Polytechnic Institute of Coimbra (P COIMBRA 02)
Coimbra Institute of Engineering - ISEC
Informatics and Systems Engineering Department

ECTS CATALOGUE

The main language of instruction at Coimbra Institute of Engineering is Portuguese. However, some courses from degree and master programs can be offered in English and/or with a tutorial support in English.

The ECTS catalogue includes subject contents in English. The Students can choose subjects from this Catalogue to the study plan proposal (Learning Agreement) to be analyzed carefully by the Departmental Coordinators and to be adjusted if necessary.

This ECTS catalogue contains information which is valid for this academic year. ISEC reserves the right to adjust the courses offered during the academic year and is not responsible for typing errors or printing mistakes.

Note:
Incoming students are able to choose subjects only from the some degree: or Bachelors or Master. Exceptions are accepted if:

a) the student is registered in the 4th year of the Bachelor (courses with 4/5 curricular years);
b) the student is enrolled in the master degree.

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Polytechnic Institute of Coimbra (P COIMBRA 02)
Coimbra Institute of Engineering - ISEC
Informatics and Systems Engineering Department

ECTS CATALOGUE

BACHELOR – Informatics Engineering

Code	Title - Portuguese	Title - English	ECTS	Term
	1.º ano / 1st Year			
911901	Análise Matemática I	Mathematical analysis I	6	Winter
911904	Sistemas Digitais	Digital Systems	5	Winter
911905	Álgebra Linear	Linear Algebra	5	Winter
911936	Introdução à Programação	Introduction to Programming	5	Winter
911937	Tecnologias WEB	Web Technologies	4	Winter
911938	Gestão	Management	5	Winter
911982	Electrónica	Electronics	4	Spring
911910	Análise Matemática II	Mathematical Analysis II	6	Spring
911943	Métodos Estatisticos	Statistical Methods	5	Spring
911940	Programação	Programming	5	Spring
911941	Tecnologias e Arquitecturas de Computadores	Computer Architecture and Technology	5	Spring
911945	Fundamentos de Computação Gráfica	Fundamentals of Computer Graphics	5	Spring
	2.º ano / 2nd Year			
911913	Introdução às Redes de Comunicação	Introduction to Data Networks	5	Winter
911915	Investigação Operacional	Operations Research	5	Winter
911939	Sistemas Operativos	Operative Systems	5	Winter
911919	Bases de Dados	Databases	5	Winter
911975	Programação Orientada a Objectos	Object Oriented Programming	5	Winter
911944	Introdução à Inteligência Artificial	Introduction to Artificial Intelligence	5	Winter
911918	Modelação e Design	Modeling and design	5	Spring
911927	Sistemas Operativos II	Operating Systems 2	5	Spring
911930	Conhecimento e Raciocínio	Knowledge and Reasoning	5	Spring
911973	Emprendedorismo e Inovação		5	Spring
911949	Serviços de Rede I	Network Services 1	5	Spring
911950	Cablagem Estruturada	Structured Cabling	5	Spring
911951	Encaminhamento de Dados	Routing	5	Spring
911952	Segurança	Security	5	Spring
911977	Interacção Pessoa-Máquina	Human Computer Interaction	5	Spring
911958	Programação Avançada	Advanced Programming	5	Spring
911980	Arquitectura e Administração de Bases de Dados	Database Architecture and Management	5	Spring
911964	Integração de Dados	Data Integration	5	Spring
911965	Sistemas de Informação I	Information Systems I	5	Spring
	3.º ano / 3rd Year			
911978	Arquitecturas Móveis	Mobile Architectures	6	Winter
911946	Programação WEB	WEB Programming	6	Winter
911955	Disponibilidade e Desempenho	Network Availability and Performance	6	Winter
911969	Estratégia Organizacional	Organizational Strategy	6	Winter
911959	Estruturas de Dados	Data Structures	6	Winter
911979	Gestão de Projecto de Software	Software Project Management	6	Winter
911956	Gestão de Redes		6	Winter
911966	Inteligência Computacional	Computacional Intelligence	6	Winter
911981	Metodologias de Optimização e Apoio à Decisão	Optimization and Decision Support Methodologies	6	Winter
911960	Programação Distribuída	Distributed Programming	6	Winter
911954	Serviços de Rede II	Network services II	6	Winter
911967	Sistemas de Informação II	Information Systems II	6	Winter
911953	Tecnologias de Ligação	Link-Layer Technologies	6	Winter
911947	Ética e Deontologia	Ethics and Deontology	3	Spring
911948	Projecto ou Estágio	Project or Traineeships	27	Spring

Title:	Mathematical Analysis I
Scientific Area:	Mathematics
Course:	Informatic Engineering
Codigo:	911901
Year /Semester:	1st / 1st
ECTS:	5
Department:	Department of Physics and Mathematics
Study plan:	Real functions of one real variable: Limit and continuity; Basic theorems; Trigonometric and inverse trigonometric functions; Basic properties of the Logarithm and the Exponential. Hyperbolic functions.
	Integral calculus: Primitives, integration by parts, integration by substitution and integration of rational functions; Definite integral (Riemann's integral) and the fundamental theorem of calculus; Applications of integration to the calculation of area, volume and length; Indefinite integrals and improper integrals.
	An introduction to ordinary differential equations: Terminology; First-order differential equations: First-order linear differential equation and separable equation.
Language:	Portuguese / Tutorial Support in English

Type of instruction:

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	Classroom, lectures
Theoretical-Practical	28	2	Classroom, lectures and problem solving
Practical	14	1	Laboratory work and problem solving
Tutorial guidance			Students have weekly voluntary support through instructor's office hours (6 hours availability)

Learning objectives:	The main aims of this course unit are: Knowledge of the basics of mathematical analysis; knowledge of real functions of one real variable; Understand and apply theoretical development of differential and integral calculus; Understand the basic concepts of ordinary differential equations and solve some simple first order differential equations; Solve and interpret real problems.
Generic learning outcomes and competences:	At the end of this course unit the learner is expected to be able: To explain the concepts, discuss and present each problem solution in an appropriate way; To solve practical problems with an increasing autonomy, using the subjects treated in the classroom and other related topics; To find and select relevant information from different sources such as monographs textbooks and the web.

<table>
<tr><td>Title</td><td>Project or Traineeships</td></tr>
<tr><td>Scientific Area:</td><td>Informatics Engineering</td></tr>
<tr><td>Course:</td><td>Degree in Computer Engineering (new curriculum)</td></tr>
<tr><td>Codigo :</td><td>911948</td></tr>
<tr><td>Term/Semester:</td><td>3rd / 2nd</td></tr>
<tr><td>ECTS:</td><td>27</td></tr>
<tr><td>Department:</td><td>Systems and Informatics Engineering</td></tr>
<tr><td>Instructor:</td><td>The proponents of the project</td></tr>
<tr><td></td><td>Course Coordinator = Leader of the Project Management Committee nominated by the Scientific Committee</td></tr>
<tr><td>Study plan:</td><td>Depend on the specific project.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Language</td><td>Portuguese / Tutorial support in English</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Type of instruction:</td><td>
<table>
<tr><th>Activities</th><th>Total Hours</th><th>Hours/week</th><th>Comments</th></tr>
<tr><td>Theoretical</td><td>--</td><td>--</td><td></td></tr>
<tr><td>Practical:</td><td>--</td><td>--</td><td></td></tr>
<tr><td>Tutorial guidance</td><td>42</td><td>3</td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td>Learning objectives:</td><td>It is intended that students undertake a work that allows them to apply the knowledge / skills acquired in different courses of the bachelor. Generally, this work consists in the development of a computer application that may be of research nature, or have a more practical character being developed in collaboration with companies / institutions. Moreover, usually the project work is carried out by a team of two or three students, except in special situations.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Generic learning outcomes and competences:</td><td>Each project has its own characteristics and, thus, its specific learning outcomes. For this reason the ones presented below are of generic nature.

After attending this course students should:
• Know how to apply and integrate the competences and capacities developed in precedent courses to a given problem solving
• Acquire the ability to explore new concepts in the area of Informatics Engineering
• Acquire the ability to search / collect / select information from various sources
• Get the capacity to interact with the others and to be involved in a team work
Get the ability to communicate orally and in writing</td></tr>
<tr><td></td><td></td></tr>
</table>

Bibliography:	Depend on the specific project.
Progress assessment:	***Evaluation:*** A project is evaluated by a jury composed by, at least, three elements of the teaching staff, two of which with no connection to the project concerned. In the case of projects developed in collaboration with companies / institutions, the jury should also include a representative of these ones. The evaluation is based on all the documentation submitted during the semester, including the final report, and on a public presentation of the work done.

Subject Title:	Link-Layer Technologies
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Code:	911953
Year/Semester:	3rd year / 1st semester
ECTS:	6
Department:	Systems and Informatics Engineering
Instructor:	Amâncio Santos
Study plan:	Packet switching concepts. Switch configuration. VLAN and VLAN Trunking Protocol (VTP). Spanning Tree Protocol (STP) and Rapid Spanning Tree Protocol (RSTP). Switch security and monitoring. Point to Point Protocol (PPP). Frame Relay. Integrated Services Digital Network (ISDN). Wireless local area network concepts. Configuration of Wireless LAN Controller Module (WLCM).
Language:	Portuguese/Tutorial Support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Theoretical-Practical			
Practical	42	3	
Tutorial guidance			

Learning objectives:	The link-layer technologies course unit provides the necessary skills involved in the selection, dimensioning and configuration of general active equipment belonging to the link layer of the OSI model.
Generic learning outcomes and competences:	Describe and distinguish composition, internal architecture and working modes of hubs, switches, routers and terminals. Develop the overhaul configuration of switches and routers based on IOS. Describe the operation of virtual local area networks (VLAN) and the corresponding routing. Apply security measures to switches. Understand and configure several protocols used on switches. Identify several link-state technologies in wide area networks (WAN). Project and configure a network according to specific requirements of a particular project, applying debugging strategies used on data networks.
Bibliography:	Wendell Odom, CCNA Official Exam Certification Library (CCNA Exam 640-802), 2nd Edition, Cisco Press, 2007. Todd Lammie, CCNA Cisco Certified Network Associate Study Guide, 7th Edition, Wiley Publishing, Inc., 2011. Kevin R. Fall and W. Richard Stevens, TCP/IP Illustrated, Volume 1: The Protocols (2nd Edition), Addison-Wesley Professional Computing Series), 2011. L. Santos, A. Santos, J. Marinho, J. Rosado, CCNA3: Switching and Wireless 4.0 (slides), ISEC, 2008. L. Santos, A. Santos, J. Marinho, J. Rosado, CCNA4: Acessing the WAN 4.0 (slides), ISEC, 2008.
Progress assessment:	In theoretical lessons a detailed exposition of the concepts is made using illustrative examples and, if possible, with demonstration in a simulation environment. It is distributed a topology in each practical lesson in order to be installed and configured by all

	the working groups, using the existing equipment in the lab. The evaluation divides by a final exam (60%) and a planning and configuration project of a local network, properly designed and configured in a simulation environment (40%). It is necessary to achieve the minimum rating of 10 values in both of these components.

