

ECTS Information Package: Degree Programme

Bachelor's Degree in

# COMPUTER ENGINEERING

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# A - General Description

**Programme Title** - Engenharia Informática

**Qualification awarded** - Bachelor's Degree in Computer Engineering

**Level of qualification** - First-cycle degree - ISCED level 5 - EQF level 6

## **Specific admission requirements**

### General

In order to be eligible to this bachelor's degree, students must hold the high-school diploma or legally equivalent qualification. Application can also be made through the following special entry routes:

- Students coming from the Portuguese education system through re-admission, degree change and transfer schemes;
- Holders of a Foundation Course Diploma (CET);
- Adults aged more than 23 who have passed tailor-made examinations intended to assess their ability to pursue higher education studies;
- Holders of Intermediary or Graduate degree diplomas;
- Students coming from foreign higher education.

### Specific

National Examination in Mathematics or Physics or Descriptive Geometry or special access schemes (mature students) or an approved CET (Technological Specialisation Course) diploma.

### **Specific arrangements for recognition of prior learning (formal, non-formal and informal)**

#### General

Procedures on the recognition of credits gained in previous learning are established in the regulations for the Recognition and Validation of Qualifications and Skills of ESTT-IPT available at <http://webmanager.ipt.pt/mgallery/default.asp?obj=4535>

#### Specific

Not applicable.

### **Qualification requirements and regulations:**

6 semesters (3 years), each with 20 weeks of full-time training (40 weeks per year) that, including lessons, self-study and evaluation, makes a total of 810 hours of study effort (1620 hours per year). Considering that 1 ECTS credit corresponds to 27 hours of student work, each semester totals 30 ECTS credits (60 ECTS credits per year).

The course curriculum, with a total of 180 ECTS credits, includes 30 modules (5 per semester) distributed and specified according to the last review regulated by Order No. 16228/2009 of 15 July 2009.

Graduates are admitted to the ANET - National Association of Technical Engineers. Professional titles are awarded by this institution in accordance with its internal rules. The course is registered in FEANI INDEX - European Federation of National Engineering Associations.

### **Profile of the program:**

The profile of the program comprises the training and development of technical and professional skills in the following areas of Computer Engineering:

- Software Development;
- Specification, Installation and Management of Computer Systems and Networks;
- Management of support technology for Information Systems.
- ICT (Information and Communication Technologies) Project Development.

**Key learning outcomes:**

The degree in Computer Engineering is awarded to students who demonstrate the following technical and professional engineering skills in information and communication technologies:

1. Developing Analysis Reports for Software Requirements and Solutions;
2. Modelling of Data, Processes and User-Interfaces and the Objects that implement Software Requirements and Solutions;
3. Defining the structure of the different application layers of a System and its Subsystems;
4. Implementing software (including design, development, testing and installation) for new applications and middleware for integration between application subsystems;
5. Specifying and sizing Computer Systems and Networks;
6. Configuring and Testing Infrastructure Computer Systems and Networks;
7. Managing Computer Systems and Networks;
8. Tracking and checking the operation features of Information Systems, including maintenance releases, load requirements, in terms of data and transactions and management of reconfigurations, backups and optimization of functional parameters;
9. Promoting the evolutive development of Information Systems and respective technical support;
10. Managing the Data and Access Security to Information Systems, including the safeguards of Privacy, Authentication, Integrity, Authenticity and availability;
11. Developing Technical Documentation of Requirement Specifications for ICT projects;
12. Developing Analysis Reports of offered or available ICT solutions, depending on the specified requirements;
13. Developing proposals for new ICT solutions complying with the specified requirements.

**Occupational profiles of graduates with examples:**

There is a severe shortage of computer engineers in the labour market; therefore the demand has been increasingly greater than the supply. The occupational profile of these professionals is also increasingly broader.

In general, graduates in Computer Engineering develop their activities in all kinds of organizations. They design, develop and manage computer-based systems. They deal with applications (software) and most computer equipment (hardware). They collaborate in the automation process of organisations and in the development of their information systems. They establish internal networks of communication within organizations (intranets) and establish a presence, as effective and safe as possible, of the organizations in external networks (Internet) to communicate with clients, partners and government officials.

Increasingly, computer engineers assume sociocultural importance in networking and computing systems with a high degree of accessibility and universality that allow communication among different generations, cultures, regions, social backgrounds, etc..

**Access to further studies:**

The Computer Engineering degree allows access to postgraduate and second-cycle programs (Masters) according to the terms and conditions specified for those programs. In the particular case of ESTT, it gives access to the Master's degree in Digital Content Production.

### Course structure diagram with credits

Course Title	Year	Semester	Credits
Algebra	1	S1	6
Digital Systems	1	S1	6
Introduction to Programming	1	S1	6
Introduction to Technology	1	S1	6
Mathematical Analysis I	1	S1	6
Internet Technologies I	1	S2	6
Introduction to Digital Electronics	1	S2	6
Logic and Computation	1	S2	6
Mathematical Analysis II	1	S2	6
Object-Oriented Programming	1	S2	6
Computer Architecture I	2	S1	6
Data Structure and Algorithms	2	S1	6
Databases I	2	S1	6
Introduction to Telecommunications	2	S1	6
Probabilities and Statistics	2	S1	6
Data Networks I	2	S2	6
Databases II	2	S2	6
Internet Technologies II	2	S2	6
Micro-Processors	2	S2	6
Operating Systems	2	S2	6
Computer Architecture II	3	S1	6
Computer Network Management and Security	3	S1	6
Data Networks	3	S1	6
Distributed Systems	3	S1	6
Systems Analysis	3	S1	6
Entrepreneurship	3	S2	5
Final Project	3	S2	12
Information Systems Design	3	S2	4
Network Design	3	S2	4

**Course structure diagram with credits (cont.)**

Course Title	Year	Semester	Credits
Organisational Information Systems	3	S2	5

## **Examination regulations, assessment and grading**

### General

General assessment rules are in line with the Portuguese law and described in the Academic Regulations of ESTT-IPT available at <http://webmanager.ipt.pt/mgallery/default.asp?obj=4538>.

The licenciado degree is awarded a final grade between 10 and 20 within a 0/20 scale as well as its equivalent in the European grading scale.

