



Course Unit: Electromechanical Drives					
<p>Department: Electrical Engineering Department Programme: 1st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialisation in: Energy Systems and Control</p> <p>Teaching Language(s): Portuguese Course Unit Chair: Luís Manuel Ramos de Oliveira Teaching Staff: Luís Manuel Ramos de Oliveira (Total lecturing load: 30 T + 15 TP + 60 OT)</p>					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 rd	2 nd	30 T+15 TP+35 OT	Required		5
<p>Workload (hours): 140</p> <p style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </p>					
<p>Learning Outcomes The scope and objective of the course is to develop an understanding of state of the art in power electronics converters and electromechanical drives: their operation, performance, and applications.</p>					
<p>Prerequisites Knowledge acquired in Power Electronics, Applied Power Engineering and Electrical Machines.</p>					
<p>Curriculum</p> <ol style="list-style-type: none"> DC-AC converters: Single-phase and three-phase switch-mode voltage source inverters. Switching strategies: square wave, PWM and space vector control. Current source inverters and multilevel converters: an overview. Introduction to motor drives: Motor drives dynamics. Drive requirements and specifications. Load profiles and characteristics. Criteria for selecting drive components. DC drives: Permanent magnet and separately excited DC motors. Equivalent circuits. Variable speed drives and servo-drives. Transfer function of the variable speed drive system. Induction motor drives: Basic principles of induction motor operation and equivalent circuit. Speed control by V/f and vector control techniques. Impact of non-sinusoidal excitation on induction motors. Synchronous motor drives: Permanent magnet AC synchronous and permanent-magnet brushless dc (BLDC) motor drives. Stepper motor drives. Switched-reluctance motor drives. Synchronous reluctance motor drives. 					
<p>Teaching and Learning Methods Lectures: formal exposition of concepts. Seminars/Problem solving classes: problem solving classes. Tutorials/practical and laboratorial classes: Subdivided into two types <ol style="list-style-type: none"> Students solve exercises and problems under teacher's guidance Practical or laboratorial assignments. </p>					
<p>Assessment</p> <ul style="list-style-type: none"> One test at the end of the semester, or a final examination, weighting 60%, with minimum passing requirements of 50%. Laboratorial/practical assignments, weighting 40%, with minimum passing requirements of 50%. 					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Bibliography

- [1] Mohan, N.; Undeland, T. M.; Robbins, W. P.: "Power electronics - converters, applications and design", John Wiley & Sons, 1995.
- [2] Palma, J. C. P.: "Accionamentos Electromecânicos de Velocidade Variável", Fund. Calouste Gulbenkian, 1999.
- [3] Rashid, M. H.: "Power electronics – Circuits, devices and applications"; Prentice Hall, 2004.
- [4] Miller, T. J. E.: "Brushless permanent-magnet and reluctance motor drives"; Oxford University Press, 1989.
- [5] Mohan, N.: "Electric drives – An integrative approach"; Mnpere, 2000.
- [6] Trzynadlowski, A. M.: "Control of induction motors"; Academic Press, 2000.
- [7] Oliveira, L. M. R.: "Textos de apoio de Accionamentos Electromecânicos", ADEE-EST, Univ. do Algarve, 2007.
- [8] Oliveira, L. M. R.: "Caderno de problemas de Accionamentos Electromecânicos", ADEE-EST, Univ. do Algarve, 2007.
- [9] Oliveira, L. M. R.: "Guião de trabalhos laboratoriais de Accionamentos Electromecânicos", ADEE EST, Univ. do Algarve, 2007.

Demonstration of the syllabus coherence with the curricular unit's objectives

The syllabus of this course provides students with an evolutionary learning on the objectives and competencies to be acquired. Thus, the first chapter provides all the basic knowledge on DC-AC power electronic converters (inverters), which are fundamental to control the AC electric machinery. Chapter 2 looks at the most common mechanical loads and provides the knowledge necessary for the design of the electromechanical drive. The last 3 chapters examine the operation of the most common electrical machines used in electromechanical drives. In this way the student can acquire skills on underlying concepts of electromechanical drives and its applications.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

Taking into account the objectives of this course, the teaching methodology used here allows the student to have contact, in the classroom and laboratory, with educational resources enabling them to obtain the theoretical and practical skills about the concepts and advanced knowledge in electromechanical drives and applications.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Linear Algebra and Analytic Geometry					
Department: Electrical Engineering Department Programme: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialisation in: Information Technology and Telecommunications / Energy Systems and Control					
Teaching Language(s): Portuguese Course Unit Chair: Maria Gabriela Figueiredo de Castro Schütz Teaching Staff: Maria Gabriela Figueiredo de Castro Schütz (Total lecture loading: 52,5T + 22,5TP + 105OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
1 st	1 st	30T+15TP+35OT	Required		5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes To develop a good understanding of the concepts and methods of linear algebra. To develop abstract and critical reasoning and the ability to deepen the knowledge. To obtain a good knowledge of the concepts involved in the syllabus and the ability in their use. Capacity to apply the concepts involved in the syllabus to other problems and fields.					
Prerequisites Knowledge acquired in Mathematics Secondary Education.					
Curriculum I - Linear Algebra Vector spaces. Linear combination. Linear dependence and independence. Properties. Subspace spanned and basis. Matrices - equality, addition, scalar multiplication. Matrix multiplication. Transpose. Determinants: the permutations expansion, Sarrus' rule, properties, Gaussian elimination, minors, Laplace expansion. Adjoint matrix, inverse matrix. Orthogonal matrix. Complex matrix. Linear systems. Cramer's rule. Change of basis. Eigenvalues and eigenvectors. Similar matrices. Diagonalizability. II - Analytic Geometry Vector calculus. Inner product: definition, geometric interpretation, properties and applications. Gram-Schmidt orthogonalization. Cross and mixed products: definitions, geometric interpretation, properties and applications. Lines and planes. Parameters and director cosines. Equations of lines and planes. Relative position of lines and planes. Coordinate systems.					
Teaching and Learning Methods Theoretical (T) - Theoretical presentation of contents, using power point and practical examples while interacting with students. Theoretical and Practical (TP) - Exercises solving by the professor after discussion of each problem and solving methods with the students. Answer to students questions. Tutorial (OT) - Presentation by the students of the solutions found for the proposed exercises. Correction of exercises and answering students' questions.					
Assessment Continuous assessment: two written tests (P1 and P2) and participation (PT) in TP and OT. The rating is equal to the weighted average of M (90%) and PT (10%), where M is the average of P1					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

and P2, being required a minimum grade of 8 points in each.

Final Assessment: Written exam.

All evaluations are done on a scale of 0 to 20.

The student is approved having at least 9.5 points in continuous or final assessment.

Bibliography

Lectures' slides and worksheets of exercises for TP and OT are available.

[1] Agudo, F. Dias, Introdução à Álgebra Linear e Geometria Analítica, Escolar Editora, 1992.

[2] Apostol, T., Calculo (Vol. 2), Reverté, 1993.

[3] Giraldes, E., Fernandes, V. H., Santos, M. H., Curso de Álgebra Linear e Geometria Analítica, McGraw-Hill, 1994.

[4] Lima, T. P., Vitória, J., Álgebra Linear, Universidade Aberta, 1998.

[5] Lipschutz, S., Álgebra Linear, Makron Books, 1994.

[6] Monteiro, A., Álgebra Linear e Geometria Analítica, Editora McGraw-Hill, 2001.

[7] Monteiro, A., Pinto, G., Marques, C., Álgebra Linear e Geometria Analítica – Problemas e exercícios, Editora McGraw-Hill, 2001.

[8] Rios, S., Álgebra Linear e Geometria Vectorial, Litexa, 1980.

[9] Winterle, P., Vectores e Geometria Analítica, Makron Books, 2000.

Demonstration of the syllabus coherence with the curricular unit's objectives

The proposed contents introduce basic concepts of linear algebra, which allow developing abstraction and deductive reasoning skills (in particular topics related to vector spaces, bases, eigenvalues and eigenvectors). Analytic geometry contents provide the development of spatial reasoning and the application of methods (operations with matrices, determinants) learned in linear algebra section, relating subjects and developing students' abilities. The domain of all concepts, techniques and methods presented allow solving several problems of other course units as well as its application in other areas.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

Theoretical lectures methodology consists in the concepts presentation, illustrated with several examples, while interacting with students in order to make them analyze, relate, induce and deduce. This interaction is deepened in the Theoretical and Practical lessons, where exercises related to the taught subjects are solved. Real applications examples are also presented as well as the use of the concepts in other course units. Tutorial focus on the students individual work and the difficulties found in solving a set of exercises. Their resolution requires the assimilation of contents. The objective of this approach is to develop the autonomous study and the students cognitive and reasoning abilities, albeit supervised.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Algorithms and Data Structures					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications					
Teaching Language(s): Portuguese Course Unit Chair: Roberto Célio Lau Lam (rlam@ualg.pt) Teaching Staff: Roberto Lam (Lecturing load: 15 T+ 30 PL+ 35 OT);					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2	1	15 T+ 30 PL+ 35 OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) Objectives: Provide students with knowledge about: a) object-oriented programming, b) search and sort algorithms, c) linear (lists) and hierarchical (trees) data structures and d) hash tables, matrices and adjacency lists. Skills: a) object oriented programming, b) construct and use search and sort routines, c) program and use simple and complex data structures (lists and trees) and d) to use class libraries to develop applications.					
Prerequisites Knowledge obtained in the discipline of programming. Knowledge of C Language. Ability of inductive and deductive reasoning.					
Curriculum (max. 1000 characters) 1 Object Oriented Programming; 2 Java; 3 Algorithmic complexity; 4 Sorting algorithms in vectors; 5 Search algorithms in vectors; 6 Lists, under the concepts LIFO and FIFO (queues, stacks); 7 Trees (Binary search trees and AVLs); 8 Hash tables; 8 Graphs; 9 Use of the contents of the course in practical applications;					
Teaching and Learning Methods (max. 1000 characters including assessment) The lectures and practical classes will have a small theoretical exposition of content, presentation of storage structures and basic algorithms. At the end of the theoretical-practical classes, case studies are presented with problems to solve. The tutorials will focus on problem solving as well as support offered to students who have disabilities. The electronic platform of UAlg will be used with the following objectives: a) Publication of resources for practical classes, b) Publication of assessments; c) Publication of notices; d) creating a space for communication (discussion forum) to clarify questions and stimulate communication between teacher/students and students/students.					
Assessment Test/written examination (50%) and presentation of practical work done on schedule (50%). To be approved the students must obtain at least seven points (scale of 0-20) in the test/exam and at least 7 points in the programming work component. Final grade = 50% test / exam + 50% programming work.					
Bibliography (max. 1000 characters) Cormen, T.H., Leiserson, C.E., Rivest, R. and Stein, C., Introduction to Algorithms, MIT Press.					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Sedgewick, R., Addison-Wesley Publishing Company, Inc.
Eckels, B., Thinking in JAVA I e II, 3th Edition.
Estruturas de Dados e Algoritmos em JAVA A. Adrego da Rocha, 2011, FCA.
Rodrigues P., Pereira P. E Sousa M., Programação em C++ Conceitos básicos e Algoritmos. FCA.
Guerreiro, P., Elementos de Programação com C, FCA Lidel. 3ª Edição

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The contents of 1 and 2 provide students knowledge on object-oriented programming. The search and sort algorithms will be addressed through the points 4 and 5. The simple data structures (vectors, lists) will be used according to the concepts: LILO and FIFO. More complex data structures, including trees and hash tables will be consolidated through small examples applied on graphs. The skills related to programming routines for storing, accessing and removing data in data structures will be acquired through language JAVA.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodology will be a mix of classic: direct, expository and fundamental methodology of Problem Based Learning (PBL). After lecturing the subject, problems and questions are presented to be answered in group analysis, serving the needs of solving problems, being student-centered and assuming the diversity of personal learning. At each point of the objectives, after lecturing, will be presented a case (problem) that constitutes the catalytic to the process of learning by students. Students meet the objectives proposed above, by working on problems, which will have to use data structures and routines.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Circuit Analysis I

Department: Electrical Engineering Department

Program: 1st Cycle in Electrical and Electronics Engineering

Scientific Area: Electrical Engineering

Specialization in: Information Technology and Telecommunications / Energy Systems and Control

Teaching Language(s): Portuguese

Course Unit Chair: Mário Rui Gil Saraiva (msaraiva@ualg.pt)

Teaching Staff: Jorge Filipe Leal Costa Semião (Lecturing load: 45 T+ 30 TP+ 30 OT); Cristiano Lourenço Cabrita (Lecturing load: 60 OT); António Fernando Marques de Sousa (Lecturing load: 60 OT).

Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
1 st	1 nd	30T+15TP+35OT	Required	15241004	5

Workload (hours): 140

Classes: 45

Tutorials: 35

Fieldwork: 0

Individual Work and Assessment: 60

Learning Outcomes (max. 1000 characters)

Develop skills to analyse and solve electric circuits electrical with direct current regime. Develop skills to analyse RC, RL and RLC circuits in transient regime.

Prerequisites

Mathematics knowledge.

Curriculum (max. 1000 characters)

PART I - LAWS AND THEORMS OF LINEAR ELECTRIC CIRCUITS

1. Fundamental concepts
2. Electrical Quantities, fundamental units and derived units.
3. Charge concept, Resistances, Inductance, Capacitors, Current Sources, Voltage Sources.
4. Ohm's Law and Kirchhoffs' Laws (current and voltage). Basic laws' application.
5. Power, Joule's Law.
6. Other Laws and theorems: Law of conservation of power; Superposition theorem; Millman's Theorem; Thévenin and Norton theorems; Theorem for the maximum power transfer; Substitution Theorem; Duality.

PART II – SYSTEMATHIC METHODS FOR LINEAR ELECTRIC CIRCUIT ANALYSIS

1. Topologies: Graph, node, branch, tree, rope, network.
2. Systematization methods for electric circuit analysis: Mesh analysis; Nodal analysis.

PART III – TRANSIENT RESPONSE IN TIME DOMAIN OF RL, RC AND RLC CIRCUITS

1. First order circuits: RL e RC.
2. Second order circuits: RLC.

Teaching and Learning Methods (max. 1000 characters including assessment)

Lectures, using exposition, explanation and projection of slides and examples; Seminars/Problem solving classes, where the teacher complements the teaching method with solving exercises and stimulating students to solve problems; Tutorials, where students solve exercises and problems under teacher's guidance and where individual or group assignments are proposed, including laboratorial assignments.

Assessment

Final Grade = 80% x (Theoretical part) + 20% x (Practical part)

The theoretical part corresponds to a final examination or a test; The practical part corresponds to a set

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

of assignments to be developed by the students. Each part must meet the minimum grade of 8 out of 20, and Final Grade must meet a minimum of 9.5.

If a student wants to improve their passing grade, only a final examination is required, and the final grade will be the examination grade (theoretical part).

When the number of students registered to a test or examination is small, an oral test may replace the written test.

Bibliography (max. 1000 characters)

[1] Lectures' slides

[2] Exercises handouts for problem-solving classes

[3] Electric Circuits, Nilsson/Riedl, Editora Wiley

[4] Circuitos Eléctricos, Vítor Meireles, Editora LIDEL

[5] Fundamentals of Electric Circuits, Alexander, Sadiku, Editora McGraw-Hill

[6] Engineering Circuit Analysis, Hayt/Kemmerly/Durbin, Editora McGraw-Hill

[7] Circuit Analysis: Theory and Practice, Allan H. Robins and Wilhelm C. Miller, Delmar Cengage Learning.

[8] Analysis of Linear Circuits, Clayton R. Paul, Editora McGraw-Hill

[9] Basic Engineering Circuit Analysis, J David Irwin, Editora McMillan

[10] Análise de Circuitos Eléctricos - Phillip Cutler - Editora McGraw-Hill do Brasil Ltd.

[11] Circuitos, Lineares - Charles M. Close - Livros Técnicos e Científicos Editora S.A.