Title	Organizational Strategy
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911969
Term/Semester:	3st/1nd
ECTS:	6
Department:	Systems and Informatics Engineering
Study plan:	Organizational strategy – vision, mission, and competitive advantage
	How information systems impact organization and business firms Tools to support the strategic choice of the information systems Techniques to analyze and assess the organization business models Business models in inter-organizational environments Techniques to develop the requirement analysis and the IT architecture
	How organizational strategy impacts project management
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Theoretical-Practical:			
Practical	42	3	

Learning objectives:	Understand the impact of the organizational context on the development/acquisition of information systems Use suitable business models to analyze and evaluate the organizational strategies Identify the appropriate information and communication technologies to support the organization's goals. Understand how organization strategy influences project management
	Manage projects
Generic learning outcomes and competences:	Evaluate the impact of information systems on organizations Assess organizational strategies and their business models, with a critical attitude Develop a information systems strategic planning for an organization
	Present the developed solutions clearly
	Create new solutions
Bibliography:	• Strategic Planning for Information Systems - Hardcover (June 15, 2002) by John L. Ward and Joe Peppard

	• Managing Information & Systems: The Business Perspective - Paperback (Jan. 13, 2006) by Adrienne Curry, Ivan Hollingworth, and Peter Flett • Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers - (Hardcover - Sept. 1, 2009) by Osterwalder Alexander and Pigneur Yves • The Fast Forward MBA in Project Management (Portable Mba Series) (Paperback - Apr. 25, 2008) by Eric Verzuh • USEFUL LINKS: a. Introduction: Information management in organizational strategy and change- http://www.download-it.org/free_files/filePages%20from%2011%20Strategy%20and%20information%20systems.pdf b. The information systems strategy triangle http://media.wiley.com/product_data/excerpt/87/04717153/0471715387.pdf c. An e-Business Model Ontology for Modelling e-Business - http://www.hec.unil.ch/yp/Pub/02-Bled.pdf d. Do Some Business Models Perform Better than Others? - http://papers.ssrn.com/sol3/papers.cfm?abstract_id=920667
Progress assessment:	One test (50%). A practical work (50%).

Title	Optimization and Decision Support Methodologies
Scientific Area:	Informatics Engineering
Course:	Degree in Computer Engineering (new curriculum)
Codigo:	911968
Term/Semester:	3st / 1st
ECTS:	6
Department:	Systems and Informatics Engineering
Study plan:	Multiobjective and multicriteria Decision Post-optimal and sensitivity analysis Decision theory in context of uncertainty Dynamic programming Data mining
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	28	2	
Tutorial guidance	14	2	

Learning objectives:	Based on the concepts learnt on introductory “Operational Research” course, this course will study other types of more complex problems/models and more close to reality, such as problems with multiple objectives. The knowledge learned in this course can be applied to solving similar algorithms/problems in real context.
Generic learning outcomes and competences:	Knowing the techniques and methods presented in the course, and be able to apply them in solving simple problems. Identify the appropriate algorithms that can be used to solve a specific optimization problem. Interpret the obtained solution(s). Analyze the sensitivity of the solution(s) relative to changes in model parameters. Develop projects that require more than the direct appliance of the concepts acquired in classes, in an autonomous way. Develop the ability to solve real optimization and decision problems, with emphasis on engineering problems.
Bibliography:	*To be defined*
Progress	*To be defined*

assessment:	

<table>
<tr><td>Title</td><td>Information Systems II</td></tr>
<tr><td>Scientific Area:</td><td>Informatics</td></tr>
<tr><td>Course:</td><td>Informatics Engineering</td></tr>
<tr><td>Codigo:</td><td>911967</td></tr>
<tr><td>Term/Semester:</td><td>3nd /1nd</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Department:</td><td>Informatics Engineering</td></tr>
<tr><td></td><td></td></tr>
<tr><td rowspan="3">Study plan:</td><td>Evolution of information systems;
Assessment of value and investments in systems and information technology;
Study of evaluation techniques;</td></tr>
<tr><td>Principles and beddings of the quality of software;
Software process maturity;
Software product evaluation;</td></tr>
<tr><td>Software quality management;</td></tr>
<tr><td>Language</td><td>Portuguese /Tutorial support in English</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Type of instruction:</td><td>
<table>
<tr><th>Activities</th><th>Total Hours</th><th>Hours/week</th><th>Comments</th></tr>
<tr><td>Theoretical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Practical:</td><td>42</td><td>3</td><td></td></tr>
<tr><td>Tutorial guidance</td><td></td><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td rowspan="4">Learning objectives:</td><td>Global understanding of the evolution of Information systems</td></tr>
<tr><td>Understanding of issues and techniques to evaluate value and investment in information systems.</td></tr>
<tr><td>Understanding of the different issues of software quality.</td></tr>
<tr><td>The different approaches to software process and their implications in quality of the product.</td></tr>
<tr><td rowspan="4">Generic learning outcomes and competences:</td><td>Capacity to chose and apply the different evaluation techniques of information systems.</td></tr>
<tr><td>Capacity to identify the level of maturity of software organization.</td></tr>
<tr><td>Capacity to mage the software quality.</td></tr>
<tr><td></td></tr>
<tr><td>Bibliography:</td><td>

- Management Information Systems, Kenneth C. Laudon and Jane P. Laudon;
- Using the Project Management Maturity Model: Strategic Planning for Project Management by Harold Kerzner (Hardcover - Mar. 17, 2005);
- Measuring information technology investment payoff: contemporary approaches byMo Adam Mahmood, Edward J. Szewczak;
- http://www.qpmg.com/sei.htm;

</td></tr>
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	- http://www.swquality.com/users/pustaver/Books/books.htm
Progress assessment:	Practical written work with individual oral presentations and discussion (Report 20% e Presentation and discussion 20%) Written exam (60%)

Title	Informatics Engineering
Scientific Area:	Informatics
Course:	Computational Intelligence
Codigo:	911966
Term/Semester:	3rd / 1st
ECTS:	5
Department:	DEIS
Study plan:	1. Introduction to Computational Intelligence; 2. Data Mining Concepts; 3. Automatic Learning with Neural Networks 4. Neuro-Fuzzy Systems 5. Clustering 6. Industrial Applications 7. OLAP Time Series Prediction
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	42	3	
Tutorial guidance			

Learning objectives:	The course presents a comprehensive overview of the most relevant computational intelligence techniques and applications to real problems in industry. Special focus is given to automatic learning techniques using neural networks and fuzzy systems.
Generic learning outcomes and competences:	A.1. Identify the main techniques and problems in computational intelligence. A.2. Explain the differences between several algorithms, describing the main advantages and disadvantages.. B.1. Evaluation of techniques as a solution to real world problems. B.2. Choose the best solutions and adjust the algorithm parameters to a specific problem C.1. Justify the proposed solutions C.2. Identify new application areas D.1. Evaluate the benefits of different strategies E.1. Production of technical reports and guides for the developed applications

	F.1. Develop innovative projects, with high degree of autonomy.
Bibliography:	Machine Learning, Tom Mitchell, McGraw Hill Neural Networks and Learning Machines, Simon Haykin, Third Edition, Prentice Hall
Progress assessment:	Two practical works (50%) + written Exam (50%)

Title	Mobile Architectures
Scientific Area:	Informatics Engineering
Course:	Bachelor in Informatics Engineering
Codigo:	9[illegible]51
Term/Semester:	3rd / 1st
ECTS:	6
Department:	Systems and Informatics Engineering
Study plan:	Introduction to mobile computing
	Mobile Devices
	Programming frameworks: . NET CF and Java ME
	Mobile communication technologies
	Local and remote databases
	Advanced architectures: Web services, caching, synchronization
	Security
	Mobile applications deployment
Language	Portuguese /Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	42	3	
Tutorial guidance	2		

Learning objectives:	Identify different technologies used with mobile devices
	Identify different mobile architectures
	Describe characteristics of mobile systems
	Identify advantages and disadvantages of mobile devices
	Describe platforms for mobile applications development
	Describe communication mechanisms used with mobile devices
	Describe mobile access methods to local and remote data
	Identify local and remote services that can be used with mobile devices
Generic learning outcomes and	Choose acceptable architectures, technologies and platforms for mobile applications development
	Develop communication methods appropriated to application needs

competences:	Make proper use of local and remote database systems
	Develop and use remote services
Bibliography:	Aplicações Móveis com J2ME Curso Completo , Luis Miguens, Pedro Remelhe, FCA
	Building Microsoft ASP.NET Applications for Mobile Devices, Andy Wigley and Peter Roxburgh, Microsoft Press
	Windows Mobile Developer Center at http://msdn.microsoft.com/en-us/windowsmobile/default.aspx
Progress assessment:	Practical assignments Final examination

Title	Distributed Programming
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911960
Term/Semester:	3rd / 1st
ECTS:	6
Department:	Department of Informatics Engineering and Systems
Study plan:	Characterization and designing of distributed systems
	Distributed objects and remote method invocation
	Components (EJB architecture)
	Parallel programming (the MPI standard)
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	42	3	
Tutorial guidance			

Learning objectives:	This curricular unit aims to address the designing and development of distributed applications, highlighting their challenges and issues. It also aims to provide students some skills in terms of designing and developing parallel and distributed applications, using several wide-deployed middleware technologies (Distributed Objects / Remote Method Invocation, components and MPI standard).
Generic learning outcomes and competences:	The ability to characterize distributed and peer-to-peer systems in terms of their fundamentals and architectural models. The ability to explain the internal aspects of main middleware technologies. The ability to explain how the serialization of objects is achieved in Java RMI, Webservices and .Net Remoting.
	The ability to describe the main approaches for parallel programming and the MPI-1 standard.
	The ability to develop distributed applications based on web services, in Java and on the .Net platform.
	The ability to develop distributed applications based on Java RMI, .Net Remoting and on component-based architectures.
	The ability to Develop parallel applications based on the MPI standard.

Bibliography:	
Progress assessment:	Practical assignments. Final examination.

Title	Data Structures
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911959
Term/Semester:	3rd / 1st
ECTS:	5
Department:	Informatics Engineering and Systems
Study plan:	Analysis of algorithms; Big-O notation; Queues and stacks; Sorting algorithms, Searching algorithms; Trees; Hash tables.
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	28	2	
Tutorial guidance	14		

Learning objectives:	Identify the fundamental data structures.
	Identify the main operations for each data structure.
	Recognize the strengths and weaknesses of different data structures
Generic learning outcomes and competences:	Determine the complexity of the algorithms used to manipulate data structures.
	Plan and implement algorithms that manipulate different data structures.
	Select the best data structures for a given situation.
Bibliography:	T. Cormen, C. Leiserson, R. Rivest, C. Stein. Introduction to Algorithms, 3rd edition, MIT Press, 2009. R. Sedgewick. Algorithms in C, Parts 1-5: Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms, Addison-Wesley, 2001.
Progress assessment:	Lab sheets with exercises. Practical assignments. Final examination.