### Specific

At the 3rd Grade, students should develop a Final Project (12 ECTS), implementation of which should be subject to a written report and a public Presentation to an assessment committee, specially nominated for the purpose. This committee should:

- Appreciate the Report;
- Appreciate the Presentation;
- Discuss the outcome of the project, and accordance with the initial objectives;
- Issue a Final Project score.

## **Graduation requirements:**

Completion of the study program requires approval in all courses that comprise it, including the submission and public discussion of a final project, making a total of 180 ECTS credits.

## **Mode of study:**

Full- or Part-time.

## **Program director or equivalente**

Director: Luís Miguel Lopes de Oliveira

Erasmus coordinator: José Manuel Palma Redes Ramos

ECTS coordinator: José Manuel Palma Redes Ramos

## B - Description of individual course units

<b>Course unit title</b>	Algebra
<b>Course unit code</b>	91192
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	First Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Ana Cristina Becerra Nata dos Santos Carlos Filipe Perquilhas Baptista
<b>Learning outcomes of the course unit</b>	To provide insight on Matrix Algebra, placing special emphasis on the discussion and resolution of systems of linear equations in vector spaces, determinants, eigenvalues and eigenvectors. These subject matters are of interest to several branches of engineering.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme componentes</b>	Not applicable.
<b>Course contentes</b>	1. Complex numbers; 2. Matrices and systems of linear equations; 3. Vector spaces; 4. Determinants; 5. Eigenvalues and eigenvectors of square matrices.
<b>Recommended or required Reading</b>	- T. Magalhães, L.(1989). <i>Álgebra Linear como Introdução à Matemática Aplicada</i> . Lisboa: Texto Editora - Smith, P. e Giraldes, E. (1995). <i>Curso de Álgebra Linear e Geometria Analítica</i> . Lisboa: McGraw-Hill - Dias Agudo, F.(1978). <i>Introdução à Álgebra Linear e Geometria Analítica</i> . Lisboa: Escolar Editora - Nicholson, W.(1995). <i>Linear Algebra with Applications</i> . Boston: PWS Publishing Company
<b>Planned learning activities and teaching methods</b>	Lectures and practical classes
<b>Assessment Methods and criteria</b>	Continuous assessment: two written tests. Exam assessment: one summative test.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.