[12] Electricidade Básica - Coleção Schaum

[13] Circuitos Eléctricos - Edminster - Coleção Schaum

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The syllabus was defined according with the curricular unit objectives, and the contents are introduced gradually, according with the initial prerequisites and the knowledge acquired in basic engineering courses. The initial chapters include fundamental concepts on electric circuits, followed by the fundamental laws in electricity, like Ohms law and Kirchhoffs' laws (among others), which are progressively introduced and will allow the student to analyze circuits in direct current regime. After that, the systematic methods to analyze electric circuits will be introduced. At the end, the transient response in the time domain for first order and second order circuits will be introduced, which requires from the students a wide-ranging knowledge, already acquired in the previous chapters. The progressive introduction of the content eases subject comprehension, and allows students to achieve the expected outcomes.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodologies include 3 different approaches, namely: (1) a theoretical approach, where the fundamental concepts are transmitted and precise hints are given on how to use these concepts to achieve the unit outcomes; (2) a theoretical-practical approach, which includes exercises, where explanations are given on how to use the key concepts to solve problems; and (3) a practical approach, which includes problem solving by the students under the guidance of the teacher, whether by solving applied problems using calculus, or by designing, building and testing circuits in the laboratory, to allow experimental verification of unit's key concepts. These three different approaches complement themselves, and allow students to have different perspectives on the same content, so their knowledge is reached in a consistent way, allowing to achieve the curricular unit's outcomes easier.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Circuit Analysis II

Department: Electrical Engineering Department

Program: 1st Cycle in Electrical and Electronics Engineering

Scientific Area: Electrical Engineering

Specialization in: Information Technology and Telecommunications / Energy Systems and Control

Teaching Language(s): Portuguese

Course Unit Chair: Jorge Filipe Leal Costa Semião (jsemiao@ualg.pt)

Teaching Staff: Jorge Filipe Leal Costa Semião (Lecturing load: 45 T+ 30 TP+ 30 OT); Fernando Beirão Emídio (Lecturing load: 0 T+ 0 TP+ 60 OT).

Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
1 st	2 nd	30T+15TP+35OT	Required	15241009	5

Workload (hours): 140

Classes: 45

Tutorials: 35

Fieldwork: 0

Individual Work and Assessment: 60

Learning Outcomes (max. 1000 characters)

Develop skills to analyse and solve single-phase electrical circuits in sinusoidal steady-state regime. Develop skills to analyse and calculate power in alternate-current circuits. Develop skills to analyse circuits with magnetic coupling. Develop skills to analyze Two-Port circuits and calculate their parameters.

Prerequisites

Knowledge acquired in Circuit Analysis I.

Curriculum (max. 1000 characters)

1. Studying the characteristics of inductors and capacitors.
2. Alternate Quantities
 - Sinusoidal Alternate Current. Frequency, Period, Amplitude, Root-mean-square value, Average value.
 - The Phasor. Angular Frequency, Phase Angle.
 - Impedance, Admittance, Susceptance, Reactance. Impedance Triangle.
 - Circuit Analysis in sinusoidal steady-state regime. Phasorial Diagram.
3. Power Calculations
 - Active, Reactive, Complex and Apparent power.
 - The Power factor.
 - Correction of the power factor.
4. Magnetic coupling circuits
 - Self and mutual inductance
 - Transformers: ideal, linear and autotransformer
5. Two-Port Circuits
 - Two-port characterization: $[Z]$, $[y]$, $[h]$, $[g]$, $[T]$ and $[T']$ parameters.
 - Analysis of two-port circuits and their parameters' calculation.
 - Transfer functions: input, output and transfer impedances and admittances
 - two-port circuits associations: series, parallel, series – parallel, parallel – series, cascade.

Teaching and Learning Methods (max. 1000 characters including assessment)

Lectures, using exposition, explanation and projection of slides and examples; Seminars/Problem solving classes, where the teacher complements the teaching method with solving exercises and stimulating students to solve problems; Tutorials, where students solve exercises and problems under

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

teacher's guidance and where individual or group assignments are proposed, including laboratorial assignments.

Assessment

Final Grade (FG) = 80% x (Theoretical part) + 20% x (Practical part)

The theoretical part corresponds to a final examination or a test; The practical part corresponds to a set of assignments to be developed by the students. Each part must meet the minimum grade of 8 out of 20, and FG must meet a minimum of 9.5.

If a student wants to improve their passing grade, only a final examination is required, and the final grade will be the examination grade (theoretical part).

When the number of students registered to a test or examination is small, an oral test may replace the written test.

Bibliography (max. 1000 characters)

[1] Lectures' slides

[2] Exercises handouts for problem-solving classes

[3] Engineering Circuit Analysis, Hayt/Kemmerly/Durbin, McGraw-Hill

[4] Electric Circuits, Nilsson/Riedl, Wiley

[5] Circuitos Eléctricos, Vítor Meireles, LIDEL

[6] Fundamentals of Electric Circuits, Alexander, Sadiku, McGraw-Hill

[7] Analysis of Linear Circuits, Clayton R. Paul, McGraw-Hill

[8] Basic Engineering Circuit Analysis, J David Irwin, McMillan

[9] Circuitos Eléctricos, Edminster, Schaum's Collection

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The syllabus was defined according with the curricular unit objectives, and the contents are introduced gradually, according with the initial prerequisites and the knowledge acquired in previous courses. The initial chapters include fundamental concepts on alternate quantities, followed by phasor, impedance and reactance concepts (among others), which are progressively introduced and will allow the student to analyze circuits in sinusoidal steady-state regime. After that, other applications for the alternate steady-state analysis will be introduced, like power calculations and magnetic coupling circuits. At the end, the two-port circuits will be introduced, which requires from the students a wide-ranging knowledge, already acquired in the previous chapters. The progressive introduction of the content eases subject comprehension, and allows students to achieve the expected outcomes.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodologies include 3 different approaches, namely: (1) a theoretical approach, where the fundamental concepts are transmitted and precise hints are given on how to use these concepts to achieve the unit outcomes; (2) a theoretical-practical approach, which includes exercises, where explanations are given on how to use the key concepts to solve problems; and (3) a practical approach, which includes problem solving by the students under the guidance of the teacher, whether by solving applied problems using calculus, or by designing, building and testing circuits in the laboratory, to allow experimental verification of unit's key concepts. These three different approaches complement themselves, and allow students to have different perspectives on the same content, so their knowledge is reached in a consistent way, allowing to achieve the curricular unit's outcomes easier.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Mathematics I					
Department: Electrical Engineering Department Programme: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialisation in: Information Technology and Telecommunications / Energy Systems and Control					
Teaching Language(s): Portuguese Course Unit Chair: Maria Gabriela F. Castro Schütz Teaching Staff: Ana Bela Batista dos Santos (Total lecture loading: 45T + 30TP + 35OT) and Larissa Robertovna Labakhua (Total lecture loading: 70OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
1 st	1 st	30T+15TP+35OT	Required		5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes To provide a solid basis on Mathematical Analysis, allowing students to successfully study other subjects. To develop abstract and critical reasoning and the ability to deepen the knowledge. To obtain a good knowledge of the concepts involved in the syllabus and the ability in their use. Capacity to apply the concepts involved in the syllabus to other problems and fields.					
Prerequisites Knowledge acquired in Mathematics Secondary Education.					
Curriculum 1. Real and complex numbers Real numbers. Complex numbers: geometric representation, operations, properties, curves and plane regions. 2. Real functions of real variable Graphs, limits, continuity, derivatives, differentials, Taylor's Theorem, primitives, integrals and its application to calculate area and volume of a solid of revolution.					
Teaching and Learning Methods Theoretical (T) - Theoretical presentation of contents, using power point and practical examples while interacting with students. Theoretical and Practical (TP) - Exercises solving by the professor after discussion of each problem and solving methods with the students. Answer to students questions. Tutorial (OT) - Presentation by the students of the solutions found for the proposed exercises. Correction of exercises and answering students' questions.					
Assessment Continuous assessment: two written tests (P1 and P2) and participation (PT) in TP and OT. The rating is equal to the weighted average of M (90%) and PT (10%), where M is the average of P1 and P2, being required a minimum grade of 8 points in each. Final Assessment: Written exam. All evaluations are done on a scale of 0 to 20. The student is approved having at least 9.5 points in continuous or final assessment.					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Bibliography

Lectures' slides and worksheets of exercises for TP and OT are available.

[1] Apostol, T. – Calculus (vol. 1), Ed. Reverté, Lda, 1999.

[2] Azenha, A. & Jerónimo, M. A. – Elementos de Cálculo Diferencial e Integral em \mathbb{R} e \mathbb{R}^n , McGraw-Hill, 1995.

[3] Campos Ferreira, J. – Introdução à Análise Matemática, Fundação Calouste Gulbenkian, 1987.

[4] Piskounov, N. – Cálculo Diferencial e Integral (vol.1), Lopes da Silva Editora, 1984.

[5] Santos Guerreiro, J. – Curso de Análise Matemática, Livraria Escolar Editora, 1989.

[6] Sarrico, C. – Análise Matemática, Leituras e Exercícios, Gradiva, 1997.

[7] Swokowski, E. W. – Cálculo com Geometria Analítica (vol.1), McGraw-Hill, 1994.

Demonstration of the syllabus coherence with the curricular unit's objectives

The proposed contents introduce basic concepts of Mathematical Analysis and the correspondent theoretical basis, in complex and real sets, allowing the development of abstraction, analysis and reasoning abilities. The calculation techniques and methods related to the contents provide the basic tools for other course units, namely those of electrical and electronics scientific areas, and also for applications to other areas.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

Theoretical Lectures methodology consists in the concepts presentation, illustrated with several examples, while interacting with students in order to make them analyze, relate, induce and deduce. This interaction is deepened in Theoretical and Practical lessons, where exercises related to the taught subjects are solved. Examples related to electrical and electronics areas are also presented. Tutorial focus on the students individual work and the difficulties found in solving a set of exercises. Their resolution requires the assimilation of contents. The objective of this approach is to develop the autonomous study and the students cognitive, operational and reasoning abilities, albeit supervised.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Mathematics II

Department: Electrical Engineering Department

Programme: 1st Cycle in Electrical and Electronics Engineering

Scientific Area: Electrical Engineering

Specialisation in: Information Technology and Telecommunications / Energy Systems and Control

Teaching Language(s): Portuguese

Course Unit Chair: Maria Gabriela F. Castro Schütz

Teaching Staff: Ana Bela Santos (Total lecture loading: 30T + 15TP + 105OT) and Larissa

Robertovna Labakhua (Total lecture loading: 15T + 15TP)

Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
1 st	2 nd	30T+15TP+35OT	Required		5

Workload (hours): 140

Classes: 45

Tutorials: 35

Fieldwork: 0

Individual Work and Assessment: 60

Learning Outcomes

To develop abstract and critical reasoning and the ability to deepen the knowledge.

To obtain a good knowledge of the concepts involved in the syllabus and the ability in their use.

Capacity to apply the concepts involved in the syllabus to other problems and fields, namely to electrotechnics.

Prerequisites

Knowledge acquired in Mathematics I.

Curriculum

1. Real functions of real variables

Graphs, curves and level surfaces, limits, continuity, derivatives and differentials.

2. Multiple integrals

Double and triple Integral - solve, change of variable and applications.

3. Differential equations

First-order differential equations and n-th order linear differential equations. Application to RL, RC, LC and RLC circuits.

Teaching and Learning Methods

Theoretical (T) - Theoretical presentation of contents, using power point and practical examples while interacting with students.

Theoretical and Practical (TP) - Exercises solving by the professor after discussion of each problem and solving methods with the students. Answer to students questions.

Tutorial (OT) - Presentation by the students of the solutions found for the proposed exercises. Correction of exercises and answering students' questions.

Assessment

Continuous assessment: two written tests (P1 and P2) and participation (PT) in TP and OT.

The rating is equal to the weighted average of M (90%) and PT (10%), where M is the average of P1 and P2, being required a minimum grade of 8 points in each.

Final Assessment: Written exam.

All evaluations are done on a scale of 0 to 20.

The student is approved having at least 9.5 points in continuous or final assessment.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Bibliography

Lectures' slides and worksheets of exercises for TP and OT are available.

[1] Azenha, A. & Jerónimo, M. A. – Elementos de cálculo diferencial e integral em \mathbb{R} e \mathbb{R}^2 , McGraw-Hill, 1995.

[2] Ferreira, A. M. e Amaral, I. – Integrais múltiplos equações diferenciais, Edições Sílabo, 1994.

[3] Ferreira A.M. – Cálculo diferencial em \mathbb{R}^n - exercícios, Edições Sílabo, 2008.

[4] Krasnov, M.; Kisseliov, A.; Makarenko, G. – Equações diferenciais ordinárias, McGraw-Hill, 1994.

[5] Piskounov, N. – Cálculo diferencial e integral (vol. 2), Lopes da Silva Editora, 1984.

[6] Swokowski, E. W. – Cálculo com geometria analítica (vol.2), McGraw-Hill, 1994.

Demonstration of the syllabus coherence with the curricular unit's objectives

The proposed contents introduce basic concepts of Mathematical Analysis on differential and integral calculus in \mathbb{R}^n , allowing the development of abstraction, analysis and reasoning abilities. The calculation techniques and methods involved in the contents provide tools for other course units, namely those of electrotechnics, and also for applications to other areas.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

Theoretical lectures methodology consists in the concepts presentation, illustrated with several examples, while interacting with students in order to make them analyze, relate, induce and deduce. This interaction is deepened in the Theoretical and Practical lessons, where exercises related to the taught subjects are solved. Examples related to electrotechnics are also presented. Tutorial focus on the students individual work and the difficulties found in solving a set of exercises. Their resolution requires the assimilation of contents. The objective of this approach is to develop the autonomous study and the students cognitive, operational and reasoning abilities, albeit supervised.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Numerical Analysis

Department: Electrical Engineering Department

Program: 1st Cycle in Electrical and Electronics Engineering

Scientific Area: Mathematics

Specialization in: Information Technology and Telecommunications / Energy Systems and Control

Teaching Language(s): Portuguese

Course Unit Chair: João Miguel Fernandes Rodrigues (jrodrig@ualg.pt)

Teaching Staff: João Miguel Fernandes Rodrigues (Lecturing load: 30T+15TP+35OT); Paulo Alexandre da Silva Felisberto (Total lecturing load: 15 TP+ 60 OT);

Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
1 st	2 nd	30T+15TP+35OT	Required	--	5

Workload (hours): 140

Classes: 45

Tutorials: 35

Fieldwork: 0

Individual Work and Assessment: 65

Learning Outcomes

Provide essential knowledge on numerical methods, produce numerical answers to mathematical problems, give students the ability to judiciously apply these methods to solve problems of technology and science that requires the understanding of the fundamentals of each numeric method, and apply the method using programming languages, calculators and computer applications. Specific skills: understand and apply the errors theory, understand and apply methods for solving nonlinear equations, systems of equations and curve fitting by polynomial interpolation and the method of least squares. Understand and apply methods for differentiation, numerical integration and for solving ordinary differential equations.

Prerequisites

Basic knowledge of programming and mathematics.

Curriculum

1. Goals of numerical analysis.
2. Errors theory: Fundamentals, absolute and relative error. Relations between errors, decimals and significant correct digits. Propagation of errors.
3. Nonlinear equations: Direct methods: Bisection, False Position. Iterative methods: Simple Iterative Method, Newton and Secant. Stop criteria of iterative methods. Errors.
4. Linear equations systems: Direct methods: Gaussian Elimination, LU Decomposition, pivoting techniques. Iterative methods: Gauss-Seidel. Convergence. Errors.
5. Polynomial interpolation: Lagrange and Newton Divided Differences formulas. Errors.
6. Curve fitting: Least squares. Extensions. Errors.
7. Numerical differentiation: Derivative of 1st and 2nd order. Errors.
8. Numerical integration: Simple and Compound. Newton-Cotes formulas. Trapezium and Simpson methods. Errors.
9. Topics on ordinary differential equations: Methods of Taylor and Runge-Kutta. Errors.

Teaching and Learning Methods

Theoretical lessons for the exhibition of the syllabus. Theoretical-practical lessons for the resolution of exercises/problems and preparation of practical work. Tutorial to support and carry out practical work done on a programming language (C). The course presents a strong component of practical work consolidating also programming concepts.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Assessment

Test or written exam (70% endnote) and the presentation with discussion of practical work (30% endnote); with minimum score on each component of 7 values (0-20). The minimum grade is required for the practical work at any examination period.

