams.
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Computer Architecture II
Course code	911923
Type of course	One-semester course
Level of Course	II
Year of study	Third
Semester/trimester	First
Number of credits	6
Name of lecturer	Luís Almeida
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The overall aim of this course is to provide an advanced understanding of the functioning of a computer and the hardware structures used in computer design. Students completing this course should be able to: Understand design concepts in modern computer architecture; Quantitatively analyse hardware/software interface models; Identify and describe the microprocessor architecture and its components; Be able to program in assembler given a guide to the instruction; Specify and manage computational hardware resources.
Prerequisites	Programming, computer architecture I and operating systems.
Course contents	1- Microprocessor architecture and microcomputer system hardware 2- Instruction Set: machine language architecture 3- Assembly language programming 4- Arithmetic for Computers 5- Arithmetic Coprocessor Programming 6- Memory Hierarchy 7- Input/Output Data Systems 8- Multiprocessors
Recommended reading	- "Computer Organization and Design", John Hennessy and David Patterson, Morgan Kaufman, 1994 - “Computer Organization and Architecture: Designing for Performance", William Stallings, Fifth Edition, Prentice Hall, 2000 - “The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, and Pentium 4 - Architecture, Programming, and Interfacing”, Sixth Edition, Barry B. Brey, Prentice-Hall ©2003
Teaching methods	Lecture sessions: Oral exposition. Laboratory sessions: Laboratorial classes with computer experimental procedures
Assessment methods	End of semester closed book examination. The final mark (CF) is the weighted sum between the score obtained in the written exam (CE), the score in the laboratorial exam (CL) and a series of lab assignments and homework (CA), CF=0.3CE+0.4CL+0.3CA
Language of instruction	Portuguese

B - Description of individual course units

Course title	Management and Security of Computer Networks
Course code	911924
Type of course	One-semester course
Level of Course	NA
Year of study	Third
Semester/trimester	First
Number of credits	6
Name of lecturer	Luís Oliveira
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Understand practical aspects of network security. Define a threat model, and describe vulnerabilities of computer networks of being attacked by adversaries and hackers using a variety of techniques. Apply methods and techniques to circumvent or defend against these attacks and to minimize their damage. Apply methods and tools to management services and computer networks.
Prerequisites	NA
Course contents	1. Network Management: a. Introduction to network management b. The infrastructure for network management c. Network management and SLA evaluation. 2. Network Security: a. Introduction to network security b. Principles of cryptography c. Authentication d. Integrity e. Key distribution and certification f. Access control: Firewalls g. Attacks and countermeasures.
Recommended reading	André Zúquete.: "Segurança em Redes Informáticas". FCA, 2006. Stallings Willian, "Network Security Essentials, Prentice Hall, 2000. Stallings William, "Cryptography and Network Security: Principles and Practice", Prentice Hall, Second Edition, 1998. H.G. Hegering, S. Abeck, B. Neumair , "Integrated Management of Networked Systems & Concepts, Architectures and Their Operational Application", Morgan Kaufmann, 1998
Teaching methods	Lecture sessions: Oral exposition. Laboratory sessions: Laboratorial classes with practical experiments.
Assessment methods	Practice (40%): Assignments and homework, Reports and presentations. Theory (60%): Written Exams.
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Distributed Systems
Course code	911925
Type of course	One-semester course
Level of Course	NA
Year of study	Third
Semester/trimester	First
Number of credits	6
Name of lecturer	António Manso
Objectives of the course (preferably expressed in terms of learning outcomes competences)	1 - Provide the students with theoretical and practical knowledge on distributed systems; 2- Study the design, implementation and operation of distributed systems 3- Program distributed applications
Prerequisites	Object-oriented programming.
Course contents	1 - Introduction to Distributed Systems 2 - Concurrent Programming 3 - Communication between processes 4 - Programming with Sockets 5 - Java RMI 6 - CORBA 7 - Net Remoting 8 - Web-Services
Recommended reading	1 -Texts and other materials available on the e-learning platform of the course unit. 2 - Weiss, Mark Allen - Data Structures and Algorithm Analysis in Java; Addison Wesley . 3 - Tecnologia de Sistemas Distribuídos , José Alves Marques e Paulo Guedes , 1999, FCA Editora de Informática.
Teaching methods	1- Theoretical classes including course content exposition. 2 - Distributed Systems: Concepts and Design , George Couloris, Jean Dollimore, Tim Kindberg , Addison-Wesley 3 - Individual guidance of students on project execution.
Assessment methods	Practical works and “closed book” examination.
Language of instruction	Portuguese