## B - Description of individual course units

<b>Course unit title</b>	Digital Systems
<b>Course unit code</b>	91194
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	First Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Manuel Fernando Martins De Barros Francisco José Alexandre Nunes Raul Manuel Domingos Monteiro
<b>Learning outcomes of the course unit</b>	Students should learn the key concepts of digital logic: numerical coding systems, basic logic gates and Boole's Algebra and be able to analyse and draw combinatorial circuits and LSI, MSI and LSI sequences. Design of logic programmable devices.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	1) Introduction 2) Logic functions 3) Simplifications of logic expressions 4) Digital data representation 5) Digital circuits and logic families 6) Combinatorial circuits of average complexity 7) Basic sequential circuits 8) Synthesis and analysis of sequential circuits 9) Counters, registers and memories. 10) Logic Programmable Devices
<b>Recommended or required Reading</b>	- Wakerly, J.(2000). <i>Digital Design Principles and Practices</i> . USA: Prentice Hall - Padilla, G. e Costa, L. (2000). <i>Electronica Digital</i> . Portugal: Mc Graw Hill - Dias, M.(2010). <i>Sistemas Digitais - Princípio e prática</i> . Portugal: FCA Editora de Informática, Lda
<b>Planned learning activities and teaching methods</b>	Lectures, Problem solving classes and Laboratory classes;
<b>Assessment Methods and criteria</b>	Written exam (50%), coursework and final project (50%).
<b>Language of Instruction</b>	Portuguese   <b>Mentoring in English</b>
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Introduction to Programming
<b>Course unit code</b>	91193
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	First Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Paulo Alexandre Gomes dos Santos Nuno José Valente Lopes Madeira
<b>Learning outcomes of the course unit</b>	Students should be able to solve problems using algorithms, use a programming language to express an algorithm and to create a computer program in "C" language.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme componentes</b>	Not applicable.
<b>Course contentes</b>	Introduction to computers and programming. Introduction to algorithms and programming languages. Data processing and manipulation. Decision-making structures. Composite data structures (arrays, structures, strings). Modularity. Iterative and recursive algorithms. Dynamic management of memory. File operations.
<b>Recommended or required Reading</b>	- Damas, L.(1999). <i>Linguagem C</i> . Portugal: FCA
<b>Planned learning activities and teaching methods</b>	Lectures and laboratory classes
<b>Assessment Methods and criteria</b>	Practice (40%): Assignments and homework. Reports and presentations. Theory (60%): Exams
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Introduction to Technology
<b>Course unit code</b>	91195
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	First Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	José Manuel Palma Redes Ramos
<b>Learning outcomes of the course unit</b>	1. Understand the main technical features of digital image processing (2D); 2. Develop solid models (3D) at a basic level; 3. Adopt the basic terminology of ICT at all levels of communication and argumentation; 4. Develop basic research on ICT issues
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	1. Digital 2D Image Processing; 2. 3D Processing: solid primitives, CSG, B-Rep and rendering; 3. Computer Solid Modelling; 4. The Socio-Technical Dimension of the computer engineer: ICT Skills; 5. History of Computing and the Internet; 6. Information and Knowledge Management, Research, and Interpersonal Communication; 7. Information and Computer Systems in Organizations.
<b>Recommended or required Reading</b>	- Mascarenhas, J. e Ramos, J. (0). <i>Documentos de apoio</i> . Acedido em 1 de julho de 2012 em vários
<b>Planned learning activities and teaching methods</b>	1. Development of laboratory projects; 2. Presentation and discussion of ICT related contents and topics.
<b>Assessment Methods and criteria</b>	1. 3 Small 3D Computer Solid Modelling projects; 2. 3 essays on ICT issues; 3. Overall mark is the average of the two components.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Mathematical Analysis I
<b>Course unit code</b>	91191
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	First Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Luís Miguel Merca Fernandes Maria Manuela Morgado Fernandes Oliveira
<b>Learning outcomes of the course unit</b>	1- Provide the mathematical foundations required in other modules of the programme. 2- Provide skills to work with differential and integral calculus of functions of one real variable.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contentes</b>	1- Subject content review. 2- Real functions of a real variable. 3- Limits and continuity. 4- Differential calculus. 5- Integral calculus.
<b>Recommended or required Reading</b>	- Stewart, J.(2005). <i>Cálculo</i> . (Vol. 1). (pp. 0-684). São Paulo: Thomson Pioneira - Howard, A.(2007). <i>Cálculo um novo horizonte</i> . (Vol. 1). (pp. 0-581). São Paulo: Bookman - Swokowski, E.(1995). <i>Cálculo com Geometria Analítica</i> . (Vol. 1). (pp. 0-744). São Paulo: Makron Books - Silva, J.(1999). <i>Princípios de Análise Matemática Aplicada</i> . (Vol. 1). (pp. 1-472). Lisboa: McGraw-Hill
<b>Planned learning activities and teaching methods</b>	Lectures, tutorials and lab classes
<b>Assessment Methods and criteria</b>	Continuous assessment: closed-book written test. Final assessment: closed-book written exam.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Internet Technologies I
<b>Course unit code</b>	911910
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	First Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	José Manuel Palma Redes Ramos