Bibliography

- [1] Rodrigues, J. Acetatos das aulas teóricas, UAlg/ISE-DEE, 2012
- [2] Rodrigues, J., Cardoso, P.. Roteiro de Análise Numérica, UAlg/ISE-DEE, 2011
- [3] Rodrigues, J.A. Métodos Numéricos, Edições Sílabo, 2003
- [4] Ruggiero, M.G., Cálculo Numérico, McGraw Hill, 1989
- [5] Scheid, Francis, Análise Numérica, McGraw Hill, 2000
- [6] Press, W.H., et al. Numerical Recipes in C, Cambridge University, Press, 1992

Demonstration of the syllabus coherence with the curricular unit's objectives

The numerical methods allow us to expand the types of problem-solving techniques, intervened in situations where analytical resolution is itself impractical or those in which the nature of the problems requires numerical approaches; expanding the possibilities of mathematics in solving problems of Eng., providing important tools of comprehension, analysis and application on calculation machines, libraries and computer applications. The syllabus on this UC covers traditional topics, beginning with analysis of errors, which will also be addressed in each of the following chapters. The remaining chapters involve the presentation and discussion of methods for solving nonlinear equations, systems of equations, curve fitting, differentiation, integration and differential equations. In any of the content presented, always focuses on examples of Eng., with main focus for examples and applications in Electrical Engineering.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

The concepts and techniques are presented using the previous knowledge of analysis and algebra and theoretical exposure is always accompanied by practical examples and graphical representations. The theoretical aspects are presented with accuracy to show the applicability of formulas. Additionally, comments are justified and comparing the various methods with regard to their efficiency, accuracy of results obtained and applicability. Students are encouraged to program calculators and explore their capabilities.

The lectures are planned for 15 weeks and are divided in terms of weeks (lecture) as follows: 2 weeks for theory of errors, 2 for non-linear equations and systems of equations 2 weeks. Three weeks for interpolation and curve fitting, 2 weeks for differentiation and integration. One week for differential equations, the remaining 2 weeks, are used primarily for solving problems that concern all the contents in one exercise problem.

In practical classes are periodically solved several case studies/problems using the calculator. The other practical lessons and tutorial guidance is designed and implemented a federating project where all the components of the course are switched on. This project is divided in 4 practical works, which focus on the different components of the syllabus, which in the end results in a single work (project) where all contents of UC were addressed and related to each other. In this practical component of the UC it is assumed that the programming language to use must be C, so while they study the contents of this UC, the students can also complement the programming knowledge obtained at UC of the previous semester - Programming.

To facilitate dialogue between all participants of the course, this is inserted into the electronic tutoring platform of UAlg. On this page and have access to all content provided by teachers; students have the possibility to consolidate the concepts and ask questions using the forums that can be viewed by the entire community of numerical analysis.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Electrical Networks Analysis					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Energy Systems and Control Teaching Language(s): Portuguese Course Unit Chair: José Manuel Guerreiro Gonçalves (jgoncal@ualg.pt) Teaching Staff: José Manuel Guerreiro Gonçalves (Lecturing load: 30 T + 15 TP + 30 OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 rd	2 nd	30 T + 15 TP + 35 OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes 1. Understand the phenomena related to the interconnection between busbars of an electrical network. 2. Analyze and present solutions to improve the several systems of electric energy. 3. Analyze magnitudes relating to short-circuit in values per unit. 4. Understand the transitory phenomena resulting from the establishment interrupt and short-circuit in the systems of electric energy. 5. Understanding some of the aspects related to the control of electrical systems. 6. Always to have the notions of capacity, quality and economy in the transmission of electrical energy.					
Prerequisites Knowledge of Mathematics I and II, Linear Algebra and Analytic Geometry, Applied Mathematics for Electrical Engineering, Numerical Analysis, Circuits Analysis I and II, Instrumentation and Measurements, and Electromagnetism.					
Curriculum 1. Concepts of Engineering of Electrical Systems (EES). Current direct (DC) and alternating (AC). Transmission lines of one-phase and three-phase. Complex power. Representation per unit (pu). Kirchoff's laws, Thevenin, Norton and superposition. Conversion Y-Δ and Δ-Y. 2. Analysis and structure of an EES. Types of networks. Parameters and coefficients of elasticity as a function of active and reactive power. Maximum power transmitted between two busbars (voltage collapse). DC and AC line. 3. EES steady state. Models and analysis system operation. Iterative calculation of equations static load flow (methods of Gauss-Seidel and Newton-Rapson). 4. Short-circuit currents. Systems analysis balanced and unbalanced. Decomposition of a three-phase system into subsystems symmetrical and asymmetrical and vice versa. Neutral current. 5. Optimal power flow. Strategies for optimal functioning. Lines with and without losses. 6. Stability of EES. Static and dynamic stabilities.					
Teaching and Learning Methods -Theoretical classes: formal exposition of the matter and, where possible, accompanied by illustrative examples. -Theoretical and practical classes: exercises selected and performed by the teacher. -Tutorial guidance: resolution of exercises and development work. Answering questions individually or collectively.					
Assessment 1- Continuous assessment: 2 written tests + 1 written report. •The students will be exempted from written examination. All students who obtain the following requirements: -average of 2 tests (CT) ≥ 50%, none of which will be less than 40%;					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

-written report (Ct) $\geq 50\%$.

For approval in this UC, the final result Cf shouldn't be less than 50%, and it is given by:

$$C_f = (3 \times C_T + C_t) / 4.$$

2 - Written exam: All students who obtain a final result Cf < 50%, may be subject to examination. The new requirements for approval in the UC are:

Final Rating C'f = (3×CE+Ct)/4, where CE - examination classification, considering approved if C'f $\geq 50\%$.

Bibliography

[1] J. P. Sucena Paiva, "Electric Power Networks. A Systemic Analysis", in Portuguese, IST Press, ISBN: 972-8469-34-9, Lisbon, 2005.

[2] I. Olle Elgerd, "Electric Energy Systems Theory", in Portuguese, Publisher McGraw Brazil, Ltd, 1976.

[3] I. Olle Elgerd, "Control Systems Theory," International Student Edition, 1967.

[4] - William D. Stevenson Jr., "Elements of Power System Analysis", in Portuguese, McGraw-Hill Publishing in Brazil Ltd, 1976.

[5] J. P. Sucena Paiva, "Energy Production and Transmission II - Network Analysis of Electricity", in Portuguese, AEIST - IST/UTL, Lisbon, 1990.

Demonstration of the syllabus coherence with the curricular unit's objectives

In relation to the objectives that require an increase of theoretical knowledge the program of this course unit includes the above mentioned objectives in an always positive relation. In terms of knowledge relating to this course unit it is intended to in-depth knowledge of electric power lines and stability methods.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

The students must achieve the objectives through the several proposed teaching methodologies. In the Theoretical lectures the knowledge required to achieve the support knowledge is analyzed and explained and supplemented by exercises in T/P classes. In Tutoring classes problems and means of self-study that allow to solve the problems related to the electrical networks are provided to students. At the end of UC students should be able to design network electrical circuits and obtain optimal power flows.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Course Unit: Microprocessor Applications					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications Teaching Language: Portuguese Course Unit Chair: Rui Fernando da Luz Marcelino (rmarcel@computer.org) Teaching Staff: Rui Fernando da Luz Marcelino (Lecturing load: 15 T+ 30 PL+ 35 OT);					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3	2	15 T+30 PL+35 OT	Required	--	5
Workload (hours): 280 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes <p>After the approval in the UC, the student should have acquired the following competences:</p> <p>Designing and manipulate embedded systems based on microcontrollers, microprocessors and reconfigurable logic system.</p>					
Pré-requisitos <p>Contents acquired in Digital Systems and microprocessors courses during High School</p>					
Curriculum <ol style="list-style-type: none"> 1. Internal structure of a microprocessor: Addressing modes. Instruction set. Systems of interruptions. 2. The timers / event counters. I / O and interrupt.driver programmed I / O. Serial communicationThe derivatives of the family 8051.Interruptões 8051 3. Memory systems. Memory types. The external memory in 8051. Address space for I / O and I / O mapped into memory. 4. Programming Microcontrollers in C Language The C data types and specific to the microcontroller. Complete Writing Program in C. 5. Basic architecture of FPGA. Features of Xilinx Spartan 3 FPGA. Comparison between the various families of FPGA. Flow for FPGA project. PicoBlaze Architecture, Hardware and Software. Example of a project Hardware / Software for the PicoBlaze. Specifications temporal project. Analysis of the reports of the various stages of the synthesis process. Techniques and synthesis options. 					
Teaching and Learning Methods <p>Theoretical Classes (T) - theoretical exposition of content, using acetates or "power point", alternating with practical examples and interacting with students.</p> <p>Tutorial Classes (OT) - Monitoring by the teacher of the student resolution chips exercises Discussion and preparation of work to be done in practical classes</p> <p>Laboratory Practices (PL) - Implementation of a set of practical work, covering the entire syllabus</p>					
Assessment <p>There are 2 components to the assessment:</p> <ul style="list-style-type: none"> - Practical works 					

⁽¹⁾ Ensino teórico (T); Teórico-prático (TP); Prático e laboratorial (PL); Trabalho de campo (TC); Seminário (S); Orientação tutorial (OT); Trabalho individual do aluno (TA).

- Single Test and/or Exam for a T and TP evaluation
Theoretical Grade = MAXIMUM (Test and/or Exam)
Final Grade= 0.5 * Practical Grade + 0.5 * Theoretical Grade

Bibliography

1. Rui Marcelino, "Folhas da disciplina de Aplicações de Microprocessadores",
2. Kenneth J. Ayala, "The 8051 Microcontroller", Edição de Cengage Learning, 2004
3. Thomas W. Schultz, "C and the 8051,..", Vol. I e II, Edição de PageFree Publishing, Inc., 2004
4. Wolf Wayne, "FPGA-Based System Design", Prentice Hall, 2004
5. Volnei A. Pedroni, "Circuit Design with VHDL", MIT Press, 2004

Demonstration of the syllabus coherence with the curricular unit's objectives

To achieve the desired skills, the syllabus was developed in order achieve the following objectives: .

To know describe the operation of a microprocessor. Understand the operation of a microprocessor based system, memory units, input / output.

Understand the operation of timers and understand the difference between functioning as a timer and counter.

Describe the asynchronous serial communication. Describe the SFR registers associated with the serial communication. Learn to develop communication subsystems series. Describe the mechanism of interruptions.

How the interruptions work in 8051. Table interrupt vectors. Priorities of interruptions. Application of SFR-related interruptions. How to develop routines to service interruption. Know generate interrupts by software.

Learn to use the C language to program microcontrollers family 8051

Describe the mapping area in the input / output memory and external data.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

In order to consolidate and deepen the acquisition of jurisdiction are proposed to achieve the practical work, focused on developing projects that address the whole matter.

In order to consolidate and strengthen the competences defined, the folowinfg lab works are proposed, focused on developing projects that address the whole matter.

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Laboratory work

Lab 1: Familiarization with the Development Tools. Objectives: To know to perform sequence from writing code in assembly to the loading of the MCU, so you can develop an entire application. Will perform read and write ports in the Input / Output

Lab 2: timers / counters. Objectives: To choose which mode of operation of the timer for use in concrete. Differentiate between operating as timer and counter. Write delay routines. Make counts events external to MCU.

Lab 3: Serial Port. Purpose: Set the parameters associated with the asynchronous serial port. To know to implement a mechanism of menus to make the input and output data, using as a terminal interface in text mode MCU connected to the serial port

Lab 4: Interruptions. Objectives: To consolidate the theoretical concepts about interruptions. To know configure the various interruptions. To know to build interrupt service routines.

Lab 5: Programming in C language LCD display. Objectives: Develop applications for the 8051 family platform using the C language as Compreendere mappings in Ports I / O and external memory d ata. Identifying the memory addresses of the external data ncontram in which the various devices. To know to set up and write a LCD module.

Lab 6. Devices with Serial Interface. Temperature Sensor DS1620 Objectives: Configure external devices-Implement programmable synchronous communication serious about SPI

Lab 7: Using Soft processor in FPGAs. Objectives To know Embed a processor described in VHDL on a project. Knowing how to write a program for PicoBlaze processor. Deploying applications using FPGA Soft Processor

(1) Ensino teórico (T); Teórico-prático (TP); Prático e laboratorial (PL); Trabalho de campo (TC); Seminário (S); Orientação tutorial (OT); Trabalho individual do aluno (TA).



Course Unit: AUTOMATION AND ROBOTICS					
<p>Department: Electrical Engineering Department Program: 1st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Power and Control Systems</p> <p>Teaching Language(s): Portuguese Course Unit Chair: Larissa Robertovna Labakhua Teaching Staff: Larissa Robertovna Labakhua (Lecturing load: 24 T+ 12 TP+ 24 OT); Ivo Manuel Valadas Marques Martins (Lecturing load: 6 T+ 3 TP+ 6 OT)</p>					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 st	1 st	30 T+15TP+35 OT	Required	--	10
<p>Workload (hours): 140</p> <p style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </p>					
<p>Learning Outcomes (max. 1000 characters) Generics: Know, analyze, and apply the main automation and robotics technologies in production systems. Specific: Illustrate, describe and explain the robotic technology in different field application; Know and select sensors to robotic systems; Select a mobile robot for a given application; Solve kinematic problems; Implement methods of trajectory planning.</p>					
<p>Prerequisites Knowledge of mathematics, algebra and physics.</p>					
<p>Curriculum (max. 1000 characters)</p> <ol style="list-style-type: none"> 1. Introduction: Fundamental in automation and robotics. Historical perspective. 2. Introduction to Automation: Industrial automation; Objectives, advantages, applications. 3. The Automation in the industry: The automation of production; Structure of the automated systems; Representation of automatisms; The automation based on Programmable Logic Controllers; Development of automated systems. 4. Operational level of Automatisms: Foundations, applications; Actuators; Sensors, transducers. 5. Robotics: Introduction to robotics; Terminology and definitions; Robots application fields; Types of robots; Components involved in the operation of a robot; Degrees of freedom and mobility; Coordinate systems; Robots classification; The robots dynamic features. 6. Kinematic and dynamic model: Introduction to the kinematic model; Kinematic and dynamic model; Kinematic model-based control. 7. Trajectory planning: Planning Types; Joint planning and operating space; Mathematics of splines; Simulation models. 					
<p>Teaching and Learning Methods (max. 1000 characters including assessment)</p> <ol style="list-style-type: none"> 1. – Lectures – theoretical exposition of the contents, using multimedia “PowerPoint” presentations, alternated with practical examples and interacting with students. 2. – Resolution by the Professor of exercise sheets after discussion with students about the solving methods to be used and doubts clarification. 3. – Lessons Tutorials – Resolution by students of exercise sheets with questions individually upon request preparation by students to seminars. 					

⁽¹⁾ Ensino teórico (T); Teórico-prático (TP); Prático e laboratorial (PL); Trabalho de campo (TC); Seminário (S); Orientação tutorial (OT); Trabalho individual do aluno (TA).

<p>Assessment</p> <ol style="list-style-type: none"> 1. –2 Single Test and/or Exam - 50% 2. – Participation in classes, final written Work, seminar (required) – 50% 3. – The student is approved when you have 10 or more rating values.
<p>Bibliography (max. 1000 characters)</p> <ol style="list-style-type: none"> 1. - Sheets published by the Department of Electrical Engineering (available in E-Tutoring). 2. - J. Pinto, “<i>Técnicas de automação</i>”, ISBN: 972-8480-07-5, ETEP, 2004. 3. - A. Francisco, “<i>Autómatos programáveis</i>”, ISBN: 972-8480-06-7, ETEP, 2003. 4. - P. Coiffet e M. Chirouze, “<i>Elementos de robótica</i>”, ISBN: 84-252-1287-1, Hermes publishing Ltd, 1982. 5. - H. Asama, T. Fukuda, T. Arai e I. Endo, “<i>Distributed autonomous robotic system</i>”, ISBN: 4-431-70147-8, Springer-Verlag Tokyo, 1994. 6. - M. Groover, M. Weiss, R. Nagel e N. Odrey, “<i>Industrial robotics</i>”, ISBN: 0-07-024989-X, McGraw-Hill, 1989. 7. - D. Piera, “<i>Como y cuándo aplicar un robot industrial</i>”, ISBN: 84-267-0682-7, MARCOMBO, 1988. 8. - J. Castellanos e J. Tardos, “<i>Mobile robot localization and map building</i>”, ISBN: 0-7923-7789-3, Kluwer Academic Publishers, 2000.
<p>Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)</p> <p>In this curriculum unit provide the students the theoretical and practical foundations that allow understanding and analyzing the movements of the robotic manipulators. Study the theoretical developments of kinematics of robots. Learn to plan and calculate the trajectories of the movements of the robotic handlers depending on the workspace. The classes are used DEEE ISE labs of UALG. Are also carried out all problems relating to the represented theory.</p>
<p>Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)</p> <p>In this curriculum unit students reach the objectives through the following methods:</p> <ul style="list-style-type: none"> -In lectures is made necessary theoretical contents exposure using the multimedia devices, which contain the approach to the study of the subjects of the curriculum unit. In these classes students take critical and objective analysis of the studied materials. -Tutorial lessons, accompanied by the teacher, the students are solved the problems. Also are provided the means of self-study that allow solving the problems proposed in individual form. In these classes is also carried out the study with the use of electronic means using the MATLAB program. <p>During the course the students carry out practical work, which are presented and discussed in the seminars. At the end of the curricular unit is carried out the test or examination that firm knowledge of students.</p>

⁽¹⁾ Ensino teórico (T); Teórico-prático (TP); Prático e laboratorial (PL); Trabalho de campo (TC); Seminário (S); Orientação tutorial (OT); Trabalho individual do aluno (TA).