<table>
<tr><td>Title</td><td>Network Services 2</td></tr>
<tr><td>Scientific Area:</td><td>Informatics Engineering</td></tr>
<tr><td>Course:</td><td>Informatics Engineering</td></tr>
<tr><td>Codigo:</td><td>911954</td></tr>
<tr><td>Term/Semester:</td><td>3rd / 1st</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Department:</td><td>Systems and Informatics Engineering</td></tr>
<tr><td></td><td></td></tr>
<tr><td rowspan="4">Study plan:</td><td>Directory services:
Lightweight Directory Access Protocol (LDAP)
Active Directory
Group Policies</td></tr>
<tr><td>Web servers:
HTTP and HTTPS Servers
FTP Servers</td></tr>
<tr><td>Messaging Services:
E-mail services
Instant Messaging services</td></tr>
<tr><td>Printing Services</td></tr>
<tr><td>Language</td><td>Portuguese /Tutorial support in English</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Type of instruction:</td><td>
<table>
<tr><th>Activities</th><th>Total Hours</th><th>Hours/week</th><th>Comments</th></tr>
<tr><td>Theoretical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Practical:</td><td>42</td><td>3</td><td></td></tr>
<tr><td>Tutorial guidance</td><td></td><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td rowspan="4">Learning objectives:</td><td>This course intends students to develop skills on installation, configuration and management of centralized authentication services, messaging services and application servers.</td></tr>
<tr><td></td></tr>
<tr><td></td></tr>
<tr><td></td></tr>
<tr><td rowspan="3">Generic learning outcomes and competences:</td><td>Plan, install and configure Active Directory services
Plan and configure group policies</td></tr>
<tr><td>Plan intranet and internet information services
Plan, install and configure HTTP, HTTPS and FTP servers</td></tr>
<tr><td>Plan, install and configure e-mail services
Configure anti-spam and anti-virus services</td></tr>
</table>

	Plan and configure centralized printing services
Bibliography:	• Dan Holme, “MCSE Self-Paced Training Kit (Exams 70-290, 70-291, 70-293, 70-294) : Microsoft Windows Server 2003 Core Requirements”, Microsoft Press • Elias N. Khnaser, “MCSE designing security for a Windows server 2003 network : exam 70-298”, Syngress • Mark Minasi, “Mastering Windows server 2003”, SYBEX • Rand H. Morimoto, “Microsoft Windows server 2003 insider solutions”, Sams • Windows 2003 Documentation at http://technet.microsoft.com/en-us/library/cc706993.aspx
Progress assessment:	A final theoretical exam Laboratory assignments and homework

Title	Knowledge and Reasoning
Scientific Area:	Computer Science / Artificial Intelligence
Course:	Computer Science Engineering - Application Development
Codigo:	911930
Term/Semester:	3rd / 1st
ECTS:	5
Department:	Computer Science
Study plan:	**THEORETICAL CLASSES** Knowledge Acquisition and Representation Rule Based Systems Case-based Reasoning Artificial Neural Networks Bayesian Networks Fuzzy Systems
	PRACTICAL CLASSES Application problems Experiments with Shells and development tools
	TUTORIAL GUIDANCE / LAB CLASSES Practical work (real application) based on a development tool (students are organized in work groups)
Language	Portuguese / English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	28	2	
Tutorial guidance			

Learning objectives:	Know when and how to apply the studied knowledge representation and inference models

Generic learning outcomes and competences:	Recognize problems where the studied models may be of help
	Knowledge acquisition
	Development of solutions based on the studied models
	Implementation of development environments
Bibliography:	Artificial Intelligence – A Modern Approach, Russel & Norvig, 2002 Machine Learning, Tom Mitchel, 2001 Expert Systems Principles and Programming, Giarratano & Riley, 1998 Introduction to Expert Systems, Peter Jackson, 1998 Applying Case Based Reasoning, Ian Watson, 1997 Fuzzy Set Theory and Its Applications, Zimmerman, 2001 CLIPS, CORVID, CBR-Works and GENIE user guides
Progress assessment:	Tutorial guidance / Lab classes : 10 marks Final Exam : 10 marks

<table>
<tr><td>Subject Title:</td><td>Security</td></tr>
<tr><td>Scientific Area:</td><td>Informatics Engineering</td></tr>
<tr><td>Course:</td><td>Informatics Engineering</td></tr>
<tr><td>Code:</td><td>911952</td></tr>
<tr><td>Year/Semester:</td><td>2nd/2S</td></tr>
<tr><td>ECTS:</td><td>5</td></tr>
<tr><td>Department:</td><td>Informatics Engineering and Systems</td></tr>
<tr><td>Instructor:</td><td>Luís Eduardo Faria dos Santos</td></tr>
<tr><td>Study plan:</td><td>1. Security vulnerabilities on information systems and communication networks;
2. Cryptography;
3. Secure communication protocols;
4. Secure authentication mechanisms;
5. Access control devices (Firewalls, IDS, IPS)</td></tr>
<tr><td>Language:</td><td>Portuguese</td></tr>
<tr><td>Type of instruction:</td><td>
<table>
<tr><th>Activities</th><th>Total Hours</th><th>Hours/week</th><th>Comments</th></tr>
<tr><td>Theoretical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Theoretical-Practical</td><td></td><td></td><td></td></tr>
<tr><td>Practical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Tutorial guidance</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Learning objectives:</td><td>This course aims to introduce students to the basics of network vulnerabilities and the off-the-shelf modern security technologies and products available to mitigate them.</td></tr>
<tr><td>Generic learning outcomes and competences:</td><td>The students are expected to become aware of the fundamental aspects of security in information systems and communications, in terms of risk classes, security policies and mitigation technologies. Practical skills are provided on defining and planning security policies, as well as on configuring popular network security devices like firewalls, intrusion prevention systems and intrusion detection systems. The contents partially cover the well-known CCNA Security course currently integrated into the Cisco Academy course portfolio.</td></tr>
<tr><td>Bibliography:</td><td>Yusuf Bhaiji, “Network security technologies and solutions”, Cisco Press, 2008, ISBN 978-1-58705-246-0;
Roberta Bragg, Mark Rhodes-Ousley, Keith Strassberg, “Network security : the complete reference”, McGrw-Hill/Osborne, 2004, ISBN 0-07-222697-8;
André Zúquete, “Segurança em Redes Informáticas”, 2ª edição, FCA, 2008, ISBN 978-972-722-565-1;
Denise Helfrich, Lou Ronnau, Jason Frazier, Paul Forbes, “Cisco network admission control”, VolI/II, Cisco Press, 2007, ISBN 1-58705-241-5;</td></tr>
<tr><td>Progress assessment:</td><td>Written exam weight: 70%; the written exam must be completed on the scheduled dates.
Project 1: weight: 10%; Reproducing a network attack and discuss mitigation.
Project 2: weight: 20%; Prepare a workshop on a subject related but not covered by the course.
Students must reach a minimum of 35% on each assessed component to succeed on the</td></tr>
</table>

	course.

<table>
<tr><td>Subject Title:</td><td>Routing</td></tr>
<tr><td>Scientific Area:</td><td>Informatics Engineering</td></tr>
<tr><td>Course:</td><td>Informatics Engineering</td></tr>
<tr><td>Code:</td><td>911951</td></tr>
<tr><td>Year/Semester:</td><td>2nd year / 2nd semester</td></tr>
<tr><td>ECTS:</td><td>5</td></tr>
<tr><td>Department:</td><td>Systems and Informatics Engineering</td></tr>
<tr><td>Instructor:</td><td>Amâncio Santos</td></tr>
<tr><td>Study plan:</td><td>TCP/IP technology. Internet Control Message Protocol (ICMP). Cisco routers configuration. Cisco Discovery Protocol (CDP). IP addressing. VLSM addressing. IP routing. Routing table lookup and processing algorithm. Routing algorithms RIPv1, RIPv2, EIGRP and OSPF. IPv6. IPv6 addressing. IPv6 tunnels. Routing protocols RIPng, EIGRPv6 and OSPFv3.</td></tr>
<tr><td>Language:</td><td>Portuguese/Tutorial Support in English</td></tr>
<tr><td>Type of instruction:</td><td>
<table>
<tr><th>Activities</th><th>Total Hours</th><th>Hours/week</th><th>Comments</th></tr>
<tr><td>Theoretical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Theoretical-Practical</td><td></td><td></td><td></td></tr>
<tr><td>Practical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Tutorial guidance</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Learning objectives:</td><td>The data routing course unit provides the necessary skills involved in the selection, dimensioning and configuration of general active equipment belonging to the network layer of the OSI model.</td></tr>
<tr><td>Generic learning outcomes and competences:</td><td>Describe and distinguish composition, internal architecture and working modes of routers and terminals. Develop the overhaul configuration of routers based on IOS. Create addressing plans in private and public IP networks using variable length subnet masking (VLSM). Describe the operation of the Internet Control Message Protocol (ICMP). Describe the concepts and techniques adopted by link-state and distance-vector routing protocols. Understand the routing table lookup process. Describe the architecture and operation of routing protocols RIP, EIGRP and OSPF. Project and configure a network according to specific requirements of a particular project, applying debugging strategies used on data networks.</td></tr>
<tr><td>Bibliography:</td><td>Wendell Odom, CCNA Official Exam Certification Library (CCNA Exam 640-802), 2nd Edition, Cisco Press, 2007.
Todd Lammie, CCNA Cisco Certified Network Associate Study Guide, 7th Edition, Wiley Publishing, Inc., 2011.
Kevin R. Fall and W. Richard Stevens, TCP/IP Illustrated, Volume 1: The Protocols (2nd Edition), Addison-Wesley Professional Computing Series, 2011.
L. Santos, A. Santos, J. Marinho, J. Rosado, CCNA1: Network Fundamentals 4.0 (slides), ISEC, 2008.
L. Santos, A. Santos, J. Marinho, J. Rosado, CCNA2: Routing Protocols and Concepts 4.0 (slides), ISEC, 2008.</td></tr>
<tr><td>Progress assessment:</td><td>In theoretical lessons a detailed exposition of the concepts is made using illustrative examples and, if possible, with demonstration in a simulation environment.</td></tr>
</table>

	It is distributed a topology in each practical lesson in order to be installed and configured by all the working groups, using the existing equipment in the lab. The evaluation divides by a final exam (60%) and a planning and configuration project of a local network, properly designed and configured in a simulation environment (40%). It is necessary to achieve the minimum rating of 10 values in both of these components.

Title	Information Systems I
Scientific Area:	Informatics
Course:	Informatics Engineering
Codigo:	911965
Term/Semester:	2nd /2nd
ECTS:	5
Department:	Informatics Engineering
Study plan:	Historical context of the information systems; Impact of the information systems in the organizations; Strategical implications in information systems development; Information systems impact on strategic options of the organization;
	Information Systems planning; Specification of business processes specification;
	Service oriented architecture; Corporative governance of the Enterprise Architecture; Introduction to the ITIL;
Language	Portuguese /Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	28	2	
Tutorial guidance			

Learning objectives:	Understanding of the context and impact of the information systems in the organization.
	Importance of the alignment of information systems with enterprise strategic.
	Business process specification as input to information systems planning.
	Understanding the underling concepts of services oriented architecture, and Governance.
Generic learning outcomes and competences:	Ability to identify business processes.
	Capacity to define the services that should be implemented by the information system.
	Capacity to integrate an ITIL and governance team.
Bibliography:	- Information Systems Development: Methodologies, Techniques and Tools - Paperback (1 Mar 2006) by David Avison and Guy Fitzgerald.