<b>Learning outcomes of the course unit</b>	1. Understanding the hierarchical structure of the DOM (Document Object Model) to HTML content; 2. Implementing HTML, CSS and JavaScript client-side coding; 3. Manipulating DOM objects based on their methods and properties; 4. Developing dynamic web applications and interfaces.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	1. The DOM (Document Object Model) for HTML content: classes, methods and properties; 2. Client-side programming techniques with HTML, CSS and JavaScript; 3. Modelling of interface behaviour: events/actions synchronization; 4. Models of motion: object animation techniques; 5. Development of web dynamic applications and interfaces for varied purposes.
<b>Recommended or required Reading</b>	- DevGuru, ..(0). ..Acedido em 1 de julho de 2012 em <a href="http://www.devguru.org">www.devguru.org</a> - W3Schools, ..(0). ..Acedido em 1 de julho de 2012 em <a href="http://www.w3schools.com">www.w3schools.com</a> - Ramos, J.(0). <i>Documentos de apoio</i> .Acedido em 1 de julho de 2012 em vários
<b>Planned learning activities and teaching methods</b>	Practical workshops in ICT Laboratory.
<b>Assessment Methods and criteria</b>	Development of an individual project based on the formulation of a requirements model.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Introduction to Digital Electronics
<b>Course unit code</b>	91198
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	First Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Pedro Daniel Frazão Correia
<b>Learning outcomes of the course unit</b>	- Analyse DC Circuits using the fundamental laws of circuit analysis; - Become familiar with the semiconductor devices used in analog and digital electronics; - Design and analyse digital circuits; - Work with computer-aided design tools for digital circuits.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Basics of digital systems.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	I- CC circuit analysis II - Semi-conductor devices: diodes, bipolar transistors, MOS transistors. III - Digital electronics: CMOS circuits; bipolar circuits; logic families; memories IV- Hardware description languages: VHDL; digital systems design.
<b>Recommended or required Reading</b>	- Silva, M.(1996). <i>Introdução aos Circuitos Eléctricos e Electrónicos</i> . Lisboa: Fundação Calouste Gulbenkian - Kemmerly, J. e Hayt Jr., W. (1993). <i>Engineering Circuits Analysis</i> . : McGraw-Hill - Santos, J.(1997). <i>Análise de Circuitos Eléctricos</i> . : Minerva
<b>Planned learning activities and teaching methods</b>	Lectures, practical classes and laboratory sessions;
<b>Assessment Methods and criteria</b>	Written test: 12 out of 20 Laboratory coursework: 8 out of 20 Continuous assessment: - Test - Laboratory coursework Laboratory component: minimum mark of 9.5/20. Final mark: weighted average of written test and laboratory coursework
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Logic and Computation
<b>Course unit code</b>	91197
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	First Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Carlos Filipe Perquilhas Baptista Luís Miguel Merca Fernandes
<b>Learning outcomes of the course unit</b>	To provide insight on the main concepts on Logics, Set Theory, Graphs and Numerical Methods, topics that are fundamental on areas such as Networks, System Analysis and Formal Verification.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Algebra and Mathematical Analysis
<b>Recommended optional programme components</b>	Algebra and Mathematical Analysis
<b>Course contentes</b>	1 – Foundations of Logic and Set Theory 2 – Graphs and digraphs.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
<b>Recommended or required Reading</b>	- Faires, J. e Burden, R. (1993). <i>Numerical Analysis</i> . (Vol. 1). New York: PWS Publishing Company - Rosen, K.(1995). <i>Discrete Mathematics and Its Applications</i> . (Vol. 1). Brasil: Mc Graw-Hill
<b>Planned learning activities and teaching methods</b>	Lectures, tutorials and laboratory classes.
<b>Assessment Methods and criteria</b>	Continuous assessment: two written tests and computational projects. Final assessment:students can choose between a summative written exam comprising all course contents or computer projects and one summative written test.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Mathematical Analysis II
<b>Course unit code</b>	91196
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	First Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Maria Cristina Oliveira Da Costa
<b>Learning outcomes of the course unit</b>	1- Provide the mathematical foundations required in other modules of the programme. 2- Provide skills to work with differential and integral calculus of functions of several real variables.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	1- Numerical and Functions Series. 2- Real functions of several real variables. 3- Multiple Integrals.
<b>Recommended or required Reading</b>	<ul style="list-style-type: none"> <li>- Swokowski, E.(1995). <i>Cálculo com Geometria Analítica</i>. (Vol. 2). (pp. 1-744). São Paulo: Makron Books</li> <li>- Zill, D. e Cullen, M. (2009). <i>Advanced Engineering Mathematics</i>. (Vol. 2). (pp. 1-1008). Sudbury: Jones &amp; Bartlett Publishers</li> <li>- Jerónimo, M. e Azenha, A. (1995). <i>Cálculo Diferencial e Integral em R e Rn</i>. (Vol. 1). (pp. 1-610). Lisboa: Mac Graw-Hill</li> <li>- Silva, J.(1999). <i>Princípios de Análise Matemática Aplicada</i>. (Vol. 1). (pp. 1-472). Lisboa: McGraw-Hill</li> </ul>
<b>Planned learning activities and teaching methods</b>	Lectures and practical classes.
<b>Assessment Methods and criteria</b>	Continuous assessment: closed-book written tests. Final assessment: exam.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.