Course Unit: Programmable Logic Controllers					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Energy Systems and Control Teaching Language(s): Portuguese Course Unit Chair: Ivo Manuel Valadas Marques Martins (immartin@ualg.pt) Teaching Staff: Ivo Manuel Valadas Marques Martins (Total lecturing load: 30T+15TP+35OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2 ^o	2 ^o	30T+15TP+35OT	Elective	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes <p>This course aims at approaching the aspects of industrial automation and its components and the integration and evolution of programmable logic controllers in automation systems. Students are supposed to learn the concepts related to the structure and functioning of programmable logic controllers and their programming languages. Students should be able to identify and solve combinatorial and sequential automatisms and able to design and implement automation systems based on programmable logic controllers. At the end of this course students should master the concepts relating to the operation, structure and programming of the LOGO! logic module and Twido programmable logic controller.</p>					
Prerequisites <p>Background knowledge in digital systems, Boolean algebra and electricity and electronics technologies.</p>					
Curriculum <p>Cap. 1: Industrial automation. Cap. 2: Introduction to Programming Logic Controllers. Cap. 3: Automation Methods. Cap. 4: LOGO! logic module. Cap. 5: Twido programmable logic controller.</p>					
Teaching and Learning Methods <p>Theoretical lectures of expository nature using slide presentation and practical examples on frame. Theoretical and practical lectures where theoretical concepts are complemented by discussing and presenting methods for solving practical examples. Tutorial lectures where students solve proposed problems and/or execute individual or group laboratory assignments under the teacher's supervision.</p>					
Assessment <p>Assessment is composed by two main components: theoretical (T) and practical (P). Theoretical component consists of 4 (four) written tests or 1 (one) written final exam. Practical component consists of 4 (four) group laboratory assignments and students lecture participation. Final grade = 0,4xT+0,6xP Theoretical grade = Mean of the written tests or written final exam grade Practical grade = 0,9x(mean of the group laboratory assignments)+0,1x(students lecture participation) Each assessment component has a minimum of 9,5 points. U.C. approval is obtained with a final grade equal or higher than 10 points.</p>					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Bibliography

- [1] Ivo Martins, "Roteiro Teórico da disciplina de Autómatos Programáveis".
- [2] Ivo Martins, "Roteiro Prático da disciplina de Autómatos Programáveis".
- [3] José Novais; "*Programação de Autómatos. Método Grafcet*"; Fundação Calouste Gulbenkian; 2ª edição.
- [4] Francisco, "*Autómatos programáveis*", ISBN: 972-8480-06-7, ETEP, 2003.
- [5] J. R. Caldas Pinto; "*Técnicas de Automação*"; ISBN: 972-8480-07-5, ETEP – Edições Técnicas Profissionais, 2004.
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- [11] Telemecanique; "Twido TwidoSoft Operation Guide Online Help".
- [12] Telemecanique; "Twido programmable controllers Software setup guide".

Demonstration of the syllabus coherence with the curricular unit's objectives

The syllabus covered in this UC aims to give students the ability to design and implement automation systems based on programmable logic controllers. The UC structure is organized so that the knowledge, skills and abilities to be developed by students allows them to complement their instruction in energy systems and control.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

Students achieve the objectives through the different proposed methodologies. In theoretical classes, theoretical knowledge is analysed and explained that, when complemented with theoretical and practical problems, enable the understanding of the background knowledge. In laboratory classes students learn to solve automation systems based on programmable logic controllers, programming the LOGO! logic module and Twido programmable logic controller.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Databases					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology Teaching Language(s): Portuguese Course Unit Chair: Pedro Jorge Sequeira Cardoso Teaching Staff: Pedro Jorge Sequeira Cardoso (Lecturing load: 15 T+ 30 TP+ 35 OT);					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3	1	15 T+ 30 TP+ 35 OT	Required	1524C1028	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) The main objectives are to present techniques for designing and developing database systems, tailored to the needs required by users and the objectives of management of organizations, considering the short, medium and long term. More specifically, it is intend to introduce the students to concepts that will: acquaint them to the basics of information management; allow them to recognize the importance of proper management of information; allow them to identify and solve practical problems by applying the concepts and techniques of relational databases and NoSQL; allow them to properly choose and use some of the more usual database management systems; acquaint them to the SQL programming language.					
Prerequisites N/A					
Curriculum (max. 1000 characters) <u>Relational Databases</u> I - Databases (BD) concepts 1 - Introduction to DB 2 - Database Management Systems (DBMS) Architecture ANSI / SPARC, the concept of transaction, DB systems vs. file system management, DB users, and DB languages 3 - Organization and Data Storage Hierarchy of memories, buffer management, access methods and file organization, clustering / de-clustering. II – DB Models 1 - 1st Generation a - Hierarchical network model 2 - 2nd Generation Relational model: concepts, standards, languages, relational language (SQL), processing and optimization issues. 3 - 3rd Generation Extensions of the relational model and the object-oriented model 4 - Distributed Databases Concepts, replication and data fragmentation. Heterogeneous DB. 5 - Performance and Scalability					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

__Introduction to non-relational databases__

1. History of non-relational databases on the Web
2. Categories
3. Examples of formats and data access.

Teaching and Learning Methods (max. 1000 characters including assessment)

- * Theoric Lectures: presentation and discussion of syllabus contents.
- * Practical Lectures: resolution and discussion of practical examples
- * Tutorial lessons: monitoring of students (individually or in groups) in the resolution of practical examples, and preparation of the practical assignment.

Assessment

The assessment has two components: Written test (WT) + Practical Work (PW). Both components are classified 0-20 values, with minimum rating of eight values each. The final score is the average of the grades of the written part, with the classification of practical work:

$$\text{Final grade} = (\text{WT} + \text{PW}) / 2$$

Bibliografia mais relevante (máx. 1000 caracteres)

- [1] J. Pereira, "Tecnologia de base de dados", FCA,
- [2] C. J. Date, "An Introduction to Database Systems", Vol I, 6ª edição, Addison Wesley Publishing Company, 1995.
- [3] Silberchatz, Korth, Sudarshan, "Database System Concepts", 5ª edição, McGraw Hill, 2005.
(<http://www.db-book.com>)
- [4] R. Ramakrishnan, J. Gehrke, "Database Management Systems", 3ª edição, McGraw Hill, 2002.
(<http://www.cs.wisc.edu/~dbbook>)
- [5] Plugge, E., Membrey, P., and Hawkins, T. The Definitive Guide to MongoDB: The NoSQL Database for Cloud and Desktop Computing. Apress, 2010.
- [6] Codd, E. F. A relational model of data for large shared data banks. Communications of the ACM, 13(6):377–387, 1970.
- [7] Damas, L. SQL.FCA, 2007.
- [8] Sumathi, S. and Esakkirajan, S. Fundamentals of Relational Database Management Systems. Springer, 2007

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

According to the course's program, students acquire the fundamental concepts related to the creation, maintenance and management of a database through the implementation of data models in face of the relational model and appropriate DBMS (MySQL + Openoffice base). Namely it is intended that the student can, before a concrete situation: propose appropriate solutions using conceptual modeling techniques (ER Diagram) and the relational model; propose appropriate software to satisfy the specificities of the problems (dimension, users, managers, etc..); can use SQL to query the database; can distinguish the advantages and disadvantages of the models client/server and objects oriented models; know to configure a DBMS (MySQL)

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodology of this Database course has an eminently practical aspect. Each week, in a reasoned manner, students are introduced to the theoretical concepts needed to solve the problems that arise in each phase, described below. These problems have two forms:

- * Problems proposed by the teacher - solved in practical and tutorials classes;
- * Practical Work (PW) - The PW is nuclear to the course, it is the unifying point a large percentage of the covered subjects. The theme of PW is proposed by students and validated by the teacher, being valued those that try to solve real problems, ie, proposed by external entities or persons. In more detail, students propose a theme, specifying the features and requirements. It follows the presentation of the conceptual model. This again is validated by the teacher according to with the original proposal. Students then move on to the normalized relational model which is followed by the interface

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

development (usually web, php + html). This is complemented with the administration of the DBMS used. Finally, the presentation of PW is made from the standpoint of a software "seller", followed by a product demonstration and the analysis of the implementation.

Therefore, and in accordance with the objectives, the student learns and uses techniques that allow the design and development of database systems, tailored to the needs required by users and the objectives of the organizations; works with concepts that allow them to be familiar with the fundamentals of information management; recognizes the importance of proper management of information; are able to identify and solve practical problems by applying the concepts and techniques of relational databases; works with one of the most widely used open source DBMS; and knows the fundamentals of the SQL programming language.

⁽¹⁾ Theoretical (**T**); Theoretical and practical (**TP**); Practical and laboratorial (**PL**); Field work (**TC**); Seminar (**S**); Tutorial (**OT**); Individual student work (**TA**).



Course Unit: Digital Communications					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications					
Teaching Language(s): Portuguese Course Unit Chair: Fernando Beirão Emídio (femidio@ualg.pt) Teaching Staff: Fernando Beirão Emídio (Lecturing load: 30 T+ 15 TP+ 35 OT);					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3	1	30 T+ 15 TP+ 35 OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes - Characterize and analyze baseband, bandpass and M-ary digital communication systems; - Characterize Public Data Networks, X.25, ISDN and SS7; - Learn spread spectrum and multiple access techniques; - Analyze the ATM and SDH hierarchy; - Characterize xDSL transmission technologies. It is also intended that students develop the ability to do group work as normal working methodology.					
Prerequisites Fundamentals of Telecommunications course unit.					
Curriculum 1- Baseband Modulation: PCM; TDM; DPCM and DM; PTM - PPM and PDM. 2- Bandpass Modulation: OOK /ASK; FSK; PSK; DPSK; BPSK; MSK. 3- M-ary Signaling: QPSK, 8PSK; QAM. 4. Spread Spectrum Systems and Multiple Access: Spread Spectrum techniques: Direct Sequencing (DS) and Fast Hopping (FH); Multiple Access: FDMA, TDMA, CDMA, SDMA). OFDM. 5- Public Data Networks: Basic Concepts; Data Communication Protocols; OSI reference model; X.25. 6- ISDN and SS7: Telecommunications networks; ISDN; Interfaces; Protocols; LAPB; HDLC; In-band and common-channel signalling (CCS); SS7. 7- ATM: ATM network basics; ATM reference model; ATM layer; Physical layer. 8- SDH: Protocol overview; SDH frames; Multiplexers. 9- xDSL Technology: Basic technology; DSL technologies.					
Teaching and Learning Methods Theoretical lectures of expository nature using slide presentation and practical examples on frame. Theoretical and practical lectures where theoretical concepts are complemented by discussing and presenting methods for solving practical examples. Tutorial lectures where students clarify their doubts, solve proposed problems and group laboratory assignments under the teacher's supervision.					
Assessment Assessment is composed by two main components: theoretical and practical. Theoretical component consists of two written tests ($\geq 8,0$ points in each test) and/or a written final exam (70% of the final grade). Practical component consists of laboratory assignments (30% of the final grade). U.C. approval is obtained with a final grade $\geq 9,5$ points.					
Bibliography [1] Theacher's CU material (Lectures' slides and proposed problems with solutions); [2] Bernard Sklar, Digital Communications, Prentice Hall, 2001; [3] Carlson, Crilly, Rutledge, Communications Systems, McGraw-Hill, 2002; [4] Research and Education Association Staff, Electronic Communications Problem Solver, 1993;					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

- [5] Timothy Ramteke , Networks, Prentice Hall, 1994;
- [6] Mário Serafim Nunes, Augusto J. Casaca, Redes Digitais com Integração de serviços, Ed. Presença, 1992;
- [7] Ken-ichi Sato, Advances in transport network technologies, Photonic Networks, ATM & SDH, Artech House, 1996;
- [8] Leybold, Digital Modulation Methods (manual);
- [9] Bellamy, Digital telephony, John Wiley & Sons, 1991;
- [10] John G. Proakis , Digital Communications, McGraw-Hill, 1995;
- [11] William L. Schweber , Data Communications, McGraw-Hill, 1988;
- [12] John G. Proakis, Masoud Salehi, Gerard Bauch, Contemporary Communication Systems using MATLAB AND Simulink, 2nd Edition, Brooks/Cole, 2004.

Demonstration of the syllabus coherence with the curricular unit's objectives

Students learn essential concepts, techniques and solutions used in information transmission in digital form. The T and TP teaching is accompanied by practical works executed during OT/PL that consolidate the theoretical knowledge acquired and develop technical, practical and also group work skills. In this sense, the syllabus covered in this UC are organized so that the acquired knowledge, skills and abilities enables students to attain the goals of the UC and complement their training in telecommunications in other UCs.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

The teaching methodology based on the exposition of fundamental theoretical concepts associated with expository learning exercises, allow students to learn and describe techniques and solutions used in information transmission on digital form described on the curricular unit's objectives. Practical work, under teacher guidance with results discussion and elaboration of reports, will consolidate the theoretical knowledge, ability to develop teamwork and self-evaluation of students' knowledge level. Practical work is carried out on the Telecommunications Laboratory with didactic equipment.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Automatic Control I					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Energy Systems and Control					
Teaching Language(s): Portuguese Course Unit Chair: Ana Beatriz Azevedo Teaching Staff: Ana Beatriz Azevedo (Lecturing load: 15T+30TP+70OT);					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2nd	2nd	15T+30TP+35OT	Required	1524C1049	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) This CU aims to develop the capacities of artificial systems of representation and use of simple techniques for analyzing compensation and Control Systems in the context of Control Classic. By the end of this CU, students should be able to: <ol style="list-style-type: none"> 1 - Describe the elements of a control system; 2 - Develop models of simple physical processes and represent them by transfer function and graphical forms (block diagram and/or signal flow graph); 3 - Apply methods of response analysis in time and frequency, collecting the most common measures of analysis and explain their relevance and physical meaning; 4 - Describe and perform the various steps involved in a control project; 5 - Describe the ideal compensators, stating advantages, disadvantages, privileged uses and considerations on their practical application; 6 - Using MATLAB to perform the relevant operations aforementioned. 					
Prerequisites Elementary knowledge of differential equations, of Kinematics and Dynamics, of Circuit Analysis and of Laplace transform. What translates into the need to have passed (or have attended seriously until the end) the following CUs: Physics II (mod1), Applied Mathematics for Electrical Engineering, and have had approval or being seriously attending Signals and Systems.					
Curriculum (max. 1000 characters) A - Introduction. Historical retrospective. B - Mathematical Models of Physical Systems. Electrical, mechanical and of level. C – Systems Representation. Transfer function, block diagrams and signal flow graphs. D - Characteristics of Control Systems. Stationary and transient response. Stability. E - Systems Analysis by Root Locus. F - Analysis of the Response Systems in Frequency. Bode diagram. Closed loop response. G - Compensation and Controllers. Controllers P, PI, PD and PID. Lead and lag compensators. Features, advantages and applications. Practical considerations for implementation. H - Design of Control Systems. I - The MATLAB simulation environment and its use (cross content introduced in parallel from					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

C to H)

Teaching and Learning Methods (max. 1000 characters including assessment)

T - Presentation of content, following the most appropriate approach (mathematical deduction and/or practical example and/or application);

TP - Practical exercises and/or simulations, after analyzing with the students the problem's statement, the methods to be used and clarifying any doubts;

OT - Practical exercises and simulations run by students individually, with clarification of any doubts.