	- A Pragmatic Guide to Business Process Modelling by Jon Holt. - - A Pragmatic Guide to Business Process Modelling by Jon Holt. - Essentials of Business Processes and Information Systems - Paperback (6 Feb 2009) by Simha R. Magal and Jeffrey Word. - Service Oriented Architecture (SOA) for Dummies by Judith Hurwitz, Robin Bloor, Marcia Kaufman, and Fern Halper. - Service-Oriented Architecture: Concepts, Technology, and Design (Prentice Hall Service-Oriented Computing Series from Thomas Erl) by Thomas Erl. - Applied SOA: Service-Oriented Architecture and Design Strategies by Michael Rosen, Boris Lublinsky, Kevin T. Smith, and Marc J. Balcer - Governance (Key Concepts) by Anne Mette Kjaer. - - Introduction to ITIL by Stationery Office Books.
Progress assessment:	Oral presentations and discussion (40%) Written exam (60%)

Title	Data Integration
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911964
Term/Semester:	2nd / 2nd
ECTS:	5
Department:	Systems and Informatics Engineering
Study plan:	1. Integration of Information Systems 2. Parallel and distributed Information System 3. Integration of data from heterogeneous sources 4. Maintaining consistent data views
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	42	3	
Tutorial guidance	14	1	

Learning objectives:	The main objective of this course is to provide knowledge, understanding and practice on management of integration of information systems, with emphasis on: - integration of database systems - integration of heterogeneous data sources
Generic learning outcomes and competences:	A.1. Identify the underlying concepts of integrating information systems A.2. Identify the underlying concepts of integration data A.3. Identify the underlying concepts of database security
	B.1. Propose the implementation of database integration procedures B.2. Propose the implementation of consistent distributed data views
	C.1. Justify proposed solutions for data integration consistency issues C.2. Justify proposed solutions for data integration mechanisms C.3. Evaluate alternative data integration proposals, demonstrating critical attitude.
	D.1. Elaborate supporting documentation of data integration projects D.2. Present and explain implementation of data integration projects.
Bibliography:	• RODRIGUES, A. - Oracle 10g e 9i Para Profissionais, FCA, 2005 • DATE, C. J. - An Introduction to Database Systems, Addison- Wesley Publishing Company,

	2004 • RAMAKRISSHNAN, R. - Database Management Systems, McGraw-Hill, 2003 • ELMASRI, R.; NAVATHE, S.B. - Fundamentals of Database Systems, Addison-Wesley Publishing, 2003 • COUCHMAN, J. S.; MARISETTI, S. N. - Oracle9i database: fundamentals I exam guide, Osborne/McGraw-Hill, 2002 • VELPURI, R. - OCP Oracle9i database: fundamentals II exam guide, Osborne/McGraw-Hill, 2002 • CAMPOS, L. M. - Oracle 8i Curso Completo, FCA, 1999 • PEREIRA, J. L. - Tecnologia de Bases de Dados, FCA, 1998
Progress assessment:	Type of assessment : Lab tests: 30% Written exam: 50% Continuous evaluation: 20 %

Programa enviado

Integração de Dados

1. Introdução aos sistemas de apoio à decisão;
2. OLAP: modelo de dados multidimensional;
3. Queries de agregação multidimensional;
4. Encontrar resposts às queries rapidamente.
5. Técnicas de implementação para OLAP;
6. Datawarehousing;
7. Vistas e apoio à decisão;
8. Vistas materializáveis;
9. Manutenção das vistas materializáveis.

Visto que existe sobreposição com UC do mestrado, sugiro

Integração de dados

1. Integração de sistemas de informação
    - Integração de dados, funções e processos
2. BD paralelas e distribuídas
    - Tuning Queries paralelas
3. Vistas Materializadas
    - Manutenção de vistas materializadas
4. Integração de fontes de dados heterogéneos

Title	Database Architecture and Management
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911963
Term/Semester:	2nd / 2nd
ECTS:	5
Department:	Systems and Informatics Engineering
Study plan:	1. Database server-side programming 2. Tuning Database Systems: Query, physical 3. Securing Database Systems 4. Distributed and Parallel Database Systems
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	42	3	
Tutorial guidance	14	1	

Learning objectives:	The main objective of this course is to provide knowledge, understanding and practice on management of database system, with emphasis on: - Tuning - Security - Management
Generic learning outcomes and competences:	A.1. Identify the underlying concepts of database management systems A.2. Identify the underlying concepts of database systems architecture A.3. Identify the underlying concepts of database security
	B.1. Propose the implementation of database systems security procedures B.2. Propose the implementation of database system tuning procedures
	C.1. Justify proposed solutions for tuning database systems C.2. Justify proposed solutions for securing database systems
	D.1. Elaborate supporting documentation of management procedures D.2. Present and explain implementation of management procedures
Bibliography:	• RODRIGUES, A. - Oracle 10g e 9i Para Profissionais, FCA, 2005

	• DATE, C. J. - An Introduction to Database Systems, Addison- Wesley Publishing Company, 2004 • RAMAKRISSHNAN, R. - Database Management Systems, McGraw-Hill, 2003 • ELMASRI, R.; NAVATHE, S.B. - Fundamentals of Database Systems, Addison-Wesley Publishing, 2003 • COUCHMAN, J. S.; MARISETTI, S. N. - Oracle9i database: fundamentals I exam guide, Osborne/McGraw-Hill, 2002 • VELPURI, R. - OCP Oracle9i database: fundamentals II exam guide, Osborne/McGraw-Hill, 2002 • CAMPOS, L. M. - Oracle 8i Curso Completo, FCA, 1999 • PEREIRA, J. L. - Tecnologia de Bases de Dados, FCA, 1998
Progress assessment:	Type of assessment : Lab tests: 30% Written exam: 50% Continuous evaluation: 20 %

Title	Human Computer Interaction
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911957
Term/Semester:	2nd / 2nd
ECTS:	5
Department:	Informatics Engineering and Systems
Study plan:	• Human Perception System • Elements of HCI design • Guides to Web Design • Accessibility in Web development • Interactive Systems Design • Assessment Techniques
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	30	2	
Practical:	30	2	
Tutorial guidance			

Learning objectives:	Provide students with the necessary knowledge to develop interactive systems so that they appear to be efficient from the standpoint of the user. This sense will be studied the characteristics of interactive systems, the importance of human factors and technology and also the usefulness of the evaluation component in the design of such systems.
Generic learning outcomes and competences:	A.1. Understand the importance of human computer interaction; A.2. Knowing and understanding the human factors and technology; A.3. Knowing the different devices and styles of interaction; A.3. Knowing the different paradigms of interaction; A.4. Identify the principles of usability and understand its necessity in software development; A.4. Knowing the principles of accessibility; A.6. Understanding the need and methods of analysis tasks; A.7. Understanding the need for evaluation of an interface; A.8. Knowing the different assessment mechanisms; A.9. Understanding the utility and the different approaches of user support.
	B1. Identify styles of interaction; B2. Apply principles of usability; B3. Develop interactive displays and layouts;

	B4. Apply several prototyping techniques; B5. Analyze existing interfaces in order to identify their advantages and disadvantages.
	C.1. Develop creative abilities in solving problem solving interaction. C.2. Analyze existing interfaces in order to submit reviews and suggestions for change where necessary. C.3 Evaluate the relative merits of different solutions to a problem.
	D.1. Develop clear documentation in the development of a program, identifying the key decisions. D.2. Present and explain the programs developed in a clear manner.
	E.1. The concepts in this course should instill in the student's interest and ability to apply them in the resolution of similar applications and more complex, in a professional context.
Bibliography:	• Human-Computer Interaction (3rd Edition) - Alan Dix, Janet E. Finlay, Gregory D. Abowd, Russell Beale. Prentice Hall; 3 edition (December 20, 2003) • The Design of Everyday Things - Donald A. Norman. Basic Books; (September 17, 2002) • Usability Engineering - Jakob Nielsen. Morgan Kaufmann; 1st edition (September 23, 1993) • Designing the User Interface: Strategies for Effective Human-Computer Interaction - Ben Shneiderman, Catherine Plaisant. Addison Wesley; 4 edition (April 10, 2004) • Designing Interactions - Bill Moggridge. The MIT Press; 1 edition (October 1, 2007) • Don't Make Me Think: A Common Sense Approach to Web Usability, 2nd Edition - Steve Krug. New Riders Press; 2nd edition (August 28, 2005)
Progress assessment:	Three practical Exercises that cover the topics that are being taught (75% of the final grade) A final theoretical exam (25% of the final grade)

Title	Advanced Programming
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911958
Term/Semester:	2nd /2nd
ECTS:	5
Department:	Department of Informatics Engineering and Systems
Study plan:	The Java programming language
	JFC library
	Implementation of design patterns in Java
	Concurrent programming in Java
	Persistence
	Junit
	Advanced services with Java technology
Language	Portuguese/Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	56	4	
Tutorial guidance			

Learning objectives:	Define classes and create objects in Java
	Know concepts related with inheritance and polymorphism in Java
	Know the meaning of exceptions
	Demonstrate basic knowledge about persistence and concurrent programming
	Demonstrate knowledge about the organization of an application in graphical environment and the involved concepts
Generic learning outcomes and competences:	Develop applications in graphical environment in Java, in which it is necessary to define classes and to relate them using the mechanisms of composition and inheritance, and also to separate the model and visual representation of the problem.
	Evaluate the structure of classes used to represent a problem, showing critical attitude.
	Explore different subjects which may be not learned in classroom, but that needed to be integrated in the development of practical works
Bibliography:	ECKEL, B. – Thinking in Java, 4/e, Prentice Hall, 2006. ISBN: 9780131872486

	DEITEL, H.;DEITEL, P. - Java™ How to Program, 7/e, Prentice Hall, 2007. ISBN-10: 0132222205
Progress assessment:	Practical assignments. Final examination.

<table>
<tr><td>Title</td><td>Network Services 1</td></tr>
<tr><td>Scientific Area:</td><td>Informatics Engineering</td></tr>
<tr><td>Course:</td><td>Informatics Engineering</td></tr>
<tr><td>Codigo:</td><td>911949</td></tr>
<tr><td>Term/Semester:</td><td>2nd / 2nd</td></tr>
<tr><td>ECTS:</td><td>5</td></tr>
<tr><td>Department:</td><td>Systems and Informatics Engineering</td></tr>
<tr><td rowspan="4">Study plan:</td><td>IP addressing services:
• Dynamic Host Configuration Protocol (DHCP and DHCP Relay)
• Network Address Translation (NAT and NAT Overload)</td></tr>
<tr><td>Name resolution services:
• Domain Name Service</td></tr>
<tr><td>Teleworker services:
• Encapsulation protocols
• Virtual Private Networks (VPNs)</td></tr>
<tr><td>Proxy services
Time synchronization services</td></tr>
<tr><td>Language</td><td>Portuguese /Tutorial support in English</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Type of instruction:</td><td>
<table>
<tr><th>Activities</th><th>Total Hours</th><th>Hours/week</th><th>Comments</th></tr>
<tr><td>Theoretical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Practical:</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Tutorial guidance</td><td></td><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td rowspan="4">Learning objectives:</td><td>This course intends students to develop skills on installation, configuration and management of common network infrastructure services.</td></tr>
<tr><td></td></tr>
<tr><td></td></tr>
<tr><td></td></tr>
<tr><td rowspan="4">Generic learning outcomes and competences:</td><td>Plan and configure dynamic addressing services
Plan and configure network address translation services</td></tr>
<tr><td>Plan and configure name resolution services</td></tr>
<tr><td>Plan and configure teleworker services based on virtual private networks</td></tr>
<tr><td>Plan and configure proxy systems
Plan and configure network time protocols</td></tr>
<tr><td>Bibliography:</td><td>• Cisco e-Learning platform contents: “CCNA Exploration 4.0 – Accessing the WAN”
• Dan Holme, “MCSE Self-Paced Training Kit (Exams 70-290, 70-291, 70-293, 70-294) : Microsoft Windows Server 2003 Core Requirements”, Microsoft Press</td></tr>
</table>

	• Elias N. Khnaser, “MCSE designing security for a Windows server 2003 network : exam 70-298”, Syngress • Mark Minasi, “Mastering Windows server 2003”, SYBEX • Rand H. Morimoto, “Microsoft Windows server 2003 insider solutions”, Sams • Windows 2003 Documentation at http://technet.microsoft.com/en-us/library/cc706993.aspx
Progress assessment:	A final theoretical exam Laboratory assignments and homework

Title	WEB Programming
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911946
Term/Semester:	2nd
ECTS:	5
Department:	Department of Informatics Engineering and Systems
Study plan:	Introduction to ASP.NET 3.5
	Web forms
	Server controls
	Form Validation
	Client-side scripts
	Configuration of applications
	Error Handling
	ADO.NET
	Data Source Controls
	Data Bound Controls
	Other controls and services
	User Controls
	Master Pages, Themes and Skins
	Security and Profiles
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical			
Practical:	56	4	
Tutorial guidance			

Learning objectives:	Identify the needs for construction of sites for the Internet
	List the main technologies used in programming for the Internet
	Establish profile models to access to sites
	Establish business models via the Internet

	Define database for use on dynamic sites
	Construct complete sites to the Internet
Generic learning outcomes and competences:	Implement dynamic websites to the Internet with special emphasis on e-commerce
	Evaluate and define the best solutions for web sites, from the technical and commercial point of view, in the case of e-commerce sites
Bibliography:	
Progress assessment:	Practical assignments. Final examination.