## B - Description of individual course units

<b>Course unit title</b>	Object-Oriented Programming
<b>Course unit code</b>	91199
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	First Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Paulo Alexandre Gomes dos Santos José Casimiro Nunes Pereira António Manuel Rodrigues Manso Pedro Miguel Aparício Dias
<b>Learning outcomes of the course unit</b>	1 - Apply the basic principles of problem solving using object-oriented programming; 2 - Develop functional code through the Java language, and its class libraries; 3 - Error and exception handling.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Basics of programming.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	Introduction to Object-Oriented Programming. Visual programming. Programming with classes. Definition of library classes.
<b>Recommended or required Reading</b>	- Bates, B. e Sierra, K. (2003). <i>Head First Java</i> . EUA: O'Reilly
<b>Planned learning activities and teaching methods</b>	Lectures, tutorials and laboratory classes.
<b>Assessment Methods and criteria</b>	Practical assignments and closed book exam.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Computer Architecture I
<b>Course unit code</b>	911914
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Second Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Carlos David Magalhães Queiroz
<b>Learning outcomes of the course unit</b>	- Understand the general principles of computer architecture, its internal organisation and the impact of the several components in the operating performance. - Describe the various levels of memory and data transfer modes
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	A pass in the modules: Introduction to Programming, Digital Systems, Introduction to Technology and Object-Oriented Programming.
<b>Recommended optional programme components</b>	The module Logic and Computation
<b>Course contents</b>	- Basics of computer architecture - CPU structure(data processing units; control units; implementation modes; performance analysis) - Memory organisation (technologies; hierarchy; cache) - Organisation of interfaces and peripherals (types; characterisation...
<b>Recommended or required Reading</b>	- Carpinelly, J.(2001). <i>Computer Systems - Organization &amp; Architecture</i> . Portugal: Prentice Hall - Pearson Education International - Brey, B.(2003). <i>The Intel Microprocessors</i> . Portugal: Prentice Hall - Pearson Education International - Stallings, W.(2003). <i>Computer Organization and Architecture</i> . Portugal: Prentice Hall - Monteiro, R.(2004). <i>Tecnologia dos Equipamentos Informáticos</i> . Portugal: FCA
<b>Planned learning activities and teaching methods</b>	Lectures and laboratory classes
<b>Assessment Methods and criteria</b>	Theoretical part: -Written test (10/20) Practical Part: -Written exam (2/20) -Practical assignments (4/20) - Classwork and tests (4/20) A minimum of 30% in each assessment component is required to pass.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Data Structure and Algorithms
<b>Course unit code</b>	911912
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Second Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Paulo Alexandre Gomes dos Santos Pedro Miguel Aparício Dias
<b>Learning outcomes of the course unit</b>	Describe the commonest data structures and algorithms, as well as its advantages, limitations and applications; Use data structures to solve real problems; Design, develop, and test code for tackling medium- and large-scale problems.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Object-oriented programming.
<b>Recommended optional programme componentes</b>	Not applicable.
<b>Course contentes</b>	1 - Introduction to Java language 2 - Algorithm development techniques 3 - Algorithm complexity analysis 4 - Sorting algorithms. 5 - Linear data structures 6 - Hierarchical data structures 7- Graphs
<b>Recommended or required Reading</b>	- Stein, C. e Rivest, R. e Leiserson, C. e Cormen, T. (2002). <i>Algoritmos Teoria e Prática – Tradução da 2ª Edição Americana</i> . Brasil: Editora Campus - Tongo, L. e Barnett, G. (2008). <i>Data Structures and Algorithms</i> . EUA:
<b>Planned learning activities and teaching methods</b>	Lectures and laboratory classes.
<b>Assessment Methods and criteria</b>	Practical coursework and closed book examination.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Databases I
<b>Course unit code</b>	911915
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Second Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	António Casimiro Teixeira Batista José Casimiro Nunes Pereira
<b>Learning outcomes of the course unit</b>	An introduction to the theory and practice of DBMS. Emphasis will be on theoretical considerations about modelling data and designing easy-to-use and effective DB systems: creation and modelling of databases, hands-on practice with SQL.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme componentes</b>	Not applicable.
<b>Course contentes</b>	Objectives and functions of DBMS. Ancient data models. Relational model. Relationships. Data dictionary. Keys. Primary key, foreign key and indices. Integrity and rules. Functional dependencies and standardization. 1FN, 2FN, 3FN and BCNF. E-R method. SQL.
<b>Recommended or required Reading</b>	- Pereira, J.(1999). <i>Tecnologia de Bases de Dados</i> . Lisboa: Lidel/FCA - Editora de Informática - Batista, A.(2012). <i>Apontamentos e material de apoio</i> . Tomar: Autor
<b>Planned learning activities and teaching methods</b>	Lectures, tutorials and laboratory classes.
<b>Assessment Methods and criteria</b>	Written Test. Laboratory coursework. Preparation and presentation of a Final Project.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Introduction to Telecommunications
<b>Course unit code</b>	911913
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Second Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Pedro Daniel Frazão Correia
<b>Learning outcomes of the course unit</b>	Students should understand the frequency analysis of continuous signals using Fourier Transform, the physical impairments of a transmission system and be able to describe continuous carrier modulation techniques in analog and digital systems.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Mathematical Analysis and Complex Analysis.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	1- Introduction to telecommunications; 2- Signals and Systems; 3- Signal theory; 4- Sampling and analog-to-digital conversion: PCM and DPCM modulation; 5- Transmission media; 6- Modulation techniques with continuous carrier; 7- Principles of digital data transmission
<b>Recommended or required Reading</b>	<ul style="list-style-type: none"> <li>- Forouzan, B.(2007). <i>Data Communications &amp; Networking</i>. .: McGraw-Hill</li> <li>- Lathi, B.(1998). <i>Modern Digital and Analog Communication Systems</i>. .: Oxford University Press</li> <li>- Lathi, B.(1998). <i>Signal Processing and Linear Systems</i>. .: Oxford University Press</li> <li>- Correia, P. e Pires, G. (2010). <i>Apostamentos de Redes de Dados e de Fundamentos de Telecomunicações</i>. Tomar: Autor</li> </ul>
<b>Planned learning activities and teaching methods</b>	Lectures, Problem solving classes, Laboratory classes;
<b>Assessment Methods and criteria</b>	Exam (70%) (a minimum of 45% is mandatory), Lab assignments (30%) (a minimum of 45% is mandatory). Admission to Exam requires a pass in the laboratory based assignments.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Probabilities and Statistics
<b>Course unit code</b>	911911
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Second Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Luis Miguel Lindinho da Cunha Mendes Grilo Maria João da Costa Antunes Inácio Francisco Paulo Vilhena Antunes Bernardino Carvalho
<b>Learning outcomes of the course unit</b>	Provide the basics of some key techniques and methodologies of Statistics, mainly quantitative, so that students can design and implement solutions to different problems under uncertainty conditions.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Mathematical Analysis and Algebra
<b>Recommended optional programme components</b>	Lectures supported by Excel tools and statistical package SPSS.
<b>Course contents</b>	1. Probability (axioms and theorems), 2. discrete and continuous random variables; 3. Some theoretical probability distributions (discrete and continuous); 4. Sampling(mean, variance and sample proportion) 5. Point and interval estimation parameters, 6. Parametric hypothesis tests (mean, variance and population proportion); 7. Correlation and simple linear regression
<b>Recommended or required Reading</b>	- Gama, S. e Pedrosa, A. (2004). <i>Introdução Computacional à Probabilidade e Estatística</i> . Porto - Portugal: Porto Editora - Cabral, J. e Guimarães, R. (2007). <i>Estatística</i> . Lisboa - Portugal: McGraw-Hill - Grilo, L.(2013). <i>Probabilidades e Estatística. Conceitos Teórico-Práticos</i> . Instituto Politécnico de Tomar, Portugal: Instituto Politécnico de Tomar
<b>Planned learning activities and teaching methods</b>	Lectures, tutorials and laboratory classes.
<b>Assessment Methods and criteria</b>	Continuous assessment: two written tests; Examination assessment: one written test.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Data Networks I
<b>Course unit code</b>	911917
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Second Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Carlos David Magalhães Queiroz
<b>Learning outcomes of the course unit</b>	The students should be able to design LAN and WAN networks with IP unicast routing; develop multicast networks; plan and select equipment and provide maintenance support.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme components</b>	Computer Architecture I Introduction to Telecommunications
<b>Course contents</b>	- Application layer (operating principles of network applications; application layer protocols) - Presentation layer (operating principles) - Session layer (operating principles, sockets) - Transport layer (Introduction to transport layer services - UD
<b>Recommended or required Reading</b>	- Forouzan, B.(2004). <i>Data Communications and Networking</i> . Portugal: McGraw-Hill - Ross, K. e Kurose, J. (2004). <i>Computer Networking: A Top Down Approach</i> . Portugal: Addison-Wesley - Boavida, F. e Monteiro, E. (2004). <i>Engenharia de Redes Informáticas</i> . Portugal: FCA
<b>Planned learning activities and teaching methods</b>	Lectures, tutorials and laboratory classes.
<b>Assessment Methods and criteria</b>	Theoretical part: -Written exam (10/20) Practical part: -Written exam (2/20) -Tests (4/20) - Classwork (4/20) Passing requirement: A minimum mark of 30% in all four assessment components.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Databases II
<b>Course unit code</b>	911918
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Second Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	António Casimiro Teixeira Batista José Casimiro Nunes Pereira
<b>Learning outcomes of the course unit</b>	Students should acquire an understanding of database technology and become familiar with the development of database applications and the administration of multi-user databases.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Databases I
<b>Recommended optional programme componentes</b>	Not applicable.
<b>Course contentes</b>	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.
<b>Recommended or required Reading</b>	- Date, C.(2003). <i>An Introduction to Database Systems</i> . : Addison Wesley - Pereira, J. e Batista, A. (2012). <i>Apontamentos e material de apoio</i> . Tomar: Autor - Navathe, S. e Elmasri, R. (2010). <i>Fundamentals of Database Systems</i> . : Addison Wesley
<b>Planned learning activities and teaching methods</b>	Lectures, tutorials and laboratory classes.
<b>Assessment Methods and criteria</b>	Theoretical test, laboratory coursework as well as preparation and presentation of a final Project.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.