Assessment

Theoretical component: two written tests (45%); practical component: two tests in MATLAB (40%) and continuous component: exercises and simulations in OT and TPCs (15%).

Exam (85%) with separate parts.

To be excused from examination is necessary to obtain an average of 10 out of 20 (minimum score of 8.0 in each test); can also be partially excused (minimum score of 9.5) in which case a student can only take the other component.

The student is approved if they obtain a total score of at least 10 out of 20.

Bibliography (max. 1000 characters)

[1] Class notes and problem worksheets, available in the course site on Moodle.

[2] Nise, Norman S. – **Control Systems Engineering**. 5th ed. S.l.: John Wiley & Sons, 2008
Student companion site:

<http://bcs.wiley.com/he-bcs/Books?action=index&itemId=0471794759&bcsId=4135>

[3] Golnaraghi, Farid e B.C. Kuo – **Automatic Control Systems**. 9th ed. S.l.: John Wiley & Sons, 2010

Student companion site:

<http://bcs.wiley.com/he-bcs/Books?action=index&bcsId=4692&itemId=0470048964>

[4] Philips, C.L. R.D. Harbor. **Feedback Control Systems**. 4th ed. New Jersey: Prentice Hall, 2000.

[5] D'Azzo, J.J. C.M. Houpis. **Linear Control Systems Analysis and Design**. 2nd ed. [s.l]: McGraw-Hill, 1981

[6] D'Azzo, J.J. C.M. Houpis. **Análise e Projeto de Sistemas de Controle Lineares**. 2^a ed. Traduzido por Bernardo Silva Filho. Rio de Janeiro: Editora Guanabara, 1984.

[7] Ogata, K. - **Engenharia do Controle Moderno**. 3^a ed. São Paulo: Prentice-Hall, 2003

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The content A is intended to achieve the objective 1, but beyond that aims to familiarize the student with the historical and scientific use of Automatic Control, as well as their uses in day-to-day. It mainly serves to generate a climate of integration with the real and palpable, and get early rid of the idea that this is “another CU full of math and boring stuff”.

The contents B and C cover the objective 2; contents D, E and F, the objective 3; and content G, the goal 4.

The objectives 5 and 6 are transverse and parallel to the other and as such are developed as the same time as the others; and are expressly described and substantiated by the contents H and I.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

As stated above, content A is intended to achieve the objective 1, but beyond that aims to familiarize the student with the historical context of Automatic Control, as well as their uses in

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

day-to-day; as such, it deals with examples from history and from everyday items as an air conditioner or a toilet flush.

For goal 2, it is started by reviewing knowledge already acquired in CUs of Physics and Applied Mathematics for Electrical Engineering. Then, working within a framework that embarks all types of systems, making it possible to analyze electrical, mechanical and level systems using basic laws of electricity. Students are alerted for the limitations of models, to raise their consciousness of the precautions to take when trying to represent a physical system by a linear model.

For goals 3-5, key concepts are presented in T-classes, where definitions, deductions and presentation of conventions, are accompanied with practical examples, contextualization of conventions, the connection of methods with mathematical principles needed for understanding and usage, etymological considerations and/or on historical settings. In addition, contents are identified either as terminal, or as to be expanded and developed in subsequent CUs, to try to solve the closed vision of some students. The methods are tested and developed in TP-classes in group work or individually through homework and in OT-classes. This group of objectives is assessed in two written tests (where the dimensions of knowing, understanding and evaluating are measured). The goal 6 is developed in parallel with 3 to 5 and are all evaluated in two tests of simulation in MATLAB (where measures of the dimensions apply, analyze and synthesize are made).

In addition, and for the expansion of a transdisciplinary panoramic and connection to society, students participate in seminars, and in the past school year participated in an action on the standard on switchboards IEC 61439-1 (with Siemens) and another on protection of persons (with the company Schneider).

The evaluation of workload associated with each activity is done informally, by witnessing the time spent on the platform Moodle and on the completion of homework; and it is expected to implement this school year certification mechanisms through weekly surveys on the Moodle platform.

The realization of four tests, with the possibility of being excused from a part of the exam, serves to create a climate where continuous assessment is strengthened.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Automatic Control II					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Energy Systems and Control Teaching Language: Portuguese Course Unit Chair: Ana Beatriz Azevedo Teaching Staff: Ana Beatriz Azevedo (Lecturing load: 15T+30TP+16PL+54OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3rd	1st	15T+30TP+8PL+27OT	Required	1524C1032	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 53 Tutorials: 27 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) This CU aims to complement the knowledge acquired within the CU Automatic Control I, extending it to newer areas of control. At the end of this CU, students should be able to: 1-Employ, in a critical manner, strategies to tune real PID controllers; 2-Identify and characterize the linear range of sensors and actuators; 3-Make reports on the laboratorial work performed respecting the rules relating to the form, writing correctly and fluently, and with considerations and reflections on the results observed; 4-Describe the principles and advantages of the representation of processes using state variables (s.v.); 5-Represent processes using s.v. and analyze them in terms of response, stability, controllability and observability; 6-Design compensators and observers; 7-Use MATLAB to perform the relevant operations aforementioned; 8-Enunciate modern control techniques; 9-Use a catalog to choose suitable controllers, sensors and actuators.					
Prerequisites When starting the course, students should be able to: A - Describe the elements of a control system; B - Develop models of simple physical processes and represent them by transfer function and graphical forms (block diagram and / or signal flow graph); C - Apply methods of response analysis in time and frequency, collecting the most common measures of analysis and explain their relevance and physical meaning; D - Describe and perform the various steps involved in a control project; E - Describe the ideal compensators, stating advantages, disadvantages, favored uses and considerations on their practical application; F - Use MATLAB to perform the relevant operations referred to in the preceding points.					
Curriculum (max. 1000 characters) I - Complements of Classic Control Identification. Linearization. Design of controllers. II - Control Modern: State-space representation. Description of physical systems and state variables. Solution of the state equation. Relationship between the transfer function and the state equation. Canonical forms.					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

<p>Stability, controllability and observability. Observers. State-feedback compensation. III - Introduction to Digital Control and others (Adaptive, Nonlinear, Intelligent, etc..). Commercial Systems.</p>
<p>Teaching and Learning Methods (max. 1000 characters including assessment)</p> <p>T - Presentation of content, following the most appropriate approach (mathematical deduction and/or practical example and/or application);</p> <p>TP - Practical exercises and/or simulations, after analyzing with the students the problem's statement, the methods to be used and clarifying any doubts;</p> <p>PL - Conducting laboratory experiments and/or simulations, under the guidance of the teacher;</p> <p>OT - Practical exercises and simulations run by students individually, with clarification of any doubts.</p>
<p>Assessment</p> <p>Theoretical component: a written test (minimum score 7.5 out of 20) or examination (50%); practical component (mandatory and minimum grade of 9.5/20 per element): three laboratory experiments with a written report and presentation (20%) and two simulations in MATLAB/Simulink with presentation (15%); continuous component: exercises and simulations in OT and / or homework (15%).</p> <p>The student passes if that obtain an average score of at least 10 out of 20.</p>
<p>Bibliography (max. 1000 characters)</p> <p>[1] Class notes and problem worksheets, available in the course site on Moodle.</p> <p>[2] Friedland, B. - Control System Design: An Introduction to State-Space Methods. New York: McGraw-Hill, 1987.</p> <p>[3] Golnaraghi, Farid e B.C. Kuo – Automatic Control Systems. 9th ed. S.I.: John Wiley & Sons, 2010 Student companion site: http://bcs.wiley.com/he-bcs/Books?action=index&bcsId=4692&itemId=0470048964</p> <p>[4] Nise, Norman S. – Control Systems Engineering. 5th ed. S.I.: John Wiley & Sons, 2008 Student companion site: http://bcs.wiley.com/he-bcs/Books?action=index&itemId=0471794759&bcsId=4135</p> <p>[5] Phillips, Charles L. e H. Troy Nagle, Digital Control Systems Analysis and Design. 2nd ed. New Jersey: Prentice-Hall, 1990.</p> <p>[6] Ogata, K. – Modern Control Engineering. 4th ed. Upper Saddle River: Prentice – Hall, 2002</p> <p>[7] Ogata, K. - Engenharia do Controle Moderno. 3^a ed. São Paulo: Prentice-Hall, 2003</p>
<p>Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)</p> <p>The contents of the module I are as the name indicates the completion hands-on of content studied at CU Automatic Control I and aims to develop the goals 1, 2 and 3. The contents of the module II aim to develop the capacities mentioned in goals 4-7.</p> <p>The contents of the module III, which are listed in a more open faction, seek to achieve the objectives 8 and 9.</p>
<p>Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)</p> <p>Since this is a continuation of other CUs, the classes start with revisions using several strategies: questioning the students in the classroom, publishing summarized notes with reformulation of content for hands-on usage and educational games available through the Moodle platform.</p> <p>The goals 1-3 start being worked on PL-classes, where one tries to develop a familiarity regarding the use of equipment and the taking of measurements. Students follow scripts that include procedures and precautions, also calls attention to aspects to observe, and to reflections on the results. Here the teacher observes and corrects improper behaviors and/or group dynamics, supports best practices and clarifies any doubt that may arise. The consolidation of these goals is made through the group report that must be delivered in at least two versions, so students have a chance to correct and learn from the execution itself.</p>

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

For 4-7 goals, key concepts are presented in T-classes, where in addition to definitions, deductions and presentation of conventions, is accompanied with practical examples and usage, contextualization conventions, connection methods to mathematical principles needed for understand and to use, and etymological considerations and/or on historical settings. In addition, contents are identified either as terminal, or as to be expanded and developed in further degrees. Methods are tested in TP-classes and developed group or individually through homework and in OT-classes. This group of objectives is assessed in a written test (which measures the dimensions of knowing, understanding and evaluating) and a simulation work (where the dimensions of applying, analyzing and synthesizing are assessed).

To the objectives 8 and 9, the methodology used is more in line with problem-based learning, where notes and other resources are made available and students should explore individually and in groups to conduct a simulation study, which assertion is made in a guided learning style. In addition, and for the expansion of a trans disciplinary panoramic and connection to society, students participate in seminars, and this school year have already participated in an action on Power Quality (with the company QEnergia) and being another one scheduled on control applications and automation for aquaculture (with the company Itelmatis).

The evaluation of the workload associated with each activity is done informally, by observing the time used in preparing the report, simulation assignments and homework; and casually, by questioning the students.

⁽¹⁾ Theoretical (**T**); Theoretical and practical (**TP**); Practical and laboratorial (**PL**); Field work (**TC**); Seminar (**S**); Tutorial (**OT**); Individual student work (**TA**).



Course Unit: Digital Control					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Energy Systems and Control Teaching Language(s): Portuguese Course Unit Chair: Cristiano Lourenço Cabrita Teaching Staff: <i>Cristiano Lourenço Cabrita</i> (Lecturing load: 30 T+ 15 PL+ 35 OT);					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3	2	30T+15PL+35OT	Elective	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) This course aims to develop the knowledge needed for the analysis of discrete time systems and implementation of digital controllers. At the end of the course students should be able to recognize sampled systems and digital systems. They must also be able to represent the functional block diagram of a digital system and must learn to apply the techniques of digital control for discrete systems compensation.					
Prerequisites Knowledge representation of discrete systems in the field. Representation of systems through state variables. Knowledge of Matlab.					
Curriculum (max. 1000 characters) 1. Introduction. System from the point of view of the computer. 2. Analysis of discrete dynamical systems. Discrete transfer function for systems without time delay. State space representation of systems without time delay. Discrete transfer function for systems with time delay. State space representation of systems with time delay. Mapping of Poles in s to z poles. Step response. Stability. Controllability, Observability and observers. 3. Sampled Systems. Introduction. Analysis of an Analog-Digital Converter. Digital systems feedback analysis. Block diagram and signal flow. 4. Discrete Equivalents of continuous representations. Discrete equivalent of transfer functions, numerical integration. Equivalent discrete state space representations by numerical integration. 5. Analysis and compensation of discrete systems. Specifications in the time domain and frequency. Controllers.					
Teaching and Learning Methods (max. 1000 characters including assessment) 30 (T) hours of lectures in order to expose the matter. 15 hours for exercise proposed resolution related to theoretical matters. 35 hours of tutoring lessons where we clarify questions and develop digital control systems simulated in Matlab/Simulink and implemented using DSPs in conjunction with Development Kits. Tutoring classes serve also to follow in carrying out evaluation work undertaken by groups of 2 elements.					
Assessment Evaluation consists of 2 components:					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

- Practical works.

- 2 Tests of theoretical evaluation or, in alternative, a theoretical examination.

Final Grade: $0.3 * \text{Practice} + 0.7 * \text{Theoretical Classification}$

Each of the components of evaluation (practical and Theoretical Classification) have a minimum rating of 8 out of 20 marks. Remark: The student is approved if the Final Grade is greater than 10 marks.

Bibliography (max. 1000 characters)

[1] Phillips, Charles L. e H. Troy Nagle, **Digital Control Systems Analysis and Design**, Prentice-Hall

[2] Aström, K.J. e B. Wittenmark, **Computer - Controlled Systems – Theory and Design**, Prentice-Hall

[3] Leigh, J.R., **Applied Digital Control**, 2^a ed., Prentice Hall, Herfordshire, UK, 1992

[4] Kuo, Benjamim C., **Automatic Control Systems**, Prentice-Hall

[5] Phillips, Charles L. e Harbor, Royce D., **Feedback Control Systems Fourth edition**, Prentice-Hall

[6] Shahian, B. e Hassul, M., **Control System design using MATLAB®**, Prentice-Hall

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The syllabus of this course are the continuation of the study of control systems, although from the point of view of discrete systems. As such, it begins by introducing the systems from the computer point of view focusing on the need for continuous time discretization. It introduces the concepts of transfer functions and state space representation for discrete systems that are essential for the student to understand the concepts such as stability, controllability and observability of discrete system. The concepts are then extended to feedback sampled time systems where students get to develop block diagrams and signal flow diagrams. This phase introduces various types of discrete controllers based on its continuous counterparts. Finally, we discuss the control of discrete systems through feedback using state variables, and some typical drivers for discrete control systems.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

Due to the total charge which consists of 80 hours total attendance overall, it was considered that the distribution of classes should follow the following model: 30T+15TP+35OT. Theoretical lectures do not only serve for exhibiting contents but also pose as a way for presenting examples when appropriate. As each chapter covers topics that require practice, 1.5 hours each week (lessons) are dedicated to the explanation and resolution of problems. To complement the classes T and TP, classes OT intend to consolidate the knowledge betting for this in: exercise resolution classes where students are accompanied during the resolution of proposed exercises; MatlabSimulink simulation lessons where you visualize and analyze actual simulated cases; lessons for practical work in the laboratory environment using DSPs in conjunction with Development Kits used for digital signal processing.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Electrical Engineering Design					
Department: Electrical Engineering Department Programme: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialisation in: Information Technology and Telecommunications / Energy Systems and Control Teaching Language(s): Portuguese Course Unit Chair: Mário Duarte Gonçalves Henrique Silva (mdsilva@ualg.pt) Teaching Staff: Mário Duarte Gonçalves Henrique Silva (15T+30TP+35OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
1 st	1 nd	15T+30TP+35OT	Required		5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes Develop skills to analyse, represent and solve electrical problems, using graphical methods. Develop skills of sketching fluidly, drawing accurately and use general and dedicated computer aided design.					
Prerequisites None.					
Curriculum <ol style="list-style-type: none"> 1. Drawing board techniques; start using autocad 2D; use some computer applications on electrical panels and networks. 2. Orthogonal and oblique projections; views and perspectives. 3. Building electrical [RTIEBT] and telecommunications [ITED2] installations. 4. Collective and individual networks; cabinets, boxes, tubes, cables, control and protection equipment; symbology and dimensioning; multiline and uniline representations. 					

⁽¹⁾ Lectures (T); Seminars/Problem-solving classes (TP); Practical and laboratorial classes (PL); Fieldwork (TC); Workshops (S); Tutorials (OT); Students Individual Work (TA).