<table>
<tr><td>Title</td><td>Operating Systems 2</td></tr>
<tr><td>Scientific Area:</td><td>Informatics Engineering</td></tr>
<tr><td>Course:</td><td>Bachelor in Informatics Engineering</td></tr>
<tr><td>Codigo:</td><td>911927</td></tr>
<tr><td>Term/Semester:</td><td>2nd / 2nd</td></tr>
<tr><td>ECTS:</td><td>5</td></tr>
<tr><td>Department:</td><td>Systems and Informatics Engineering</td></tr>
<tr><td></td><td></td></tr>
<tr><td rowspan="4">Study plan:</td><td>Windows Operating Systems
Windows/Windows NT Programming</td></tr>
<tr><td>Memory management</td></tr>
<tr><td>Input/output management</td></tr>
<tr><td>File systems</td></tr>
<tr><td>Language</td><td>Portuguese /Tutorial support in English</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Type of instruction:</td><td>
<table>
<tr><th>Activities</th><th>Total Hours</th><th>Hours/week</th><th>Comments</th></tr>
<tr><td>Theoretical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Practical:</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Tutorial guidance</td><td></td><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td rowspan="4">Learning objectives:</td><td>This course aims to develop students’ skills in Windows programming and related concepts.</td></tr>
<tr><td>It’s also intended to supply students with important concepts/knowledge about memory organization, management and related algorithms, input/output device control, and file systems (UNIX, FAT and NTFS)</td></tr>
<tr><td></td></tr>
<tr><td></td></tr>
<tr><td rowspan="4">Generic learning outcomes and competences:</td><td>Develop Win32 programs: GUI applications, Dynamic Link Libraries, Control Panel applications, Windows NT Services</td></tr>
<tr><td>The use of Win32 technologies and resources like: processes, threads, synchronization objects, pipes and named pipes, registry, security.</td></tr>
<tr><td>Understand advantages and disadvantages of different memory organizations
Recognize advantages and disadvantages of different memory allocation algorithms</td></tr>
<tr><td>Identify the necessity of file systems and different approaches for their implementation</td></tr>
<tr><td>Bibliography:</td><td>

Operating Systems Concepts (8th Ed.), Silberschatz, Galvin, Gagne, Addison-Wesley
Fundamentos de Sistemas Operativos (3ª ED.), José Alves Marques; Paulo Guedes, Editorial Presença
Sistemas Operativos, J. Marques, P. Ferreira, C. Ribeiro, L. Veiga, R. Rodrigues, FCA

</td></tr>
</table>

	• Inside Windows Nt (2nd Ed.), David ,A. Solomon • Windows NT 4 Programming, Herbert Schildt • Windows NT4 Advanced Programming, Raj Rajagopal & Subodh Mónica • MSDN Library • Microsoft TechNet Library
Progress assessment:	• Windows basic administration practical exam (2/20) • Students have to develop a Windows system with diverse modules (GUI, Windows NT service and Control Panel applet) that interact between them (6/20) • Final written examination (12/20)

Title	Informatics Engineering
Scientific Area:	Informatics
Course:	Software Engineering
Codigo:	911922
Term/Semester:	2nd / 2nd
ECTS:	5
Department:	DEIS
Study plan:	I – Introduction II - Product and Engineering III –Processes III.1. Process Models III.2. General Activities IV – Requirements Specification IV.1. Requirements Elicitation; IV.2. Requirements Analysis IV.3. Requirements Validation V - Requirements Management VI - Development VI.1. Design/Project VI.2. Implementation VII – Validation and Testing VIII – Agile Development IX – Project Management
Language	Portuguese / Tutorial support in English

Type of instruction:

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	28	2	
Tutorial			

	guidance | | |
Learning objectives:	This subject has the objective of introducing several techniques on a general level which will permit the development of software in a systematic manner.
Generic learning outcomes and competences:	A.1. Identify the main concepts related to software development A.2. Identify and explain the general activities in software production. B.1. Use and apply several methodologies for requirements elicitation B.2. perform requirements analysis according to different paradigms B.3. Software design B.4. Define the tests plan C.1. Justify the options taken in the software development. D.1. Evaluate the best approach to do a specific development E.1. Write a Software Requirements Specification (SRS) document. F.1. Develop new projects which will permit to adopt new techniques and processes.
Bibliography:	“Software Engineering”, 7th Edition, Ian Sommerville, Addison Wesley, 2004 “Software Engineering: A Practitioner's Approach”, 6th Edition, Roger S. Pressman, Mc Graw Hill, 2004.
Progress assessment:	Practical works (50%) + Exam (50%)

Subject Title:	Structured Cabling
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Code:	911950
Year/Semester:	2nd/2S
ECTS:	5
Department:	Informatics Engineering and Systems
Instructor:	Luís Eduardo Faria dos Santos
Study plan:	1. Standardization; 2. Twisted pair; 3. Optical fiber; 4. Other transmission systems; 5. Structured cabling project; 6. Digital telephony
Language:	Portuguese
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Theoretical-Practical			
Practical	28	2	
Tutorial guidance			

Learning objectives:	The focus of this course is on the design and deployment of structured cabling plants for local area networks.
Generic learning outcomes and competences:	Students will acquire skills on design, specify, install, verify and troubleshoot structured cabling plants according to the ISO/IEC and the IEEE global standards. Knowledge on the operation principles of alternative transmission media, as well as basic experience about handling them are expected to be gained along the course. Skills on identifying and planning the basic requirements of passive and active equipment involved complement the generic learning outcomes.
Bibliography:	Robert N. Bucceri , “Structured wiring design manual”, Silent Servant, Inc., 2004, ISBN 0-9700057-1-7, 1A-6-185 (ISEC); “ISO/IEC 11801 – Generic cabling for customer premises cabling”, ISO/IEC, 2010; Edmundo Monteiro; Fernando Boavida, “Engenharia de Redes Informáticas”, FCA, 2000, 1A-6-138 (ISEC);
Progress assessment:	Written exam weight: 70%; the written exam must be completed on the scheduled dates. Project weight: 30%; Preparing and presenting a Structured Cabling project. Students must reach a minimum of 35% on each assessed component to succeed on the course.

Title	Introduction to Artificial Intelligence
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911944
Term/Semester:	2nd / 1st
ECTS:	5
Department:	Informatics Engineering and Systems
Study plan:	Rational Agents; Problem solving techniques; Blind Search; Heuristic Search; Local Search; Evolutionary Computation; Game playing; Artificial Life
Language	Portuguese/Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	28	2	
Tutorial guidance			

Learning objectives:	Identify the main paradigms of artificial intelligence.
	Identify the main classes of problem solving algorithms.
	Recognize the strengths and weaknesses of applying intelligent optimization algorithm
Generic learning outcomes and competences:	Analyse an optimization problem, identify its features and determine its key components .
	Plan and implement optimization algorithms that discover good quality solutions for difficult problems
	Develop rational strategies for board games.
Bibliography:	S. Russell e P. Norvig: “Artificial Intelligence: A Modern Approach”, Second edition, Prentice-Hall, 2003 E. Costa e A. Simões: Inteligência Artificial: Fundamentos e Aplicações, 2ª edição, FCA, 2008. Z. Michalewicz e D. Fogel: “How to Solve It: Modern Heuristics”, Springer, 2004. W. Banzhaf, P. Nordin, R. Keller, F. Francone: “Genetic Programming: An Introduction”. D. Floreano, C. Matiussi: “Bio-inspired Artificial Intelligence”, Mit Press, 2008.
Progress assessment:	Lab sheets with exercises. Practical assignments. Final examination.

Title	Object Oriented Programming
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911942
Term/Semester:	2nd / 1st
ECTS:	5
Department:	Department of Informatics Engineering and Systems
Study plan:	Fundamental concepts of object oriented programming
	Differences between C and C + +
	Functions
	Classes
	Classes and memory allocation
	Operator overloading
	Classes with members that are pointers to dynamic memory
	Composition
	Inheritance
	Polymorphism
	Templates and STL
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	14	1	
Practical:	56	4	
Tutorial guidance			

Learning objectives:	Identify the concepts of class, members (attributes and methods), access levels, constructors and destructors.
	Identify the issues related with classes which have members that are pointers for dynamic memory.
	Understand the composition concept
	Understand the inheritance concept
	Understand the polymorphism concept.
Generic	Develop applications where it is necessary to define classes and to relate them by using the

learning outcomes and competences:	mechanisms of composition, inheritance and polymorphism.
	Justify the classes defined in the scope of an application and its relationships
	Evaluate the classes' structure, which are proposed to represent a problem, showing critical attitude.
Bibliography:	ECKEL, B. , Thinking in C++ - Volume 1, (2nd edition), 2000, Prentice Hall Inc., http://www.bruceeckel.com/
	BROKKEN F. B., C++ Annotations Version 5.2.2, 2003, Published at the University of Groningen
Progress assessment:	Practical assignments. Final examination.