B - Description of individual course units

Course title	Entrepreneurship
Course code	911926
Type of course	One-semester course
Level of Course	NA
Year of study	Third
Semester/trimester	Second
Number of credits	6
Name of lecturer	Carlos Duarte
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Development of skills to build a business plan, preparing the diagnosis of opportunity, the implementation strategy, the investment project and the implementation plan.
Prerequisites	Basic concepts of management.
Course contents	1-Concepts of entrepreneurship. 2-The process of the entrepreneur 3-Methodologies for choosing the project. 4-Developing a business plan. 5-Financing of the project. 6-Creating your company. 7-Success / business failure.
Recommended reading	1- Costa, Horácio e Ribeiro, Pedro (2004). *Criação & Gestão de Microempresas & Pequenos Negócios*, Lisboa: Lidel-Edições Técnicas. 2- Silva, Fábio Geraldes (2001). *Manual do Empreendedor*, Lisboa: Bertrand.
Teaching methods	Theoretical-practical classes in which theory is presented and discussed with presentation of case studies that serve as a support for theoretical concepts. The students' Business Plans are carried out in class with the lecturer supervision.
Assessment methods	Presentation and discussion of the Analysis/Opportunity Plan, the Business Plan and the Final Report of the Project. Written Examination.
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Information Systems on Organizations
Course code	911927
Type of course	One-semester course
Level of Course	NA
Year of study	Third
Semester/trimester	Second
Number of credits	6
Name of lecturer	Nuno Madeira
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Understand the difference between Information, Information Systems and Information Technology. Understand the role of Information Systems at the Organizations. Acquire sensibility for organizational aspects involved when we introduce a new information system. Know how to Manage the Information systems in an organization. Know the importance of aligning IT with business. Know IT-related legislation and standards, mainly IT security. Know how to design an IT department within an organization. Know ERP, CRM, SCM packages to be used inside an organization to support the value chain.
Prerequisites	NA
Course contents	IT Systems on Organizations: Value Channel – Processes to be Supported; IT Systems history; Solutions Map; Information Contents and Flow; Market Solutions; IT Department Organization; IT Strategy; IT Security; IT Investments; Risk Analysis; Aligning Cobit, ITIL and Security Standards; Legislation.
Recommended reading	*Management Information Systems: New Approaches to Organization and Technology*; Laudan K. e Laudan J., Prentice Hall 2004, 8th edition A arquitectura da gestão dos Sistemas de Informação, João Eduardo Quintela Varajão, FCA Editora *Gestão de Serviços TI*; Ivor Macfarlane Colin Rudd: Edição da itSMF (The IT Service Management Forum) Portugal, Lisboa, Maio 2003 Sistemas de Informação: uma abordagem sistémica; Manuel João Pereira; Universidade Católica Editora Unipessoal, Lda; Lisboa 2005 *Método de Auditoria a Sistemas de Informação;* José António Oliveira; Porto Editora; Lisboa, Janeiro 2006 *A Arquitectura e Gestão de Sistemas de Informação*; João Eduardo Quintela Varajão; FCA, Editora de Informática; Agosto 1998 *Estratégias Empresariais e Tecnologias da Informação*; N. Caroline Daniels; Editorial Caminho; 1997 Material prepared by the lecturer.
Teaching methods	Lectures and Group Work
Assessment methods	Examinations, Presentations and Project Work
Language of instruction	Portuguese