Teaching and Learning Methods

T – Lectures, using exposition, explanation, examples on board, and projection of slides.
TP – Seminars, where are proposed works to be developed on class, sponsored by the teacher.
OT - Tutorials, where individual assignments are proposed under teacher's guidance.

Assessment

A set of assignments to be developed by the students on drawing board [TE] and using autocad [TA], under teacher's guidance/supervision. One test [TF] at the end of the semester, weighting 34%, or a final examination [EF], weighting 50%.

Final Grade = 33% TE + 33% TA + 34% TF, or

Final Grade = 25% TE + 25% TA + 50% EF

Students fulfil minimum passing requirements if one of the previous formulas reaches 9,5 out of 20. If a student has already fulfilled the minimum passing requirements and wants to improve their grade, only a final examination is required, and the final grade can be the examination grade.

Bibliography

- [1] Lectures' slides
- [2] Summary tables and dimensioning grills attached to the works
- [3] Manufacturers Catalogs
- [4] Electrical and Telecommunications projects
- [5] Desenho Técnico, L. Veiga da Cunha, Fundação Calouste Gulbenkian
- [6] Desenho Técnico Básico, Simões Morais, Volume 3
- [7] Regras Técnicas de Instalações Eléctricas de Baixa Tensão [RTIEBT]
- [8] Normas e Simbologia Electrotécnica. Normas Portuguesas [NP]
- [9] Manual ITED 2ª Edição
- [10] AUTOCAD – The Complete Reference, Nelson Johnson, McGraw-Hill

Demonstration of the syllabus coherence with the curricular unit's objectives

After presentation of the resources, knowledge, techniques and legislation, the student develops always work under supervision, but with increasing autonomy and initiative, culminating in the final work with minimal influence of the teacher.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

It's proposed a coherent and progressive set of practical works, presented in detail in previous lectures, after the introduction and development of needed material, accompanied by illustrations and stimulus set.

⁽¹⁾ Lectures (**T**); Seminars/Problem-solving classes (**TP**); Practical and laboratorial classes (**PL**); Fieldwork (**TC**); Workshops (**S**); Tutorials (**OT**); Students Individual Work (**TA**).



Course Unit: Multimedia Applications Development					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications Teaching Language(s): Portuguese Course Unit Chair: Roberto Célio Lau Lam (rlam@ualg.pt) Teaching Staff: Roberto Lam (Lecturing load: 15 T+ 30 TP+ 35 OT);					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3	2	140	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) Objectives: To make students aware of, a) architecture, protocols, languages and meta-languages for authoring, deployment, maintenance and dissemination of information on the web, b) multimedia services and applications distributed over the Internet. Skills: a) describe the architectures of the main platforms to support applications for broadcasting multimedia content on the web and b) designing, programming, debugging and installing distributed applications on the Web (information systems, video and audio).					
Prerequisites Programming; Data Structures and Algorithms; Databases and Data Networks					
Curriculum (max. 1000 characters) 1. Overview of the web, web services; 2. Study of: HTML, CSS, Javascript and XML; 3. Programming in PHP 4. Use of DBMS application development for web; 5. Topics on Information Systems					
Teaching and Learning Methods (max. 1000 characters including assessment) The lectures and practical classes will have a small theoretical exposition of content, presentation of real cases. At the end of the theoretical-practical classes, case studies are presented with problems to solve. The tutorials will focus on problem solving as well as support offered to students who have disabilities. The electronic platform of UAlg will be used with the following objectives: a) Publication of resources for practical classes, b) Publication of assessments; c) Publication of notices; d) creating a space for communication (discussion forum) to clarify questions and stimulate communication between teacher/students and students/students.					
Assessment Test / written examination (50% final) and presentation of practical work done on schedule (50% final). To be approved the students must obtain at least seven points (in a scale of 0;20) in the test / exam and at least 7 points (in a scale of 0;20) the component of the programming work. Final grade = 50% test /					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

exam + 50% programming work.

Bibliography (max. 1000 characters)

Coelho, P., XML A nova linguagem da WEB, Lidel-Edições Técnicas, Lda.

Tittel, E., XML, Teoria e problemas, Coleção Schaum BookMan.

Gundavaram, S., CGI programming, O' Reilly & Associates, Inc.

Graham, I. S., HTML Source Book third edition, John Wiley & Sons, Inc.

Wyke, R. A., Rehmam S. e Leupen B., XML Programming, Microsoft Press.

Sturm, J., Developing XML Solutions, Microsoft Press.

MySQL Reference Manual

Manual PHP

H.264 and MPEG-4 Video Compression: Video Coding for Next Generation Multimedia, Iain E. G.

Richardson, Iain E. G. Richardson. John Wiley & Sons Ltd.

C. Perkins, RTP: Audio and Video for the Internet. Addison Wesley.

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The course content allows students to grasp knowledge about: architecture, protocols, languages and technologies for the broadcast content on the web. The themes number 1, 2 and 3 will give the knowledge on protocols and languages of the web. The remains subjects will provide the lore for broadcast contents on web. Given that the teaching methodology used is a mixture between the expositive method and fundamental of PBL, the case studies that served as a "case study" on different syllabuses allowed the students to gain skills for the design, programming and installation of distributed applications on the Web.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodology will be a mix of classic: direct, expository and fundamental methodology of Problem Based Learning (PBL). After lecturing the subject, problems and questions are presented to be answered in group analysis, serving the needs of solving problems, being student-centered and assuming the diversity of personal learning. At each point of the objectives, after lecturing, will be presented a case (problem) that constitutes the catalytic to the process of learning by students. Students meet the objectives proposed above, by working on problems, which will have to use data structures and routines.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Domotics					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Energy Systems and Control					
Teaching Language(s): Portuguese Course Unit Chair: Ivo Manuel Valadas Marques Martins (immartin@ualg.pt) Teaching Staff: Ivo Manuel Valadas Marques Martins (Total lecturing load: 15TP+30PL)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 ^o	2 ^o	15TP+30PL	Elective	--	5
Workload (hours): 110 <div style="text-align: right;"> Classes: 45 Tutorials: 0 Fieldwork: 0 Individual Work and Assessment: 65 </div>					
Learning Outcomes This course aims at approaching the aspects of home automation and intelligent buildings and the integration and evolution of home automation systems in buildings. Students are supposed to learn the concepts related to the structure and functioning of home automation systems and concepts related to the KNX system. Students should be able to plan, design and commissioning KNX installations and able to identify and use KNX system devices. At the end of this course students should be able to design projects in ETS environment.					
Prerequisites Background knowledge in digital systems, Boolean algebra and electricity and electronics technologies.					
Curriculum Cap. 1: Introduction to home automation and intelligent buildings Cap. 2: KNX system <ul style="list-style-type: none"> - System arguments - Communication - Topology - Telegram - Bus devices - TP1 installation Cap. 3: ETS software <ul style="list-style-type: none"> - Project design - Commissioning - Diagnostics 					
Teaching and Learning Methods Theoretical and practical lectures of expository nature using slide presentation and practical examples on frame, complemented by discussing and presenting methods for solving practical examples. Practical and laboratorial lectures where students solve proposed problems and/or execute individual or group laboratory assignments under the teacher's supervision.					
Assessment Assessment is composed by two main components: theoretical (T) and practical (P). Theoretical component consists of 1 (one) written test or 1 (one) written final exam. Practical component consists of 1 (one) group laboratory assignment and students lecture participation. Final grade = 0,6xT+0,4xP Theoretical grade = Written test grade or written final exam grade					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Practical grade = 0,9x(group laboratory assignment)+0,1x(students lecture participation)
Each assessment component has a minimum of 9,5 points.
U.C. approval is obtained with a final grade equal or higher than 10 points.

Bibliography

- [1] KNX Association; "KNX Handbook for Home and Building Control – Basic Principles"; ZVEI; 2006.
- [2] KNX Association; "KNX Basic Course Documentation"; ZVEI; 2006.
- [3] Alexandre Chamusca; "Domótica & Segurança Electrónica – A inteligência que se instala"; Ordem dos Engenheiros / Ingenium Edições, Lda; 2006.

Demonstration of the syllabus coherence with the curricular unit's objectives

The syllabus covered in this UC aims to give students the ability to plan, design and commissioning KNX installations in ETS environment. The UC structure is organized so that the knowledge, skills and abilities to be developed by students allows them to complement their instruction in energy systems and control.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

Students achieve the objectives through the different proposed methodologies. In theoretical and practical classes, theoretical knowledge is analysed and explained that, when complemented with theoretical and practical problems, enable the understanding of the background knowledge. In laboratory classes students learn to design KNX installations using ETS software.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Electromagnetism					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications / Energy Systems and Control Teaching Language(s): Portuguese Course Unit Chair: José Manuel Guerreiro Gonçalves (jgoncal@ualg.pt) Teaching Staff: Fernando Beirão Emídio (Lecturing load: 30 T + 15 TP + 30 OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2 nd	1 st	30 T+15 TP+35 OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes 1. Understand the main laws related to electromagnetism. 2. Identify analogies between electromagnetics and mechanics. 3. Apply acquired knowledge in the analysis and study of various fields of electrical engineering, including production and transmission of electrical energy, electrical networks, motive power, electronics, telecommunications, and other areas of electrical engineering.					
Prerequisites Knowledge of Mathematics I and II, Linear Algebra and Analytic Geometry, and Circuits Analysis I.					
Curriculum 1. Electrostatics. Coulomb's law and field intensity. Difference of potential between two points. Gauss's theorem. Electric flux density (4 th Maxwell's eq.). Energy density in electrostatic fields. 2. Conductors, dielectrics and capacitors. Electric dipole. Polarization in dielectrics. Boundary conditions. Association of capacitors. 3. Electrodynamics. Notion of Ohm's law in a point. Continuity equation. Joule's law. Kirchoff's laws. Association of resistances. 4. Electromagnetics. Magnetostatic fields. Gauss's law (3 rd Maxwell's eq.). Effect of a magnetic field on a current. Laws of Biot-Savart and of Ampere (1 st Maxwell's eq.). 5. Magnetic forces. Materials, coils and inductances. Magnetic circuits. Electromagnetic torque. Force between two conductors. Association of inductances. Energy stored in the magnetic field. Hopkinson's law. Magnetic dipole. 6. Electromagnetic induction. Induced electromotive force. Faraday's law (2 nd Maxwell's eq.). Lenz's law.					
Teaching and Learning Methods -Theoretical classes: formal exposition of the matter and, where possible, accompanied by illustrative examples. -Theoretical and practical classes: exercises selected and performed by the teacher. -Tutorial guidance: resolution of exercises and development work. Answering questions individually or collectively.					
Assessment 1- Continuous assessment: 2 written tests + 1 written report. •The students will be exempted from written examination. All students who obtain the following requirements: -average of 2 tests (CT) $\geq 50\%$, none of which will be less than 40%; -written report (Ct) $\geq 50\%$. For approval in this UC, the final result Cf shouldn't be less than 50%, and it is given by: $Cf = (3 \times CT + Ct) / 4.$					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

2 - Written exam: All students who obtain a final result $C_f < 50\%$, may be subject to examination. The new requirements for approval in the UC are:
Final Rating $C_f = (3 \times CE + Ct)/4$, where CE - examination classification, considering approved if $C_f \geq 50\%$.

Bibliography

- [1] Mathew N.D. Sadiku, "Elements of Electromagnetics", 2nd Ed, Saunders College Publishing, USA, ISBN: 0 - 03 - 098981-7, 1994.
- [2] Mathew N.D. Sadiku, "Solutions Manual for Elements of Electromagnetics", 2nd Ed., Saunders College Publishing, USA, ISBN: 0 - 03 - 094948-3, 1994.
- [3] John D. Kraus, "Electromagnetics", McGraw-Hill International Editions, Electrical Engineering Series, 4th Ed, Singapore, ISBN: 0 - 07-112666 - X, 1992.
- [4] L. Bessonov, "Applied Electricity for Engineers", in Portuguese, 1st Ed, Publisher Lopes da Silva, Porto, 1976.

Demonstration of the syllabus coherence with the curricular unit's objectives

In relation to the objectives that require an increase of theoretical knowledge, the program of this course includes the above mentioned objectives in a way practically always positive. In terms of knowledge relating to this course unit, it is intended an in-depth knowledge of Electrostatics, Electromagnetics and Electrodynamics.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

The students must achieve the objectives through the several proposed teaching methodologies. In the Theoretical lectures the knowledge required to achieve the support knowledge is analyzed and explained and supplemented by exercises in T/P classes. In Tutoring classes problems and means of self-study that allow to solve the problems related to the Electromagnetism are provided to students. At the end of this UC the students should be able to know notions of Electrostatics, Electrodynamics and Electromagnetics, that are fundamental for courses of Specialization in Information Technology and Telecommunications, and Energy Systems and Control, of Electrical and Electronics Engineering.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: ELECTRONICS I

Department: Electrical Engineering Department

Program: 1st Cycle in Electrical and Electronics Engineering

Scientific Area: Electrical Engineering

Specialization in: Information Technology and Telecommunications / Energy Systems and Control

Teaching Language(s): Portuguese

Course Unit Chair: *Mário Rui Gil Saraiva*

Teaching Staff: *Mário Rui Gil Saraiva* (Lecturing load: 45 T+ 30 TP+ 60 OT); *Celestino Virtudes Dias Martins* (Total lecturing load: 60 OT)

Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2	1	30 T + 15 TP + 35 OT	Required	15241014 + 15241042	5

Workload (hours): 140

Classes: 45

Tutorials: 35

Fieldwork: 0

Individual Work and Assessment: 60

Learning Outcomes (max. 1000 characters)

The student at the end of the course should understand the operation of the junction diode. The student must be able to analyze circuits with diodes, and in particular, clippers circuits, clampers, peak detectors, voltage multipliers, zener diode voltage regulators, voltage rectifiers. The student must understand the operation of bipolar junction transistor and the field effect transistor, in particular, the JFET, the D_MOSFET and the E_MOSFET. The student must be able to analyze circuits with bipolar transistors or/and field effect transistors, types. The student must know the biasing techniques used with these transistors as well as their advantages and limitations. The student should understand and be able to analyze the response sensitivity of a circuit with respect to variations of the parameters of its components.

Prerequisites

Contents acquired in the courses of Circuit Analysis I and Circuit Analysis II

Curriculum (max. 1000 characters)

1. Study of the junction diode and its properties - transfer curve i-v, exponential equations of operation, temperature effects, linear models
2. Analysis of circuits with diodes - limiters, clampers, peak detectors, voltage multipliers, shunt voltage regulators with zener diode, half wave and full wave rectifiers with a filter capacitor
3. Study of the bipolar transistors (BJT) and the field effect transistors types (JFET), (D-MOSFET) and (E-MOSFET). Introduction to the operation of these transistors, operating zones, transfer curves, operating equations and models. Analysis of circuits containing bipolar transistors and/or field effect transistors. The transistor as an amplifier and as a switch
4. Different techniques for biasing the BJT and FET transistors, their advantages and shortcomings
5. Study of the response sensitivity of a circuit as a result of variations in the parameters of its components

Teaching and Learning Methods (max. 1000 characters including assessment)

- T classes– 2 hours. Theoretical concepts are presented using the board and the data projector).
- TP classes– 1 hour. Sets of analytical problems are presented and solved on the board. All student questions submitted are answered.
- OT classes– 2 hours tutoring class. In some classes, sets of problems and quizzes are presented and solved with the help of the teacher when necessary. The remaining classes are spent in the lab. There are circuits to be assembled, tested, and a number of questions to be answered regarding its operation.
- Private tutoring– 2 hours in the teacher's office for students with special needs.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Assessment

The final assessment has 2 components: a theoretical component for T and TP assessment, and a laboratory component for the laboratorial work assessment.

2 Tests or/and a Final Exam for the theoretical component and a score for the lab component.

It is necessary a score of more than 45% in each of the 2 components

Final score: $N=80\% \times (\text{Test average or Final Exam}) + 20\% \times (\text{Lab})$.

Bibliography (max. 1000 characters)

[1] "Handouts" – Mário Saraiva

[2] "Microelectronic Circuits" - A. Sedra e K. Smith - Editora Saunders College Publishing

[3] "Electronic Devices and Circuit Theory" - R. Boylestad e L. Nashelsky - Prentice-Hall

[4] "Electronics – A top down approach to computer aided circuit design – Allan Hambley – Prentice Hall

[5] "Engineering Electronics: a practical approach" – Roberto Mauro

[6] "Additional Problems with Solutions: A Supplement to Microelectronic Circuits", Third Edition, Adel S. Sedra / Kenneth C. Smith, Oxford University Press.