<table>
<tr><td>Title</td><td>Databases</td></tr>
<tr><td>Scientific Area:</td><td>Informatics Engineering</td></tr>
<tr><td>Course:</td><td>Informatics Engineering</td></tr>
<tr><td>Codigo:</td><td>911919</td></tr>
<tr><td>Term/Semester:</td><td>2nd / 1st</td></tr>
<tr><td>ECTS:</td><td>5</td></tr>
<tr><td>Department:</td><td>Systems and Informatics Engineering</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Study plan:</td><td>Databases introduction;
Entity-relationship model;
Relation Algebra and Calculus;
SQL language;</td></tr>
<tr><td></td><td>Functional dependencies;
1st NF to BCNF normalization;
Indices and clusters introduction;</td></tr>
<tr><td></td><td>Transactions management;
Recovery;
Concorrency;</td></tr>
<tr><td>Language</td><td>Portuguese / Tutorial support in English</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Type of instruction:</td><td>
<table>
<tr><th>Activities</th><th>Total Hours</th><th>Hours/week</th><th>Comments</th></tr>
<tr><td>Theoretical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Theoretical-Practical:</td><td>14</td><td>1</td><td></td></tr>
<tr><td>Practical</td><td>28</td><td>2</td><td></td></tr>
</table>
</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Learning objectives:</td><td>Identify the concepts under the relation databases.
Use the main normalization techniques of relational databases.
Know how to interrogate a relational database using SQL.
Build a normalized relation database model.</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Generic learning outcomes and competences:</td><td>Develop and test relational databases models.
Define the physical and conceptual model of a normalized relational database.</td></tr>
<tr><td></td><td>The proposed solutions at the databases projects level.
Evaluate database models, with a critical attitude.</td></tr>
<tr><td></td><td>Do the appropriate documentation to the specification and analysis of relational databases.
Present and explain the developed projects clearly.</td></tr>
<tr><td></td><td>Develop innovative projects, with a high autonomy degree, not limited to the concepts learned at classes.</td></tr>
</table>

Bibliography:	• RODRIGUES, A. - *Oracle 10g e 9i Para Profissionais*, FCA, 2005 • DAMAS, L. - *SQL*, FCA, 2005 • DATE, C. J. - *An Introduction to Database Systems*, Addison- Wesley Publishing Company, 2004 • BARBOSA, F. - *Apontamentos de Bases de Dados,* 2009 – http://moodle.isec.pt • RAMAKRISSHNAN, R. - *Database Management Systems*, McGraw-Hill, 2003 • ELMASRI, R.; NAVATHE, S.B. - *Fundamentals of Database Systems*, Addison-Wesley Publishing, 2003 • CAMPOS, L. M. - *Oracle 8i Curso Completo,* FCA, 1999 • PEREIRA, J. L. - *Tecnologia de Bases de Dados*, FCA, 1998 • USEFUL LINKS: a. SQL course - www.sqlcourse.com b. Advanced SQL course - www.sqlcourse2.com c. Oracle information- http://www.oracle.com/technology/index.html d. Visual Basic .NET information- http://support.microsoft.com/default.aspx?xmlid=fh%3BEN-US%3Bvbnet&sd=msdn e. Power Designer information - http://www.sybase.com/products/enterprisemodeling/powerdesigner/techsupport f. Delphi information - http://www.borland.com/us/products/delphi/index.html
Progress assessment:	Two tests (20% and 20%). A practical work (30%). Final written examination (20%+20%+30%).

Title	Informatics Engineering
Scientific Area:	Informatics
Course:	Modeling and Design
Codigo:	911918
Term/Semester:	2nd / 1st
ECTS:	5
Department:	DEIS
Study plan:	Introduction UML Diagrams Overview Objectives Generic Description of UML diagrams
	Use Case Diagrams Activity Diagrams Class Diagrams Object Diagrams Sequence Diagrams Communication Diagrams Component Diagrams Deployment Diagrams
	Software patterns Creational Patterns Structural Patterns Behavioral Patterns Model, View and Controller
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	28	2	
Tutorial guidance			

Learning objectives:	In this course, students will learn to analyze and represent different views and perspectives of software, such as requirements, logical and physical environment, architecture, processes, etc, using a properly defined graphical language (UML) with well defined semantics.

Generic learning outcomes and competences:	A.1 recognizing the appropriate UML diagrams for describing organizations, processes, static software structures and dynamic behavior. A.2 Correctly interpret the UML diagrams used for describing organizations, processes, static software structures and dynamic behavior. B.1 Creating UML diagrams suited for the detailed description of a software system. C.1 Making an object oriented analysis of a system C.2 Correctly identifying and representing the requirements and business processes of an organization using proper diagrams. D.1 Evaluating the impact of architectural options in software development. E.1 Creating suited UML diagrams for representing a specific analysis or implementation F.1. Developing projects, with a high degree of autonomy.
Bibliography:	UML Distilled", Martin Fowler, 3ª Edição "The Unified Modeling Language Reference Manual", Rumbaugh et al UML Metodologias e Ferramentas CASE, VOL. 1, Alberto Silva e Carlos Videira Fundamental de UML, 4ª Ed., M. Nunes and H. O'Neill
Progress assessment:	Three practical works (50%) + written Exam (50%)

Title	Operations Research
Scientific Area:	Informatics Engineering
Course:	Degree in Computer Engineering (new curriculum)
Codigo:	911915
Term/Semester:	2st / 1st
ECTS:	5
Department:	Systems and Informatics Engineering
Study plan:	Introduction to Operational Research The linear programming model The Simplex method Duality and the dual Simplex method Network Optimization Special problems of linear programming
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	14	1	
Tutorial guidance	28	2	

Learning objectives:	With this course students should learn to translate simple optimization and decision problems into LP mathematical models, to determine the optimal solution(s) of these models using one of the LP algorithms and, finally, to interpret the meaning of the obtained solution(s) in the context of the real problem. Students should also learn to computationally implement the mentioned algorithms.
Generic learning outcomes and competences:	*Knowledge and Comprehension* A.1 Understand the construction of the LP mathematical model of simple optimization and decision problems. A.2 Identify the LP algorithms that can be used to solve the problem. A.3 Interpret the obtained solution(s). A.4 Analyze the sensitivity of the solution(s) relative to changes in model parameters.
	Knowledge application B.1 Solve practical problems that imply 1) the construction of PL mathematical models, 2) the use of the LP algorithms to solve the problems, 3) the interpretation of the obtained solutions and 4) the sensitivity analysis of the last ones. B.2 Develop software projects consisting of the implementation of PL algorithms.

	Supported Decisions making C.1 Evaluate the possible options in terms of which PL algorithm to choose in order to solve the problems and justify the choice. C.2 Justify the adopted solutions in the computational implementation of the PL algorithms.
	Judgment making D.1 Evaluate the decisions that were taken in terms of the choice of PL algorithms used to solve the problems. D.2 Evaluate the options used in the computational implementation of the algorithms.
	Communication E.1 Make appropriate documentation about the developed projects, where all the options taken should be presented / justified, in a clear and summarized way. E.2 Make presentations and explanations of the developed projects in a clear way.
	Self-learning competences F.1 Develop projects that require more than the direct appliance of the concepts acquired in classes, in an autonomous way.
Bibliography:	• Study material prepared by teachers ***and*** • Hillier, F.S. , Liberman, G.J. "*Introduction to Operations Reasearch*" – 6th Edition McGraw-Hill, 1996 • Tavares, L.V, Oliveira, R.C, Themido, L.H., Correia, F.N. "*Investigação Operacional*" McGraw-Hill, 1996 • Bronson, R., Naadimuthu, G. "*Investigação Operacional*" – Segunda Edição Schaum McGraw-Hill, 2001 • Ramalhete, Guerreiro e Magalhães *"Programação Linear"* (Volumes I e II) McGraw-Hill, 1984
Progress assessment:	• Learning results B1, B2, C1, C2, D1, D2, E1, E2 e F1 are assessed through a practical work - 5 points; • Learning results A1, A2, A3 e A4 are assessed through a final exam: - 15 points; - Minimum mark of 40%.

Title	Fundamentals of Computer Graphics
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911945
Term/Semester:	1st / 2nd
ECTS:	5
Department:	Informatics Engineering and Systems
Study plan:	Introduction to computer graphics
	Graphics systems and computational models
	Graphics Primitives
	Geometric Transformations
	Viewing
	Graphics modeling
	Texture mapping
	Lighting
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	30	2	
Practical:	30	2	
Tutorial guidance			

Learning objectives:	Introduce computer graphics.
	Learn hardware and software basic concepts
	Model, manipulate and visualize 2D and 3D geometric objects using software tools.
	Use texture mapping and lighting.
	Introduce animation concepts
Generic learning outcomes and competences:	A.1. Know the main concepts related to computer graphics A.2. Describe the hardware and software architecture of a computer graphics system. A.3. Understand the concepts of geometric transformation and visualization. A.4. Describe graphics data modeling techniques. A.5. Understand the concepts of texture mapping and lighting.
	B.1. Select the topology of a graphics system. B.2. Build 3D models, using software tools, and apply textures and lighting to them.
	C.1. Analyze graphic models, identify different optional solutions and come to a decision.
	D.1. Compare documents and public domain models, and evaluate their utility for solving his home work. D.2. Choose the graphic presentation and the user interaction for his graphics works.

	E.1. Write documentation for the entire home work done. E.2. Present and explain the main options taken during the home work development.
	F.1. Develop projects with open issues to adopt techniques not necessarily exposed during the contact hours.
Bibliography:	• Lecture notes. • Foley, Dam, Feiner, Hughes: Computer Graphics Principles and Practice (second edition in C), Addison Wesley, 1997 • Alan Watt: 3D Computer Graphics (Third edition), Addison-Wesley, 2000. • Peter Shirley, Steve Marschner: Fundamentals of Computer Graphics, Third Edition, A. K. Peters, 2009. • James Chronister: Blender Basics, 2009. • David F. Rogers, J. Alan Adams: Mathematical Elements for Computer Graphics, McGraw-Hill, 1989.
Progress assessment:	The assessment consists of one homework and a final exam. The homework is developed in groups of 2 students and will count as 30%. The exam consists of a theoretical part (35%) and a practical part (30%), this one using a computer to draw a graphic scene. The participation of the student in the classes count as 5%.

Title	Computer Architecture and Technology
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911941
Term/Semester:	1st /2nd
ECTS:	5
Department:	Systems and Informatics Engineering
Study plan:	Introduction to programmable logical devices.
	Representation of digital information. Computer architecture and related components.
	Assembly language.
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	28	2	
Tutorial guidance			

Learning objectives:	This course unit aims to enable students to identify, characterize and perceive the functionality of the main components of a computer, namely main memories, storage memories and microprocessors. It is expected that students know how to identify the main performance measures of recent processors. The students should also understand and interpret the digital representation of information. They should explain the way the computer works, at the low level, in particular the way the processor interprets and executes the instructions, using Assembly language.
Generic learning outcomes and	Identify the underlying concept of Programmable Logic Devices. Identify, characterize and comprehend the functionality of the main computer components.

competences:	Identify the major performance measures of recent microprocessors. Understand and interpret the digital information representation.
	Develop and test Assembly programs.
	Evaluate and justify proposed solutions for different computational systems, showing critical attitude. Evaluate common solutions used in different computer architectures, demonstrating critical attitude.
	Keep up to date with the technological evolution of microprocessors.
Bibliography:	Monteiro, R. V., Neves, F., Pereira, J., Rodrigues, N. e Martinho, R., Tecnologias dos Equipamentos Informáticos, FCA, 2004 - ISBN 972-722-419-9 White, Ron, How Computer works, QUE, 2002, ISBN 0-7897-2549-5 Tanenbaum, A. S., Structured Computer Organization, Prentice-Hall International, 1999, ISBN 0-13-020435-8 Lala, P. K., "PLD – Digital System Design Using Programmable Logic Devices, Prentice Hall Series in Computer Engineering Edward J. McCLuskey, Series Editor, ISBN 0-13-215088-3 Mazidi, M. A. and Mazidi , J. G., The 80x86 IBM PC and Compatible Computers: Assembly Language, Design and Interfacing (Volumes I & II), Prentice Hall, 2000, ISBN 0-13-016568-9
Progress assessment:	Two laboratorial assignments (25% of the final grade). Final written examination (75% of the final grade).