B - Description of individual course units

Course title	Networking Project
Course code	911928
Type of course	One-semester course
Level of Course	NA
Year of study	Third
Semester/trimester	Second
Number of credits	6
Name of lecturer	Luís Miguel Lopes de Oliveira
Objectives of the course (preferably expressed in terms of learning outcomes competences)	▪ LAN project and design. ▪ Designing reliable Campus Networks with multimedia services support.
Prerequisites	Data computer networking I and II, Management and security of systems and computer networks.
Course contents	▪ Layer two WAN technologies. ▪ LAN project and design o Wired and wireless networks o VoIP support o Multimedia services support ▪ QoS o QoS models o QoS support and constrains. o SLA evaluation. ▪ Overview and Design of a Campus Network ▪ Building a Campus Network
Recommended reading	Data Networks, IP and the Internet: Protocols, Design and Operation, Martin P. Clark, Wiley, ISBN: 978-0-470-84856-2 Data Networks: Routing, Seurity, and Performance Optimization, Tony Kenyon, Digital Press, ISBN-13: 978-1555582715 High Performance Data Network Design (IDC Technology), Tony Kenyon, Digital Press, ISBN-13: 978-1555582074 Top-Down Network Design, Priscilla Oppenheimer, Cisco Press, ISBN-13: 978-1578700691 Data Communications and Networking, Behrouz A. Forouzan; 4ª Edição; McGraw-Hill. ISBN: 007-125442-0 Computer Networking, Kurose e Ross; 3ª Edição; Addison Wesley. ISBN – 0-321-26976-4
Teaching methods	Lecture sessions: Oral exposition. Laboratory sessions: Laboratorial classes with practical experiments.
Assessment methods	Practice (40%): Assignments and homework; Reports and presentations. Theory (60%): Written Exams.
Language of instruction	Portuguese

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B - Description of individual course units

Course title	Information Systems Project
Course code	911929
Type of course	One-semester course
Level of Course	NA
Year of study	Third
Semester/trimester	Second
Number of credits	6
Name of lecturer	José Ramos; António Manso.
Objectives of the course (preferably expressed in terms of learning outcomes competences)	To perform different tasks in software development teams. To develop version management processes; To describe and apply testing, inspecting and revising strategies, techniques and tools; To develop deliverable software applications or components from predefined requirements.
Prerequisites	NA
Course contents	Prescriptive Process Models: Incremental and Evolutionary Models; Unified Process Models; Agile Development Models; Software Engineering Practice: Requirements Engineering; System Engineering and Analysis Modelling; Design Engineering Fundamentals: Architectural Design; Standardization and Modularity; Refinement and Refactoring; Component-Level Design and Development; Usability and Interfaces; Testing, Inspecting and Revising Strategies and Techniques; Product Metrics for Software; Project Development of Software Applications Components and Associated Documentation.
Recommended reading	Digital resources supplied by lecturers; Pressman, Roger S.; *Software Engineering – A Practitioner's Approach – 6th edition;* McGraw-Hill, 2005 - 2006.
Teaching methods	Content presentations and teamwork project practice
Assessment methods	Assessment of developed software applications and associated documentation
Language of instruction	Portuguese

B - Description of individual course units

Course title	Final Project
Course code	911930
Type of course	One-semester course
Level of Course	NA
Year of study	Third
Semester/trimester	Second
Number of credits	6
Name of lecturer	José Ramos; António Manso; Nuno Madeira; Luís Oliveira; José Casimiro Pereira; Luís Almeida; Carlos Queiroz.
Objectives of the course (preferably expressed in terms of learning outcomes competences)	To foster effective teamwork behaviour and tasks in ICT Project Environments; To establish and control metrics for ongoing ICT products; To communicate ICT product features to respective audiences; To develop ICT product written documentation and reports.
Prerequisites	NA
Course contents	Market of ICT Solutions; ICT Projects: ICT Project Life Cycle; ICT Project Charter Elements; ICT System Requirements Specifications. ICT Project Planning: designing, cost estimation and analysis, document revising and assessing; Work Breakdown Structure (WBS) Methodologies; Team Management for ICT Projects: setting roles, responsibilities and leadership; Research Techniques; Technical Communication: writing, editing, illustrating and presenting ICT Projects; ICT Project Development;
Recommended reading	Digital resources supplied by lecturers; Pressman, Roger S.; *Software Engineering – A Practitioner's Approach – 6th edition;* McGraw-Hill, 2005 - 2006.
Teaching methods	Content presentations and teamwork project practice
Assessment methods	Assessment of developed ICT projects, including respective product metrics, product presentation and product documentation (Final Report)
Language of instruction	Portuguese