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The syllabus is organized according to the objectives of a first course in the area of electronics. It begins by presenting the simplest electronic device, the diode, and then, the bipolar transistors and the field effect transistor. Each time a new device is introduced it will be applied the following methodology. First, the device is presented, explaining how it works and its operating properties. Then, a number of fundamental circuits of increasing complexity based on that device are described and their operation studied. Also, a detailed analysis of the circuit and a comparison with similar circuits is done. The syllabus includes a practical demonstration and testing in the laboratory of the subjects taught. The methodology employed provides the student with a comprehensive theoretical and practical knowledge of the field, in a step by step fashion, so that the objectives of the syllabus are fully met.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodology employs 3 strands that complement each other - a theoretical (T) strand, a theoretical-practical (TP) strand and a practical (P) strand.

The (T) strand introduces the concepts, the electronic devices, the typical circuits that incorporate them, as well as the function that these circuits perform. Next, the circuits are analyzed and their performance is compared to the performance of similar circuits, in order to identify the advantages and limitations of each one of them.

The (TP) strand uses the theoretical concepts to solve a set of problems and quizzes. At this stage, the problems are solved by the teacher to show how analytical techniques can be used.

The (P) strand is divided in 2 parts. In the first part, sets of exercises and problems are presented to the students, and some of them are solved in the classroom with the help of the teacher, when needed. The remaining exercises are intended to be solved by students, at home, to help them develop their skills.

Any difficulty will be answered by the teacher in the TP class, or privately. The second part of the (P) strand is done in a laboratory environment. Some circuits that were taught in the T classes are assembled, tested and its performance analyzed. The idea is to introduce the students to a lab environment where they can verify experimentally the concepts that were presented and analyzed in the (T) and (TP) strands.

These 3 different strands, which complement each other, are designed to show the student different ways of looking at the same subject - a theoretical, an analytical and an experimental approach. This method is employed to help the student better understand the subjects taught in the T classes.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Electronics II					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications					
Teaching Language(s): Portuguese Course Unit Chair: <i>Mário Rui Gil Saraiva</i> Teaching Staff: <i>Mário Rui Gil Saraiva</i> (Lecturing load: 30 T+ 15 TP+ 30 OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2	2	30 T + 15 TP + 35 OT	Required	15241020	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) At the end of the course the student should have acquired the concepts of amplification, amplifiers and frequency response of amplifiers. The student must know the operational amplifier (opamp), its operation and its practical limitations. The student must be able to analyze circuits that incorporate opamps and opamps and diodes, and must be to analyze voltage comparators. The student must be able to analyze amplifiers circuits with one or more bipolar transistors and/or FET. The student must know some common amplifier configurations, including Darlington amplifiers, differential and cascode. The student must be able to determine the amplifier response at low, mid and high frequencies.					
Prerequisites Contents acquired in the courses of Circuit Analysis I, Circuit Analysis II and Electronics I					
Curriculum (max. 1000 characters) <ol style="list-style-type: none"> The concept of amplification. The operational amplifier (opamp), its characteristics and limitations. Ampop circuits - inverter, non inverter, weighted adder, integrator, differentiator, difference amplifier, instrumentation amplifier, Schmitt Trigger. Ampop and diode circuits - limiters, ideal diode, half wave and full-wave precision rectifiers, dead zone circuits, clipper, peak detector. Voltage comparators. Transistor amplifiers Diode, BJT and the FET small signal models Common emitter, common base and common collector amplifier configurations. Special amplifiers - Darlington, differential and cascode. Frequency response analysis of transistor amplifiers. Diodes and transistor internal capacitors. Miller's theorem. Low, mid and high amplifier frequency response. Open and short circuit time constants. 					
Teaching and Learning Methods (max. 1000 characters including assessment) <ul style="list-style-type: none"> - T classes– 2 hours. Theoretical concepts are presented using the board and the data projector. - TP classes– 1 hour. Sets of analytical problems are presented and solved on the board. Use of electronic simulation verify the circuit analysis. - OT classes– 2 hours tutoring class. Sets of problems and quizzes are presented and solved with the help of the teacher if necessary. Some classes are in the lab where circuits are to be assembled and tested or simulated. Quizzes are put to the students regarding the operation of the circuits under test. - Private tutoring– 2 hours in the teacher's office for students with special needs. 					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Assessment

The final assessment has 2 components: a theoretical component for T and TP assessment, and a lab component for the laboratorial work assessment.

2 Tests or/and a Final Exam for the theoretical component and a score for the lab component.

It is necessary a score of more than 45% in each of the 2 components

$N = 90\% \times (\text{Test or Final Exam score}) + 10\% \times (\text{Lab score})$.

Bibliography (max. 1000 characters)

[1] Handouts and sets of proposed and solved exercises, Mário Saraiva

[2] "Microelectronic Circuits", Adel S. Sedra / Kenneth C. Smith, Oxford University Press.

[3] "Design with Operational Amplifiers and Analog Integrated Circuits" – Sergio Franco, McGraw-Hill

[4] "Operational Amplifier & Linear Integrated Circuits", R. Coughlin, F Driscoll, Prentice Hall

[5] "Engineering Electronics: A practical Approach", R. Mauro, Prentice Hall

[6] "Analysis and Design of Analog Integrated Circuits", 3rd Edition, P. Gray, R. Meyer, John Wiley.

[7] "Electronic Devices Discrete and Integrated", S. Fleeman, Prentice Hall.

[8] "Additional Problems with Solutions: A Supplement to Microelectronic Circuits", Third Edition, Adel S. Sedra / Kenneth C. Smith, Oxford University Press, 1992.

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The course contents have been defined in order to fulfill its objectives, in the wake of Electronics I. A new device, the opamp, has been added, and the operation of the transistor has been extended to encompass the small signal amplifier and its frequency response. The methodology follows a step by step approach. The opening chapters of these materials include the fundamental concepts needed to understand them, so that in subsequent chapters, the more complex and fundamentals subjects can be taught, allowing the student to achieve the goals that were set for him.

An important part of the course consists of practical demonstration of the subjects taught based on laboratory testing or electronic simulation of several circuits. The methodology employed provides the student with a comprehensive theoretical and practical knowledge of the subjects, as well as the skills needed to use a set of learning tools, in a step by step fashion, so that the objectives of the syllabus are fully met.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodology employs 3 strands that complement each other - a theoretical (T) strand, a theoretical-practical (TP) strand and a practical (P) strand.

The (T) strand introduces the concepts, the electronic devices, the typical circuits that incorporate them, as well as the function that these circuits perform. Next, the circuits are analyzed and, when appropriate, their performance is compared to the performance of similar circuits, in order to identify the advantages and limitations of each one of them.

The (TP) strand uses the theoretical concepts to solve a set of problems and quizzes. At this stage, the problems are solved by the teacher to show how analytical techniques can be used. An electrical circuit simulator is used to help understand and visualize the response of these circuits.

The (P) strand is composed of 2 parts. In the first part, sets of exercises and problems are presented to the students, and some are solved in the classroom with the help of the teacher, when needed. The remaining exercises are intended to be solved by students, at home, to help them develop their skills. Any difficulty will be answered by the teacher in the TP class, or privately. The second part of the (P) strand is done in a laboratory environment. Some circuits that were taught in the T or TP classes are assembled, tested or simulated and its performance analyzed. The idea is to introduce the students to a lab environment where they can verify experimentally the concepts that were presented and analyzed in the (T) and (TP) strands.

These 3 different strands, which complement each other, are designed to show the student different ways of looking at the same subject - a theoretical, an analytical and an experimental approach. This method is employed to help the student better understand the subjects taught in the T classes.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: APPLIED ELECTRONICS					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications					
Teaching Language(s): Portuguese Course Unit Chair: <i>Mário Rui Gil Saraiva</i> Teaching Staff: <i>Mário Rui Gil Saraiva</i> (Lecturing load: 30 T+ 15 TP+ 30 OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3	1	30 T + 15 TP + 35 TP	Required	15241030	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) At the end of the course the student should have acquired the following concepts and skills. He must understand the concept of the negative feedback, and know its properties and topologies, and must be able to analyze feedback amplifiers. The student should know the basics of Signal Flow Graph theory and must be able to apply it to the circuit analysis. The student must understand the concepts of oscillation and must know how to analyze linear RC and tuned LC oscillators and nonlinear oscillators. The student must acquire the concept of filtering, must understand approximation functions and must be able to derive the Butterworth and Chebyshev approximations. The student must understand the inverse Chebyshev approximations, elliptical and Bessel-Thomson approximations. The student must be able to apply frequency and impedance denormalizations and frequency transformations. The student must be able to synthesize LC ladder passive filters and single and multi- amplifier RC active filters.					
Prerequisites Contents acquired in the courses of Circuit Analysis I, Circuit Analysis II and Electronics I, Electronics II, Signals and Systems					
Curriculum (max. 1000 characters) <ol style="list-style-type: none"> 1. Feedback in electronic circuits <ul style="list-style-type: none"> Types of amplifiers General feedback equation Negative feedback properties Feedback topologies 2. Signal Flow Diagrams <ul style="list-style-type: none"> Elements and operations Mason theorem Circuit analysis with signal flow graphs 3. Oscillators <ul style="list-style-type: none"> Barkhausen criterion Linear RC oscillators - Wien bridge, phase-shift, Quadrature Linear LC oscillators - Colpitts, Hartley, Clapp, crystal oscillators Nonlinear oscillators Techniques for stabilizing the amplitude of the oscillations 4. Filters <ul style="list-style-type: none"> Concepts of filtering Low pass, high pass, band pass, band reject filters, phase equalizer Frequency and impedance denormalizations 					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

<p>amplitude and phase approximations Approximations to low pass filters - Butterworth, Chebyshev Frequency transformations Realization of filters with passive components - filters LC ladder Implementation of filters with active components - Sallen-Key, GIC, Biquad state-variable, Tow-Thomas</p>
<p>Teaching and Learning Methods (max. 1000 characters including assessment)</p> <ul style="list-style-type: none"> - T classes – 2 hours. Theoretical concepts are presented using the board and the data projector. - TP classes – 1 hour. Sets of analytical problems are presented and solved on the board. Use of electronic simulation verify the circuit analysis. - OT classes – 2 hours tutoring class. Sets of problems and quizzes are presented and solved with the help of the teacher if necessary. Some classes are in the lab where circuits are to be assembled and tested or simulated. Quizzes are put to the students regarding the operation of the circuits under test. - Private tutoring – 2 hours in the teacher's office for students with special needs.
<p>Assessment</p> <p>There are 2 tests and a final examination. It is needed a test average score of at least 9,5, and no single test score under 8, or a final examination score of at least 9,5, to get the course approval. The final score is the same as the tests average score, or the final examination score.</p>
<p>Bibliography (max. 1000 characters)</p> <p>[1] Handouts, Mário Saraiva [2] "Principles of Active Network Synthesis and Design", Gobind Daryanani, John Wiley [3] "Active and Passive Analog Filter Design", Lawrence Huelsman, McGraw-Hill [4] "Design of Analog Filters", R. Schaumann, M. E. Van Valkenburg, Oxford University Press [5] "Microelectronic Circuits", A. Sedra, K. Smith, Saunders College Publishing [6] "Engineering Electronics" – a Practical Approach", Robert Mauro, Editora Prentice Hall. [7] "Electronics – A Top-Down Approach to Computer-Aided Circuit Design", A. Hambley, Prentice Hall</p>
<p>Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)</p> <p>The syllabus have been developed in order to fulfill its objectives. The main topics covered in this course are the negative feedback and negative feedback amplifiers, oscillators and analog filters. The methodology follows a step by step approach with an increasing degree of difficulty. Therefore, the opening chapters of these materials include the fundamental concepts needed to understand it, so that in subsequent chapters, the more complex and fundamentals subjects can be taught, allowing the student to achieve the goals that were set for him.</p> <p>An important part of the course consists of practical demonstration of the subjects taught based on laboratory testing or electronic simulation of circuits. The methodology employed provides the student with a comprehensive theoretical and practical knowledge of the subjects, as well as the skills in order to use a set of learning tools, in a step by step fashion, so that the objectives of the syllabus are fully met.</p>
<p>Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)</p> <p>The teaching methodology employs 3 strands that complement each other - a theoretical (T) strand, a theoretical-practical (TP) strand and a practical (P) strand.</p> <p>The (T) strand the concepts are presented in a way that will result in a coherent and comprehensive approach, always starting by introducing the most basic concepts first and the fundamental applications and more evolved, later, in the following chapters. The theoretical component may include some simulation results in order to facilitate the understanding of the subjects taught.</p> <p>The (TP) strand uses the theoretical concepts to solve a set of problems and quizzes. At this stage, the problems are solved by the teacher to show how analytical techniques can be used. An electrical circuit or a filter simulator is used to help understand and visualize the response of these circuits.</p> <p>The (P) strand is composed of 2 parts. In the first part, sets of exercises and problems are presented to the students, and some are solved in the classroom with the help of the teacher, when needed. The remaining exercises are intended to be solved by students, at home, to help them develop their skills. Any difficulty will be answered by the teacher in the TP class, or privately. The second part of the (P) strand is done in a laboratory environment. Some circuits that were taught in the T or TP classes are assembled, tested or simulated and its performance analyzed. The idea is to introduce the students to a lab environment where they can verify experimentally the concepts that were presented and analyzed in the (T) and (TP) strands.</p> <p>These 3 different strands, which complement each other, are designed to show the student different</p>

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

ways of looking at the same subject - a theoretical, an analytical and an experimental approach. This method is employed to help the student better understand the subjects taught in the T classes.

⁽¹⁾ Theoretical (**T**); Theoretical and practical (**TP**); Practical and laboratorial (**PL**); Field work (**TC**); Seminar (**S**); Tutorial (**OT**); Individual student work (**TA**).



Course Unit: Power Electronics					
Department: Electrical Engineering Department Programme: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialisation in: Energy Systems and Control Teaching Language(s): Portuguese Course Unit Chair: Luís Manuel Ramos de Oliveira Teaching Staff: Luís Manuel Ramos de Oliveira (Total lecturing load: 30 T + 15 TP + 60 OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 rd	1 st	30 T+15 TP+35 OT	Required		5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes The scope and objective of the course is to develop an understanding of state of the art in power electronic devices and circuits: their operations, performance, and applications.					
Prerequisites Knowledge acquired in Applied Power Engineering and Instrumentation and Measurement.					
Curriculum <ol style="list-style-type: none"> Power semiconductor devices: Diodes, thyristors, bipolar junction transistors and darlingtonts, MOSFET's, GTO's, IGBT's, and MCT's. Desired characteristics in controllable switches. Comparison of power semiconductor devices. Power semiconductor losses. Protection. Drive and snubber circuits. Heatsinks. Diode rectifiers (AC-DC power converters): Half-wave rectification. Single-phase rectifier bridge. R and RL load. Capacitive and LC filters. Effect of single-phase rectifiers on the neutral currents of three-phase four-wire systems. Three-phase rectifier bridge. R and RL load. Capacitive and LC filters. Effect of the AC-side inductance on the current commutation. DC-DC Switch-mode converters: Buck converter. Boost converter. Buck-boost converter. Isolated converters: an overview. Full bridge DC-DC converter. Thyristorized converters: AC-DC controlled converters. AC-AC controlers. 					
Teaching and Learning Methods Lectures: formal exposition of concepts. Seminars/Problem solving classes: problem solving classes. Tutorials/practical and laboratorial classes: Subdivided into two types <ol style="list-style-type: none"> Students solve exercises and problems under teacher's guidance Practical or laboratorial assignments. 					
Assessment <ul style="list-style-type: none"> One test at the end of the semester, or a final examination, weighting 60%, with minimum passing requirements of 50%. Laboratorial/practical assignments, weighting 40%, with minimum passing requirements of 50%. 					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Bibliography

- [1] Mohan, N.; Undeland, T. M.; Robbins, W. P.: "Power electronics - converters, applications and design", John Wiley & Sons, 1995.
- [2] Rashid, M. H.: "Power electronics – Circuits, devices and applications"; Prentice Hall, 2004.
- [3] Batarseh, I.: "Power electronic circuits"; John Wiley&Sons, 2004.
- [4] Ertugrul, N: "LABVIEW for electric circuits, machines, drives and laboratories", Prentice-Hall, 2002.
- [5] Oliveira, L. M. R.: "Textos de apoio de Electrónica de Potência", ADEE-EST, Univ. do Algarve, 2007.
- [6] Oliveira, L. M. R.: "Caderno de problemas de Electrónica de Potência", ADEE-EST, Univ. do Algarve, 2007.
- [7] Oliveira, L. M. R.: "Guião de trabalhos laboratoriais de Electrónica de Potência", ADEE-EST, Univ. do Algarve, 2007.