Title	Programming
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911940
Term/Semester:	1st/2nd
ECTS:	5
Department:	Informatics Engineering and Systems
Study plan:	Pointers; header files; finding and sorting algorithms; structures; files; dynamic structures; recursion; data structures.
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Practical:	42	3	
Tutorial guidance			

Learning objectives:	Organize a C program using several source and header files.
	Identify crucial data structures in a programming environment.
	Explain the need for data and text files.
Generic learning outcomes and competences:	Develop a structured C language program.
	Choose the appropriate memory and file structures in a specific problem.
	Implement algorithms in C language using dynamic storage manipulation.
Bibliography:	K. N. King. “C Programming: A Modern Approach”. M. Bermudez. “Study Guide for C Programming: A Modern Approach”
Progress assessment:	Lab sheets with exercises, simulation and experimental results. Final examination.

Title	Operative Systems
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911939
Term/Semester:	1 / 2nd
ECTS:	5
Department:	Department of Informatics and Systems
Study plan:	**1. Basic aspects of operating systems – Introduction** • OS installation. Case study – Linux • Booting process. Dual boot systems • Partitioning the hard drive. File systems selection. • Software package configuration. • User interface **2. Command Line operation of Unix systems** • Internal shell commands. • Environment variables. • Command line utilities for file, users and process management. • File system security management in UNIX • Central configuration files. **3. Shell programming in Bash** • Shell script basics. Environment and arguments. • Expressions, assignment and conditional expressions. • Input/output in shell • Loops: for, while. Select and Case. **4. Unix programming in C** • Process management. Fork, exec, PID, wait. • Signals. kill, signal, pause, alarm. • File operation. I/O Redirection to files. • Unnamed pipes. I/O redirection between processes. • Names pipes. Client-Server communication. • Synchronization fundamental aspects. Theoretical case studies. • Synchronization in Unix with Semaphores. • Shared memory. **5. Theoretical aspects of OS implementation** • OS role in the computer. Hardware interaction and user interaction. • OS evolution. • Types of operating systems • Architectural variants of OS implementation. From monolithic to Micro-kernel. • SMP and distributed systems. • Real time and virtual time systems. • Hardware support for OS implementation. Execution modes, Interrupt mechanisms, atomic instructions. • System call. Implementation. • Process scheduling basic concepts. Process states. *Programmatic content of the practical part:* **1. Unix (Linux) administration** • Instalation, user management, file management, software management, security management. **2. Command line operation in Unix Environment** • File management; user management.

<table>
<tr><td></td><td>

3. Shell Programming in Bash

- Shell script development for the Bash

4. Unix application development

Application development for the Unix platform using the concepts given in the theoretical lessons.
</td></tr>
<tr><td>Language</td><td>Portuguese /Tutorial support in English</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Type of instruction:</td><td>
<table>
<tr><th>Activities</th><th>Total Hours</th><th>Hours/week</th><th>Comments</th></tr>
<tr><td>Theoretical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Practical:</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Tutorial guidance</td><td></td><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td>Learning objectives:</td><td>

The general learning objectives of this course are:

- Knowledge about operating systems at large.
- Knowledge about Unix system management.
- Ability to build applications for the Unix environment.
</td></tr>
<tr><td>Generic learning outcomes and competences:</td><td>

Knowledge about operating systems at large:

Internal architecture and OS components (hardware management, scheduler, memory management, synchronization, communication mechanisms)

Knowledge about Unix system management:

Command line management and bash scripting

Ability to build applications for the Unix environment:

C Applications using the Unix API
</td></tr>
<tr><td>Bibliography:</td><td>

- OPERATING SYSTEMS CONCEPTS (6TH ED.), SILBERSCHATZ & GALVIN, ADDISON-WESLEY
- FUNDAMENTOS DE SISTEMAS OPERATIVOS (3ª ED.), JOSÉ ALVES MARQUES; PAULO GUEDES, EDITORIAL PRESENÇA
- THE LINUX SYSTEM ADMINISTRATORS' GUIDE, LARS WIRZENIUS
- THE LINUX PROGRAMMER'S GUIDE, SVEN GOLDT, SVEN VAN DER MEER, SCOTT BURKETT, MATT WELSH
- BEGINNING LINUX PROGRAMMING, 3RD EDITION, NEIL MATTHEW, RICHARD STONES, ALAN COX, WROX
- ASORTED COURSEWARE MATERIAL USED IN THE LESSONS
</td></tr>
<tr><td>Progress assessment:</td><td>

- Two written exams:

  Theoretical: Evaluates the theoretical aspects of the course (closed book) – Weigth: 8

  Practical part: evaluates the skills related to operation and development in the Unix environment –Weight: 7
- Development project

  Evaluates the skills in software development for Unix environment – Weight: 5
</td></tr>
</table>

Title	Mathematical Analysis II
Scientific Area:	Mathematics
Course:	Degree in Informatics Engineering
Codigo:	911910
Year/Semester:	1st/2nd
ECTS:	6
Department:	Physics and Mathematics Department
Study plan:	Three-Dimensional Space; Rectangular Coordinates in 3D-Space; Magic Cube – Viewport 3D; Points; Vectors; Planes; Spheres; Cylindrical Surfaces; Quadric Surfaces. Functions of Two or More Variables; Limits and Continuity; Partial Derivatives; Differentiability and Chain Rules; Tangent Planes; Total Differentials; Differentiability; Directional Derivatives and Gradients; Maxima and Minima of functions of two variables; Lagrange Multipliers.
	Multiple Integrals; Double Integrals; Double Integrals Over Nonrectangular Regions; Double Integrals in Polar Coordinates; Area and Surface Area; Triple Integrals; Volume of Solids; Centroid; Center of Gravity; Triple Integrals in Cylindrical and Spherical Coordinates; Change of Variables in Multiple Integrals; Jacobians.
	Introduction to Numerical Methods using Matlab. Solutions of Equations in one Variable: The Bisection Method; Newton's Method; Interpolation and Polynomial Approximation: Divided Differences; Numerical Differentiation and Integration; Trapezoid Rule and Simpson Rule; Initial-Value Problems for Ordinary Differential Equations: Euler's Method and Runge-Kutta Methods.
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	Lectures
Practical	28	2	Exercises: mathematical and computational implementation.
Lab	14	1	Laboratory work, programming in Derive, Maple and Matlab

Learning objectives:	The main aims of this course unit are to teach students:
	The important role of mathematics as a fundamental basis within the engineering fields;
	The use and application of mathematics software, such as, Derive, Maple and Matlab;
	The use of mathematics as an auxiliary tool for analytical computational matter.
Generic learning outcomes and competences:	At the end of this course unit the learner is expected to be able:
	To develop skills of abstraction, demonstration, 3D Visualization and representation, algorithms and programming of numerical methods.
	To understand and apply programmed matter and other matters related to the topics covered in study plan of this course unit.

Bibliography:	Correia, Arménio A. S., Sebenta de Análise Matemática II, ISEC, 2008 Glyn James, Modern Engineering Mathematics, Addison – Wesley Stanley, J., An Introduction to Differential Equations and Their Applications. McGraw-Hill Burden, Richard L., J. Douglas, Numerical Analysis, Pws-Kent Publishing Company Fausett, L.V., Applied Numerical Analysis Using Matlab, Prentice Hall Kreyszig, E., Advanced Engineering Mathematics, John Wiley & Sons
Progress assessment:	There are two options: First option: A midterm exam and/or a final written exam worth 100% of the final grade. Second option: Continuous evaluation - A midterm exam and/or a final written exam worth 60% of the final grade - Theoretical-Practical activities (written assignments and programming of mathematical methods) distributed over the semester worth 40% of the final grade For purposes of calculating the final grade, weighted average of the tests and works, the student must have a minimum score of 6.5 (out of 20) on the exam. If students attend more than 70% of classes, 0.5 points are added to the final grade. If students attend office hours and/or participate in forums offered through e-learning platform more than 70% of classes, 0.5 points are added to the final grade. Students receiving a grade higher than 18 (on a grading scale of 1 to 20) are required to do an extra written and/or oral test. If students choose not to do this extra test, the final grade will remain 18.

Title	Electronics
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Codigo:	911907
Term/Semester:	1st / 2nd
ECTS:	4
Department:	Informatics Engineering and Systems
Study plan:	DC and AC electrical concepts; DC network analysis; transient response of RC and RL circuits; analysis of circuits with p-n junction diodes; analysis of circuits with bipolar junction transistors.
Language	Portuguese / Tutorial support in English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	14	1	
Practical:	28	2	
Tutorial guidance			

Learning objectives:	Identify main DC and AC electrical signals.
	Describe main techniques for network analyses.
	Solve practical problems involving diodes and transistors circuits.
	Mount circuits in a breadboard with electric/electronic components.
Generic learning outcomes and competences:	Understand the electrical signals and the differences among them.
	Calculate the transfer characteristic of a given circuit.
	Use electronics simulation software.
	Design of general amplifier circuits.
Bibliography:	Nilsson, Riedel, Electric Circuits, Pearson Prentice Hall, 2008. Kuphaldt, Lessons In Electric Circuits, http://www.ibiblio.org/kuphaldt/electricCircuits/, 2008.
Progress assessment:	Lab sheets with exercises, simulation and experimental results. Final examination.

<table>
<tr><td>Subject Title:</td><td>Management</td></tr>
<tr><td>Scientific Area:</td><td>Informatics Engineering</td></tr>
<tr><td>Course:</td><td>Informatics Engineering</td></tr>
<tr><td>Code:</td><td>911938</td></tr>
<tr><td>Year/Semester:</td><td>1st year/1st semester</td></tr>
<tr><td>ECTS:</td><td>5</td></tr>
<tr><td>Department:</td><td>Systems and Informatics Engineering</td></tr>
<tr><td>Instructor:</td><td>Nelson Luis Pincho</td></tr>
<tr><td>Study plan:</td><td>

Theoretical

Organizations and Management
Legal aspects of a company
Companies as economic units
Key roles in a company

Management
Supply Chain
Production
Sales and Distribution

Hierarchical structure in a company
Human Resources and organizational behavior
Manager and Accounting documents

Theoretical-Practical

Business Plan conception
Basic concepts
PEST Analysis
PORTER and SWOT Analysis
Strategic Analysis
Strategic Planning
Management Polices
Financial forecast

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<tr><td>Language:</td><td>Portuguese</td></tr>
<tr><td>Type of instruction:</td><td>
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<tr><th>Activities</th><th>Total Hours</th><th>Hours/week</th><th>Comments</th></tr>
<tr><td>Theoretical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Theoretical-Practical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Practical</td><td></td><td></td><td></td></tr>
<tr><td>Tutorial guidance</td><td></td><td></td><td></td></tr>
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</td></tr>
<tr><td>Learning objectives:</td><td>The main purpose of this course is to nurture the ability to apply management fundamentals into problems that occur daily in student’s professional life no matter if he has the role of employee or employer.</td></tr>
</table>