## B - Description of individual course units

<b>Course unit title</b>	Internet Technologies II
<b>Course unit code</b>	911920
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Second Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	José Manuel Palma Redes Ramos José Casimiro Nunes Pereira
<b>Learning outcomes of the course unit</b>	1. Implement XML, ASP.NET and SQL programming technologies; 2. Develop client-side and server-side Web applications; 3. Implement XSL and XMLDOM technologies for XML-HTML transformation; 4. Develop web interfaces for remote databases; 5. Implement usability criteria.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contentes</b>	1. XML representation of information and static presentation techniques with XSL; 2. XML architectures and information models; 3. Dynamic presentation techniques with javaScript on XMLDOM; 4. Server-side Programming with ASP.NET; 5. ASP.NET/SQL technologies for web interfaces to remote databases; 6. Basic notions of Usability in Human-Machine Interface building.
<b>Recommended or required Reading</b>	- Ramos, J.(2012). <i>Documentos de apoio</i> . Tomar: Autor - DevGuru, ..(0). ..Acedido em1 de julho de 2012 em <a href="http://www.devguru.org">www.devguru.org</a> - W3C-Org, ..(0). ..Acedido em1 de julho de 2012 em <a href="http://www.w3c.org">www.w3c.org</a> - W3Schools, ..(0). ..Acedido em1 de julho de 2012 em <a href="http://www.w3schools.com">www.w3schools.com</a>
<b>Planned learning activities and teaching methods</b>	Practical workshops in ICT Laboratory.
<b>Assessment Methods and criteria</b>	1. An individual project on XML middleware; 2. An individual project on Web-based interfaces to remote databases; 3.Final mark is the average of the two assessment components.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Micro-Processors
<b>Course unit code</b>	911919
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Second Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Manuel Fernando Martins De Barros
<b>Learning outcomes of the course unit</b>	The students should get familiar with the operation and control of the architectures of modern systems based on MCS 8051, PICS and AVR micro-controllers, develop skills to handle and design embedded systems and have a good command of development tools and remote communications.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	1) Introduction to microcontrollers 2) MCS51, PIC and AVR microcontrollers family. 3) Interrupt system (8051, PIC18F458 & AVR) 4) Timers (8051, PIC18F458 & AVR) 5) Serial communication (UART, USB) 6) Wireless remote communications (bluetooth, wifi & IR) 7) Digital and analog interfaces 8) Address decoding
<b>Recommended or required Reading</b>	- <a href="http://www.arduino.cc/">Http://www.arduino.cc/</a> , A.(0). <i>Arduino - Getting Start, Learning and examples</i> .Acedido em8 de junho de 2012 em <a href="http://www.arduino.cc/">http://www.arduino.cc/</a> - <a href="http://www.mikroe.com/">Http://www.mikroe.com/</a> , M.(0). <i>PIC Microcontrollers - Programming in C</i> .Acedido em8 de junho de 2012 em <a href="http://www.mikroe.com/eng/product_downloads/download/">http://www.mikroe.com/eng/product_downloads/download/</a> - Intel, I.(0). <i>MCS-51 Family of Single chip Microcomputers, User´s Manual</i> .Acedido em8 de junho de 2012 em <a href="http://www.industrologic.com/MCS51FamilyUsersGuide.pdf">http://www.industrologic.com/MCS51FamilyUsersGuide.pdf</a>
<b>Planned learning activities and teaching methods</b>	Lectures, tutorials and laboratory classes.
<b>Assessment Methods and criteria</b>	Written exam (50%), labs (20%) and mini project (30%).
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Operating Systems
<b>Course unit code</b>	911916
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Second Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Luis Agnelo de Almeida
<b>Learning outcomes of the course unit</b>	Students should understand the concept of operating system (OS), its functions and components. They should be able to specify, configure and maintain operating systems.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Basic knowledge of programming skills and computer architecture.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	1- Introduction to Operating Systems, 2- The core of an Operating System, 3- Management of Processes and Threads, 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.
<b>Recommended or required Reading</b>	<ul style="list-style-type: none"> <li>- Galvin, P. e Silberschatz, A. (2003). <i>Operating System Concepts</i>. : Addison-Wesley</li> <li>- Stallings, W.(2005). <i>Operating systems internals and design principles</i>. : Prentice-Hall</li> <li>- Veiga, L. e Marques, J. e Ferreira, P. e Ribeiro, C. e Rodrigues, R. (2009). <i>Sistemas Operativos</i>. : FCA Editora Informática</li> <li>- Nutt, G.(2004). <i>Operating Systems: A Modern Perspective</i>. : Addison Wesley</li> </ul>
<b>Planned learning activities and teaching methods</b>	Lectures and Laboratory classes.
<b>Assessment Methods and criteria</b>	Written test: 40% Laboratory test: 30% Ongoing coursework: 30% (minimum 30% in each component)
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Computer Architecture II
<b>Course unit code</b>	911923
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Third Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Luis Agnelo de Almeida
<b>Learning outcomes of the course unit</b>	An advanced overview of the operation of a computer and the hardware structures used in computer design. Identify and describe the microprocessor architecture, its components and the hardware/software interface models; to program in Assembly; Specify and manage hardware resources.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Programming, Computer Architecture I and Operating Systems.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	1- Computer Architecture 2- Instruction Set: machine language architecture 3- Assembly programming language (processor and peripherals) 4- Computational arithmetics 5- Arithmetic Coprocessor Programming 6- Memory Hierarchy 7- Input/Output Data Systems 8- Multiprocessors
<b>Recommended or required Reading</b>	- Stallings, W.(2000). <i>Computer Organization and Architecture: Designing for Performance</i> . : Prentice Hall - Brey, B.(2003). <i>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</i> . : Prentice-Hall - Patterson, D. e Hennessy, J. (1994). <i>Computer Organization and Design</i> . : Morgan Kaufman
<b>Planned learning activities and teaching methods</b>	Lectures and laboratory classes.
<b>Assessment Methods and criteria</b>	End of semester closed book examination (30%) Lab test (40%) Ongoing coursework (30%) (minimum requirement of 30% on each component)
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Computer Network Management and Security
<b>Course unit code</b>	911924
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Third Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Luís Miguel Lopes de Oliveira
<b>Learning outcomes of the course unit</b>	Students should be able to apply new methodologies for managing and maintaining computer networks; identify the critical services of an infrastructure proposing solutions and strategies to minimise its inoperability; use protocols and security mechanisms.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Data Networks I
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	Data networks and systems management - Introduction to integrated management - IETF data management protocols Data networks security - Introduction to cryptography - Authentication systems, certification and access control - Firewalls and intrusion detection systems - Security on wireless networks - Network access control mechanisms
<b>Recommended or required Reading</b>	<ul style="list-style-type: none"> <li>- Boavida, F. e Monteiro, E. (2000). <i>Engenharia de Redes Informáticas</i>. Lisboa: FCA - Editora de Informática</li> <li>- William, S.(1998). <i>Cryptography and Network Security: Principles and Practice</i>. .: Prentice-Hall</li> <li>- William, S.(2000). <i>Network Security Essentials</i>. .: Prentice-Hall</li> <li>- Zúquete, A.(2006). <i>Segurança em Redes Informáticas</i>. Lisboa: FCA - Editora de Informática</li> </ul>
<b>Planned learning activities and teaching methods</b>	Theoretical and practical classes using audiovisual resources and simulation.
<b>Assessment Methods and criteria</b>	Individual or group laboratory assignments(40%) Written test/exam (60%) Minimum requirements: 8 marks in the theoretical component and 10 marks in the practical component.
<b>Language of Instruction</b>	Portuguese   <b>Mentoring in English</b>
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Data Networks
<b>Course unit code</b>	911922
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Third Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	Luís Miguel Lopes de Oliveira
<b>Learning outcomes of the course unit</b>	Understand the routing mechanisms for IGPs and EGPs and be able to configure it. Understand the issues related with local area networks. Be able to manage and optimize data computer networks.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Be familiar with the main TCP/IP stack protocols
<b>Recommended optional programme components</b>	Data Networks I Basics of telecommunication systems
<b>Course contents</b>	Networking layer and routing - (IPv4; IPv6, routing protocols for IGP and EGP, Multicast IP; Multicast routing; IPv4 to IPv6 transition scenarios) Data link layer - (error detection and correction mechanisms, Ethernet, wireless networks, MSTP, LACP, VLANs) Traffic management and data network optimization on local area networks)
<b>Recommended or required Reading</b>	<ul style="list-style-type: none"> <li>- Forouzan, B.(2006). <i>Data Communications &amp; Networking</i>. .: McGraw-Hill</li> <li>- Ross, K. e Kurose, J. (2005). <i>Computer Networking</i>. .: Addison Wesley</li> <li>- Perlman, R.(1999). <i>Interconnections: Bridges, Routers, Switches, and Internetworking Protocols</i>. .: Addison Wesley</li> </ul>
<b>Planned learning activities and teaching methods</b>	Lectures (face-to-face or e-learning) and laboratory classes supported by audiovisual resources and simulation.
<b>Assessment Methods and criteria</b>	Individual or group laboratory assignments (40%) Written test/exam (60%) Minimum requirements: 8 marks in the theoretical component and 10 marks in the practical component.
<b>Language of Instruction</b>	Portuguese   <b>Mentoring in English</b>
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Distributed Systems
<b>Course unit code</b>	911925
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Third Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	António Manuel Rodrigues Manso Pedro Miguel Aparício Dias
<b>Learning outcomes of the course unit</b>	Students will be provided with theoretical and practical knowledge on distributed systems. They should have a good command of general techniques of design, implementation and operation of distributed systems and be able to program distributed applications.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Basics of computer programming, data structures and networking.
<b>Recommended optional programme componentes</b>	Not applicable.
<b>Course contentes</b>	1 - Introduction to distributed systems 2 - Parallel and concurrent programming 3 - Distributed systems programming 3.1 - Distributed Systems Security 3.2 - Programming with sockets 3.3 - Programming with remote objects 3.4 - Programming with web services 4 - Mobile devices programming
<b>Recommended or required Reading</b>	- Cardoso, J.(2010). <i>Programação de Sistemas Distribuídos em Java</i> . Lisboa: FCA - Alves Marques, J. e Guedes, P. (1998). <i>Tecnologia de Sistemas Distribuídos</i> . (Vol. 1). Lisboa: FCA - Coulouris, G. e Dollimore, J. (2011). <i>Distributed Systems: Concepts and Design</i> . (Vol. 1). USA: Addison Wesley - Guedes, P. e Marques, J. (1998). <i>Tecnologia de Sistemas Distribuídos</i> . Lisboa: FCA - Editora de Informática - Cardoso, J.(2008). <i>Programação de Sistemas Distribuídos em Java</i> . Lisboa: FCA - Editora de Informática - Blair, G. e Kindberg, T. e Dollimore, J. e Coulouris, G. (2011). <i>Distributed Systems: Concepts and Design</i> . : Addison Wesley
<b>Planned learning activities and teaching methods</b>	Lectures and laboratory classes.
<b>Assessment Methods and criteria</b>	Practical assignments and closed-book written test.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Systems Analysis
<b>Course unit code</b>	911921
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Third Year
<b>Semester/Trimester when the course unit is delivered</b>	First Semester
<b>Number of ECTS credits allocated</b>	6
<b>Name of Lecturer(s)</b>	José Casimiro Nunes Pereira
<b>Learning outcomes of the course unit</b>	Development of skills for the specification/design of Information Systems, with UML language and RUP method.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Knowledge of object-oriented programming and of Data Base Systems
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	- 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 Pro
<b>Recommended or required Reading</b>	- Larman, C.(2007). <i>Utilizando UML e Padrões</i> . São Paulo: Bookman - Fowler, M.(2007). <i>UML distilled, 3rd Ed.</i> NY: Addison-Wesley - Stevens, P.(2006). <i>Using UML - Software Engineering with Objects and Componentes</i> . England: Addison-Wesley
<b>Planned learning activities and teaching methods</b>	Lectures and tutorials.
<b>Assessment Methods and criteria</b>	- Written Test (45%); - Practical Coursework (45%); - Laboratory Coursework (10%)
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.