Generic learning outcomes and competences:	Identify basic concepts of management of organizations Identify and evaluate the relations between the organizations and the surrounding environment Identify and understand the several functions in an organization and their role Understand and apply the main frameworks of strategical analysis (PEST, PORTER and SWOT) Understand Marketing and its strategical role to an organization Build, present and defend a business plan Develop social skills to foster effective team work and conflict management, ability to influence others and negotiations skills
Bibliography:	• Introdução à Gestão – Uma abordagem sistémica, António Sousa, Verbo, 1990 • Introdução à Gestão das Organizações, João Lisboa e outros, Vida Económica, 2004 • Gestão das Organizações, Sebastião Teixeira, McGraw Hill, 2001 • Gestão Estratégica das Organizações – Ao encontro do 3º Milénio, Luis Cardoso, Verbo, 1998 • Management, Gary Dressler, Prentice Hall, 2000 • Management, Stephen Robbins e Mary Coulter , Prentice Hall, 2001 • Gestão, P. Baranger et al., Edições Silabo, 1995 • Estratégia – Sucesso em Portugal, Adriano Freire, Verbo, 1997 • Mercator 2000 – Teoria e prática do Marketing, P. Dionísio, J. Lendrevie e D. Lindon, Publicações Dom Quixote, 2000 • Marketing Management, 11th edition, Philip Kotler, Prentice Hall, 2003 • Gestão de Projectos – Uma perpectiva integrada, Vitor Sequeira Roldão, Monitor, 2000
Progress assessment:	One, in class, surprise test (20%). A practical work (40%). Final written examination (40%). The assessment has two mandatory components: Final exam - 8 points - Minimum mark of 40% Practical component – 1 practical work performed during the semester - 8 points - Minimum mark of 40%

Subject Title:	Digital Systems
Scientific Area:	Informatics Engineering
Course:	Informatics Engineering
Code:	911904
Year/Semester:	1st year/1nd semester
ECTS:	
Department:	Systems and Informatics Engineering
Instructor:	Francisco José Simões Duarte
Study plan:	Basic concepts - Boolean algebra, truth tables, Karnaugh maps, logic gates, logic families, binary system, binary codes and binary arithmetics. Combinatory circuits - Analysis and synthesis of combinatory circuits - Dedicated combinatory circuits: Multiplexers, Demultiplexers, Encoders, Decoders, Adders, Comparators Sequential circuits - Generic model of sequential circuits, synchronous and asynchronous circuits, elementary memory cells - Analysis and synthesis of sequential circuits - Binary counters
Language:	Portuguese
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	
Theoretical-Practical			
Practical	28	2	
Tutorial guidance			

Learning objectives:	The main purpose of this course is to teach the digital systems fundamentals so that students can be able to understand how computers work and how they process information.
Generic learning outcomes and competences:	Dominate basic concepts, such as: Boolean algebra, Karnaugh maps, binary numeration system and binary codes. Identify basic physical components, such as: logic gates, dedicated combinational circuits and Flip-Flops. Understand formal techniques for the analysis and the design of low complexity digital circuits (combinational and sequential) Develop works consisting of design and implementation of low complexity digital circuits

	(combinational and sequential). Justify the adopted solutions in the design / implementation of combinational / sequential circuits. Evaluate the options taken during the work of design / implementation of combinational / sequential circuits, demonstrating critical attitude. Make appropriate documentation about the developed works, where all the options taken should be presented / justified, in a clear and summarized way. Solve problems that require more than the direct appliance of the concepts acquired in classes.
Bibliography:	E. J. McCluskey, Logic Design Principles, Prentice Hall, 1986 Ronald J. Tocci, Neal S. Widmer, Sistemas digitais: princípios e aplicações, 10ª Edição, Prentice Hall, 2007 John F. Wakerly, Digital Design: Principles and Practices, 4th Edition, Prentice Hall, 2005 L. Cuesta, A. Gil Padilla, F Remiro, Electrónica digital, McGraw-Hill, 1994
Progress assessment:	Two tests (10% and 10%). A practical work (20%). Final written examination (60%). The assessment has two components: Final exam - 14 points - Minimum mark of 35% Practical component – three practical works performed during the semester - 6 points - Minimum mark of 40%

<table>
<tr><td>Title</td><td>Introduction to Programming</td></tr>
<tr><td>Scientific Area:</td><td>Informatics Engineering</td></tr>
<tr><td>Course:</td><td>Degree in Computer Engineering (new curriculum)</td></tr>
<tr><td>Codigo:</td><td>911936</td></tr>
<tr><td>Term/Semester:</td><td>1st / 1st</td></tr>
<tr><td>ECTS:</td><td>5</td></tr>
<tr><td>Department:</td><td>Systems and Informatics Engineering</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Study plan:</td><td>Program development
General introduction to the C language
Types, operators and expressions
Mechanisms of control
Functions
Arrays and Strings</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Language</td><td>Portuguese/ Tutorial support in English</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Type of instruction:</td><td>
<table>
<tr><th>Activities</th><th>Total Hours</th><th>Hours/week</th><th>Comments</th></tr>
<tr><td>Theoretical</td><td>28</td><td>2</td><td></td></tr>
<tr><td>Practical:</td><td>42</td><td>3</td><td></td></tr>
<tr><td>Tutorial guidance</td><td>0</td><td>0</td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td>Learning objectives:</td><td>With this introductory course of programming the students learn how to construct modular and reused programs through a structuralized form, giving special importance to the phases of problem specification, algorithm development and implementation.

In order to put in practice and to consolidate the acquired knowledge, the students learn the basic concepts of C language (which make possible the implementation of simple programs).</td></tr>
<tr><td></td><td>Different stages necessary to the development of programs are explained to the students, In a first part. Thereafter, a general introduction to the C language is made.</td></tr>
<tr><td></td><td>In relation to each topic, it will be used a strategy of learning based on the experimentation from the matter exposed in the classes, through the resolution of small problems with C.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Generic learning outcomes and</td><td>Knowledge and Comprehension
Identify and understand the different phases normally used to construct modular programs.
Be familiar with types, operator e expressions of C language.
Know the different control mechanisms of C language.</td></tr>
</table>

competences:	Understand and know how to use the standard input-output functions of C language. Explain the advantages of the use of arrays and know to identify the situations where they become necessary Understand and know how to use the String type (as well as, the main functions that operate in Strings).
	Knowledge application Develop simple applications using the C and Java languages, having always in the mind different phases to construct a program (problem specification, analysis, algorithm and implementation).
	Supported Decisions making Select the convenient mechanisms and strategies to the resolution of a concrete problem.
	Judgment making Evaluate the relative merit of different solutions for one determined problem.
	Communication Make appropriate documentation in the scope of program development. Make presentations and explanations the developed programs in a clear way.
	Self-learning competences The concepts apprehended in this discipline must instil in students the interest and the possibility to apply them in the resolution of similar and more complex applications, in a professional context.
Bibliography:	Study material prepared by teachers ***and*** Damas, Luis – "Linguagem C", 6ª edição FCA, 1994. ISBN: 972-722-156-4 Kernighan, B.; Ritchie, D. – "The C programming language", 2nd ed., Prentice Hall Software Series, 1988. ISBN: 0-13-110362-8. 0-13-110370-9 Guerreiro, Pedro – "Elementos de Programação em C", 3ª Edição Actualizada e Aumentada, FCA. ISBN: 972-722-510-1 Schildt, H. – "Teach yourself C", 3rd ed, Berkeley : McGraw-Hill, 1998. ISBN: 0-07-882311-0 King, K. N. – "C programming: A Modern Approach", New York [etc.] : W.W.Norton & Company, cop. 1996. ISBN: 0-393-96945-2
Progress assessment:	Final practical (written) examination.

Title	Linear Algebra
Scientific Area:	Mathematics
Course:	Informatics Engineering
Codigo:	911905
Term/Semester:	1st/1st
ECTS:	5
Department:	Physics and Mathematics
Study plan:	**1. Matrices and Linear Systems** Introduction; Matrix operations and their properties; Row echelon form and rank; Classification and geometry of linear systems; Gaussian elimination; Homogeneous systems; Matrix inversion: Gauss-Jordan method; Block matrices. **2. Determinants** Definition and properties; Adjunct matrix and the inverse; Applications to Cryptography. **3. Vectors in** $\square^n$ Vectors and lines in the plane; Vectors in 3D-space; Lines and planes in 3D-space; Vectors in $\square^n$; Linear transformations: application to Computer Graphics. **4. Linear Spaces** Definition, Examples and Properties; Subspaces; Linear combinations; Linear expansion; Linear independence; Basis and dimension. **5. Eigenvalues** Eigenvalues, eigenvectors and their properties; Diagonalization; Cayley-Hamilton Theorem. 6. **Elementary Linear Algebra in Matlab** Matrices, linear systems, eigenvalues and eigenvectors in Matlab.
Language	Portuguese and English
Type of instruction:	

Activities	Total Hours	Hours/week	Comments
Theoretical	28	2	Lectures
Theoretical-practical	28	2	Problem solving
Practical:			
Tutorial guidance			Students have weekly voluntary support through instructor's office hours (6 hours availability, overall)

Learning objectives:	• Perform basic matrix operations. • Compute matrix determinants, eigenvalues and eigenvectors.

	• Understand and apply concepts related to vector spaces and linear transformations. • Solve and interpret linear systems using matrix theory. • Understand the importance of linear algebra and analytic geometry in computer science and informatics engineering. • Recognize the importance of the algorithms in linear algebra. • Solve real problems which are modelled by matrices and systems.
Generic learning outcomes and competences:	• Develop algorithms using a logical and structured reasoning. • Base problem solving on mathematics. • Compare, with criticism, the results obtained by analytical means with the ones obtained by computational means. • Select appropriately the accessible information (from monographs, textbooks, web, …). • Expose, using documents, the problems' solution in a clear and simple way. • Explain the concepts and problems' solution in an appropriated way. • Solve practical problems with autonomy using, not only the subjects treated in the class, but also other related topics.
Bibliography:	• Cardoso, João, *Apontamentos de Álgebra Linear*, DFM, ISEC, 2007. • Higham, D.J. and Higham, N.J., *Matlab Guide*, SIAM, Philadelphia, 2000. • Kolman, B. and Hill, D.R., *Introductory Linear Algebra – an applied first course*, 8ª Ed., Pearson-Prentice Hall, 2005. • Leon, Steven J., *Ágebra Linear com Aplicações*, 4ª Ed, Livros Técnicos e científicos, Rio de Janeiro, 1999. • Magalhães, Luis T., *Álgebra Linear: como Introdução a Matemática Aplicada*, Texto Editora, 1993. • Meyer, Carl D., *Matrix Analysis and Applied Linear Algebra*, SIAM, Philadelphia, 2000.
Progress assessment:	There are two tests (2x50%) along the semester. If the final grade is less than 9.5, the students can access a final written exam (100%).

Bibliography:	Anton, H., Cálculo - um novo horizonte, vol. 1, 3ª Edição, Bookman, 2000. Apostol, T.M., Calculus, vol. I, 2th Edition, John Wiley & Sons, 1967. Azenha, A., Jerónimo, M.A., Cálculo diferencial e integral em R e Rn, McGraw-Hill, 1995. Guidorizzi , H.L., Um curso de cálculo, vol. 1, 3ª Edição, Livros técnicos e científicos, 1999. Larson, R., Hostetler, R. P., Edwards, B.H., Cálculo com aplicações, vol. 1, 3ª Edição, McGraw-Hill, 1998.
Progress assessment:	Intermediate Testes (20%) and final written exam (80%) or final written exam (100%). It is approved any student who obtains as final classification, note greater than or equal to 9,5 values.