## B - Description of individual course units

<b>Course unit title</b>	Entrepreneurship
<b>Course unit code</b>	911926
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Third Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	5
<b>Name of Lecturer(s)</b>	Olinda Maria dos Santos Sequeira
<b>Learning outcomes of the course unit</b>	The students should develop an entrepreneurial mindset, be able to identify business opportunities, evaluate the potential of a new business, apply the financial analysis tools and identify the financing sources as well as be aware of the advantage of partnerships.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme components</b>	Seminars and events in the area of entrepreneurship.
<b>Course contents</b>	1. Concepts of entrepreneurship 2. Entrepreneurial process 3. Selecting a project 4. Preparing a business plan 5. Financing the Project 6. How to create your own business 7. Entrepreneurial success/failure
<b>Recommended or required Reading</b>	<ul style="list-style-type: none"> <li>- Silva, M. e Mainardes, E. (2012). <i>"Inovação Empreendedora das Pequenas e Médias Empresas" in Marketing Empreendedor - Novos Rumos para o Sucesso nos Negócios de Micro, Pequenas e Médias Empresas.</i> (pp. 59-89). Curitiba: Editora Xibpex</li> <li>- Sarkar, S.(2007). <i>Empreendedorismo e Inovação.</i> Lisboa: Escolar Editora</li> <li>- Snell, S. e Bateman, T. (2007). <i>Management - Hill Leading &amp; Collaborating in a Competitive World.</i> .: McGraw-Hill</li> <li>- Drucker, P.(1989). <i>Inovação e Gestão. Uma nova concepção de estratégia de empresa..</i> : Editorial Presença</li> </ul>
<b>Planned learning activities and teaching methods</b>	Theoretical and practical classes supported by case studies.
<b>Assessment Methods and criteria</b>	Ongoing assessment: preparation of a business plan as part of a team including presentation (60%); Individual final report and presentation (30%). Minimum pass grade is 10/20.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Final Project
<b>Course unit code</b>	911930
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Third Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	12
<b>Name of Lecturer(s)</b>	Célio Gonçalo Cardoso Marques Paulo Alexandre Gomes dos Santos António Casimiro Teixeira Batista José Casimiro Nunes Pereira Luís Miguel Lopes de Oliveira Nuno José Valente Lopes Madeira Gabriel Pereira Pires Luis Agnelo de Almeida Carlos David Magalhães Queiroz António Manuel Rodrigues Manso Pedro Miguel Aparício Dias
<b>Learning outcomes of the course unit</b>	To foster effective teamwork behaviour and tasks in ICT Project Environments; To establish and control metrics for ICT products under development; To communicate ICT product features to their respective audiences; To develop written documentation and reports for ICT products.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme componentes</b>	Not applicable.
<b>Course contentes</b>	Markets for ICT-based solutions; ICT Projects: Lifespan; System Requirements Specifications. ICT Project Planning: designing, cost analysis, document organisation; Team Management for ICT Projects: roles, responsibilities and leadership; Research Techniques; Technical Communication: writing and presenting ICT Projects.
<b>Recommended or required Reading</b>	- Pressman, R.(2005). <i>Software Engineering – A Practitioner's Approach</i> . NY: McGraw-Hill
<b>Planned learning activities and teaching methods</b>	Laboratory teamwork.
<b>Assessment Methods and criteria</b>	Assessment of assignments carried out by the students including product presentation and documentation (final report)
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Information Systems Design
<b>Course unit code</b>	911929
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Third Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	4
<b>Name of Lecturer(s)</b>	António Manuel Rodrigues Manso Pedro Miguel Aparício Dias
<b>Learning outcomes of the course unit</b>	Apply strategies, techniques and tools for testing, inspecting and reviewing information systems. Develop applications from predefined requirements to a deliverable version. Perform different functions in software development teams.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme componentes</b>	Not applicable.
<b>Course contentes</b>	1-Prescriptive software Process Models 2-Software Engineering 3-Project Engineering 4-Project development
<b>Recommended or required Reading</b>	- Roger, P.(2006). <i>Software Engineering – A Practitioner's Approach</i> –. : McGraw-Hill
<b>Planned learning activities and teaching methods</b>	Lectures and laboratory coursework (teamwork)
<b>Assessment Methods and criteria</b>	Assessment of the computer applications developed by the students and respective technical details. Assessment of each student's individual contribution to the project.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Network Design
<b>Course unit code</b>	911928
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Third Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	4
<b>Name of Lecturer(s)</b>	Luís Miguel Lopes de Oliveira
<b>Learning outcomes of the course unit</b>	Understand the main issues related to data computer networks e be familiar with the good practices to be taken into account when designing state-of-the-art data networks.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Data Networks I and II Data networks Security and Management
<b>Recommended optional programme componentes</b>	Not applicable.
<b>Course contentes</b>	RF Wireless networks design Introduction to service oriented architectures networks design Local area project design Datacenter networks project design Datacenter and local area security mechanisms Network infrastructure solutions
<b>Recommended or required Reading</b>	- ..(2007). <i>Design Cisco Network Service Architectures</i> . : Cisco Press - McCabe, J.(2007). <i>Network Analysis, Architecture and Design</i> . : Morgan Kaufmann - Oliveira, L.(0). <i>Apontamentos e material de apoio</i> .Acedido em 1 de julho de 2012 em e-learning.ipt.pt
<b>Planned learning activities and teaching methods</b>	Theoretical and practical classes with e-learning resources available and laboratory classes including simulation.
<b>Assessment Methods and criteria</b>	Individual or group lab assignments (40%) + individual test/exam (60%) Requirements: minimum mark of 8/20 in the theoretical component and minimum mark of 10/20 in the practical component.
<b>Language of Instruction</b>	Portuguese   <b>Mentoring in English</b>
<b>Work placement(s)</b>	Not applicable.

## B - Description of individual course units

<b>Course unit title</b>	Organisational Information Systems
<b>Course unit code</b>	911927
<b>Type of course unit</b>	Compulsory
<b>Level of Course unit</b>	First Cycle
<b>Year of Study</b>	Third Year
<b>Semester/Trimester when the course unit is delivered</b>	Second Semester
<b>Number of ECTS credits allocated</b>	5
<b>Name of Lecturer(s)</b>	Nuno José Valente Lopes Madeira
<b>Learning outcomes of the course unit</b>	The students should be able to discriminate between information systems and their underlying information technologies, understand the strategic importance of Information Systems in organizations and be aware of the role of IT and its associated processes within an organisation.
<b>Mode of delivery</b>	Face-to-face
<b>Prerequisites and co-requisites</b>	Not applicable.
<b>Recommended optional programme components</b>	Not applicable.
<b>Course contents</b>	Organizational Information Systems: Supported Processes - Value Chain; Evolution of Information Systems; Map Solutions, Content and Information Flow; Existing Market Tools; Organization of an IT Department; Evaluation of Investments in IT, IT Audit, IT Security, Risk Analysis, Aligning Cobit, ITIL and Safety Standards; legislation.
<b>Recommended or required Reading</b>	<ul style="list-style-type: none"> <li>- Torres, C. e Carvalho, H. e Silva, P. (2003). <i>A Segurança dos Sistemas de Informação</i>. .: Centro Atlântico</li> <li>- Bach, S.(2001). <i>A Gestão de Sistemas de Informação</i>. .: Centro Atlântico</li> <li>- Rascão, J.(2004). <i>Sistemas de Informação para as Organizações</i>. .: Edições Sílabo</li> <li>- Madeira, N.(0). <i>Apontamentos e material de apoio</i>.Acedido em 1 de julho de 2012 em e-learning.ipt.pt</li> </ul>
<b>Planned learning activities and teaching methods</b>	Lectures and teamwork. Workshops using applications in real environment.
<b>Assessment Methods and criteria</b>	Written tests. Presentations and teamwork.
<b>Language of Instruction</b>	Portuguese
<b>Work placement(s)</b>	Not applicable.