Demonstration of the syllabus coherence with the curricular unit's objectives

The syllabus of this course provides students with an evolutionary learning on the objectives and competencies to be acquired. Thus, the first chapter provides all the basic knowledge of power semiconductors and tools for the analysis and simulation of power electronics converter circuits. The other three chapters are dedicated to the analysis of power electronics converters. In this way the student can acquire skills on underlying concepts of power electronics and its applications

Demonstration of the coherence between the teaching methodologies and the learning outcomes

Taking into account the objectives of this course, the teaching methodology used here allows the student to have contact, in the classroom and laboratory, with educational resources enabling them to obtain the theoretical and practical skills about the concepts and advanced knowledge in power electronics systems and applications.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Applied Electrical Engineering					
<p>Department: Electrical Engineering Department Programme: 1st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialisation in: Energy Systems and Control</p> <p>Teaching Language(s): Portuguese Course Unit Chair: Luís Manuel Ramos de Oliveira Teaching Staff: Luís Manuel Ramos de Oliveira (Total lecturing load: 30 T + 15 PL + 35 OT); João Gomes (Total lecturing load: 60 OT)</p>					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2 nd	1 st	30 T+15 PL+35 OT	Required		5
<p>Workload (hours): 140</p> <p style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </p>					
<p>Learning Outcomes</p> <ul style="list-style-type: none"> • Develop skills to analyse and solve polyphase circuits. • Develop skills to analyse and solve magnetic circuits. Develop skills to analyse circuits with coupled coils. • Develop skills to analyse electric circuits with non-sinusoidal and distorted supply. 					
<p>Prerequisites Knowledge acquired in Circuit Analysis I and II.</p>					
<p>Curriculum</p> <ol style="list-style-type: none"> 1. Poliphase circuits: Two-phase and three-phase circuits. Analysis of balanced and unbalanced three-phase circuits. Three-phase active, reactive, apparent and complex powers. Power factor compensation. Active and reactive powers measurement. Symmetrical components. 2. Magnetic circuits: Properties of magnetic materials. Hysteresis curve and magnetization curve. Magnetic circuits. Self-inductance and mutual Inductance. Dot convention for voltage polarity determination. Hysteresis and eddy current losses (Foucault currents losses). Linear transformer. Ideal transformer. Magnet circuit analysis with permanent magnets. Electromagnetic energy conversion: an introduction. 3. Harmonics: Fourier series and coefficients. Harmonics. Total harmonic distortion and form factor. Analysis of linear electric circuits with nonsinusoidal waveforms. Active, non-active and apparent powers calculation. Power factor. Harmonic resonance. Harmonics in three-phase circuits. 					
<p>Teaching and Learning Methods</p> <p>Lectures: formal exposition of concepts. Seminars/Problem solving classes: problem solving classes. Tutorials/practical and laboratorial classes: Subdivided into two types</p> <ol style="list-style-type: none"> 1. Students solve exercises and problems under teacher's guidance 2. Practical or laboratorial assignments. 					
<p>Assessment</p> <ul style="list-style-type: none"> - One test at the end of the semester, or a final examination, weighting 60%, with minimum passing requirements of 50%. - Laboratorial/practical assignments, weighting 40%, with minimum passing requirements of 50%. 					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Bibliography

- [1] Bessonov, L.: "Electricidade aplicada para engenheiros", 2ª Ed., Lopes da Silva Editora, 1977.
- [2] Alexander, C.; Sadiku, M.: "Fundamentals of electric circuits", 2nd Ed., McGraw-Hill, 2003.
- [3] Nilsson, J. W.; Riedel, S. A.: "Electric Circuits", Prentice Hall, 6th Ed. 1999.
- [4] Ertugrul, N: "LABVIEW for electric circuits, machines, drives and laboratories", Prentice-Hall, 2002.
- [5] Oliveira, L. M. R.: "Textos de apoio à disciplina de Electrotecnia Aplicada", DEE-ISE, Univ. Algarve, 2009.
- [6] Oliveira, L. M. R.: "Caderno de Problemas de Electrotecnia Aplicada", DEE-ISE, Univ. Algarve, 2009.
- [7] Oliveira, L. M. R.: "Guião de trabalhos laboratoriais de Electrotecnia Aplicada", DEE-ISE, Univ. Algarve, 2009.

Demonstration of the syllabus coherence with the curricular unit's objectives

The syllabus of this course gives the student an evolutionary learning with respect to the objectives and competencies to be acquired. This is the first course that the student encounters in specific to the Energy Systems and Control Specialization. The syllabus of this course will introduce the basic concepts and prepare the students to face the disciplines in the advanced level, in the Energy Systems and Control Specialization. In this way the student can acquire skills about basic concepts essential to understand the operation of electric power systems, electrical machines and power electronics converters.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

Taking into account the objectives of this course, the teaching methodology used here allows the student to have contact, in the classroom and laboratory, with educational resources enabling them to obtain the theoretical and practical skills about the concepts and advanced knowledge in polyphase circuits, magnetic circuits and harmonics.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: RENEWABLE ENERGIES					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Energy Systems and Control Teaching Language(s): Portuguese Course Unit Chair: <i>Carlos Manuel Aguiar Rodrigues Cabral</i> Teaching Staff: <i>António Fernando Marques de Sousa</i> (Contact hours: 2 T+ 1 TP+ 2 OT);					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 rd	2 nd	7	Elective	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 30 Fieldwork: 5 Individual Work and Assessment: 60 </div>					
Learning Outcomes Students should: <ol style="list-style-type: none"> 1. Become aware of the world's electricity production and consumption alternatives, and be able to make informed judgments on the best source for each application. 2. Acquire and develop skills on the technical and economic feasibility analysis of electricity generation projects from renewable sources: <ol style="list-style-type: none"> a) Mini-hydro projects. b) Wind parks. c) Photovoltaic plants and micro-generation systems. 					
Prerequisites No previous course is required. However, some knowledge on spreadsheets, electromagnetism, electrical machines and circuit analysis will be an advantage.					
Curriculum <ol style="list-style-type: none"> 1. Renewable energies among all sources of energy. 2. Elements of economical and financial evaluation of investments. 3. Hydroelectricity and mini-hydropower projects. 4. Wind energy, wind turbines and wind parks. 5. Solar energy. Solar radiation. Photovoltaic cells and photovoltaic systems. 6. Conditions for Grid connection of wind and photovoltaic systems. 7. Micro-generation in Portugal. 					
Teaching and Learning Methods Theoretical lectures: using exposition and explanation, supported by visual resources (video projector) Theoretical-practical classes: solving problems in order to complement the teacher's explanations. Tutorial orientation classes: under teacher's guidance, the students solve problems and execute a set of laboratorial works. Field work: students participate in one or two field trips to electricity production facilities that tap into renewable sources of energy.					
Assessment A written Test (TE) by the end of the semester, a Final written Exam (EX), a Group assignment (TG), a Field report (TC) and tutorial classes evaluation based on participation (OT). Final grade, CF, is calculated according to: $CF = TE \text{ or } EX \times 0,6 + TG \times 0,2 + TC \times 0,1 + OT \times 0,1.$					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

TG and TC ≥ 10; TE and EX ≥ 9.

Bibliography (max. 1000 characters)

- [1] – “Uma Introdução às Energias Renováveis – Eólica, Fotovoltaica e Mini-hídrica”, Rui Castro, IST Press
[2] – Lectures’ notes, António Fernando Marques de Sousa
[3] – “Solar Electricity”, Thomas Markvart, ED. John Wiley & Sons
[4] – “Wind Energy Technology”, John F.Walker/Nicholas Jenkins, Ed. John Wiley & Sons

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The syllabus provides students with theoretical knowledge about the different renewable energy sources, and the calculation tools that allow them to evaluate technically and economically the wind, photovoltaic and mini-hydro projects, from the point of view of an electrical engineer, but without neglecting the environmental and social aspects involved.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

Lectures (T) expose the students to the theoretical knowledge required on the conventional and renewable energy sources, in a rigorous but richly illustrated way, allowing detailed observation of the equipment. In addition, students are prompted to participate in the discussion of environmental, social and economic impacts of different sources of electricity production, so they can support their views on more solid foundations. In theoretical-practical classes (TP), the instructor solves exercises on calculation methods for the producible energy, as well as the economic and financial evaluation of renewable energy projects. In tutorial sessions (OT), students practice the methods taught in T-P classes, using spreadsheets and other types of dedicated software, in order to develop the ability to predict production and assess the financial viability of renewable energy potentials. They also take short quizzes to assess their progress, or perform laboratory work. The final assignment consists of dimensioning and evaluating the economic feasibility of a renewable energy project, such as a wind farm, a photovoltaic plant, a small grid-connected photovoltaic installation, or a mini-hydro power plant, and researching a specific topic, such as the generators used in wind turbines, the batteries used in photovoltaic installations, or the environmental aspects of hydropower production. Field trips are vital and enriching experiences for the consolidation of the knowledge acquired in the classroom. Students can contextualise the subjects studied in practical situations, and with the professional experience of the technicians from the companies that receive and guide them through these visits. The different teaching methodologies used complement each other harmoniously in order to achieve the proposed objectives.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Physics I					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications / Energy Systems and Control					
Teaching Language(s): Portuguese Course Unit Chair: Paulo Jorge Maia dos Santos (pjsantos@ualg.pt) Teaching Staff: Paulo Jorge Maia dos Santos (Lecturing load: 30T+15TP); Vítor Vicente Madeira Lopes (Lecturing load: 15T+15TP+105OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
1 st	1 st	30T+15TP+35OT	Required		5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) Develop skills to analyse and to understand mechanical systems that can be used to describe natural phenomena. Develop skills to understand the basic principles of classical mechanics and to apply the laws of mechanics in order to solve a wide range of problems. Analyse and calculate the transfer of energy by heat. Understand how semiconductor materials work and are used to make a range of modern electronic devices. Applicability of the syllabus, with flexibility and critical sense, to other disciplines and other scientific areas.					
Prerequisites No prerequisites.					
Curriculum (max. 1000 characters) 1 – Heat transfer: Types of heat transfers - conduction, convection and radiation. Fundamental laws of heat transfer. The effect of geometry in the conduction of the heat. Heat dissipation. 2 – Semiconductors: Energy bands of metals, insulators and semiconductors. Free electron model. Electrical properties of intrinsic and extrinsic semiconductors. Temperature dependence. PN junction. 3 – Classical mechanics - Statics: Newton's first law. The concept of force. Moment about a point and about an axis. Static Equilibrium. Equilibrium equations for two and three dimensional for rigid objects. Forces of friction.					
Teaching and Learning Methods (max. 1000 characters including assessment) Lectures - using exposition, explanation and projection of slides and examples; Seminars/Problem solving classes, where the teacher complements their explanations method with solving exercises and stimulating students to solve problems; Tutorials, where students solve exercises and problems under teacher's guidance and where individual or group assignments are proposed.					
Assessment The U.C. assumes two types of evaluation: continuous and final. Continuous assessment comprises two parcels, 3 mini tests (P1, with minimum rating of 8 out of 20) and evaluation of student achievement, in carrying out series of exercises in tutoring classes and/or at home (P2). The final grade is calculated by: 90%P1 + 10%P2. The final assessment is made by an exame, assessed in the range of 0 to 20 values. The student is approved when get 10 or more in the final grade.					
Bibliography (max. 1000 characters) [1] Teacher's c.u. material, lectures' slides, Sebenta de Física I – (Roteiro da disciplina disponibilizado pelo docente), ISE/UAlg. [2] Beer and Johnson,, Mecânica Vectorial para Engenheiros – Vol. I , Makron Books do Brasil. [3] James L. Merian, Estática . [4] Holman, J. P., Transferência de Calor , McGraw-Hill.					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

- [5] Resnick, R.; Halliday, D., **Física 2 / Física 4**, Livros Técnicos e Científicos Editora.
- [6] Jacob Millman; Arvim Grabel, **Microelectrónica (Vol. 1)**, McGraw-Hill.
- [7] Fonseca, **Curso de Mecânica**, Livros Técnicos e Científicos S. A. Rio de Janeiro – Centro Livro Brasileiro.
- [8] Haliday/Resnick, **Física**, Livros Técnicos e Científicos S. A. Rio de Janeiro – Centro Livro Brasileiro.
- [9] Sears/Zemansky, **Física**, Livros Técnicos e Científicos S. A. Rio de Janeiro – Centro Livro Brasileiro.
- [10] Alonso e Finn, **Física - Um Curso Universitário**, Dinalivro.
- [11] Campos, Luís Braga, **Mecânica Aplicada I**, Escolar Editora.

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The study of the basic concepts and principles of heat transmission and the physics of semiconductors, are essential materials in the basic training of students in electrical engineering and electronics. In addition, it is intended to provide students with the Static visualization capabilities of vectors in the plane and in space as well as analyze the various conditions of equilibrium of bodies. In this sense, the syllabus covered in this UC are arranged so that the knowledge and skills to be developed by students to enable them to complement their training at other UCs. The lectures will be accompanied through the resolution, in theoretical and practical lessons and tutorial guidance, of several exercises of application of theoretical principles contained in the syllabus.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodology adopted in this UC is based on interconnection and switching between exposure of fundamental theoretical concepts, and of the respective physical interpretations of mathematical formulations that are involved with the discussion and resolution of practical problems involving the concepts presented. For this purpose, are taught theoretical lessons and theoretical-practical where the teacher introduces and explains in detail the contents of the UC interacting with students and solving problems of practical and theoretical-practical nature that allows for full understanding of the material. In order to consolidate and deepen the acquisition of knowledge the tutorial classes focus on solving problems, under the guidance of teaching staff, promoting the training of knowledge gained and the evaluation of the student's knowledge level

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Physics II					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications / Energy Systems and Control					
Teaching Language(s): Portuguese Course Unit Chair: Paulo Jorge Maia dos Santos (pjsantos@ualg.pt) Teaching Staff: Paulo Jorge Maia dos Santos (Lecturing load: 22,5T+15TP+52,5OT); Ana Bela Santos (Lecturing load: 15T+7,5TP); João Gomes (Lecturing load: 7,5T+7,5TP+52,5OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
1 st	2 nd	30T+15TP+35OT	Required		5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) Generally, the student develops the skills of inductive reasoning and deductive reasoning and who knows how to take advantage of symbiosis between the mathematics, physics and engineering. The Courses are divided into two modules, the module 1st to provide understanding of dynamics of rigid bodies as well as notions of center of mass; with the 2nd module is intended to provide understanding of vector analysis and usability of the theorems of Stokes, of Green and of divergence. Specifically the student must master the concepts involved in syllabus and use them skillfully, and apply them with suppleness and critical sense, to other disciplines and other scientific areas, especially when it electromagnetism.					
Prerequisites Knowledge acquired in Mathematic Analysis I, in particular the derivatives and integrals. Knowledge acquired in Physics I..					
Curriculum (max. 1000 characters) Module I: Mechanics 1 – The center of mass. 2 – Moment of inertia. 3 – Motion of a particle: position, velocity and acceleration. 4 – Newton's second law. 5 – Linear momentum and conservation of mechanical energy. 6 – Kinematics: rotation of a rigid object about a fixed axis, rotational motion, angular and linear quantities. Work, power and energy in rotational motion. Angular momentum. Conservation of angular momentum. 7 – Oscillatory motion: motion of an object attached to a spring, the pendulum. Mathematical representation of Simple Harmonic Motion (SHM or MHS in Portuguese). Module II: Vector analysis 1 – Vector function of a scalar argument: limits of functions; continuity; derivatives and integral. 2 – Scalar fields: differential operations; directional derivative; gradient theorem and nabla operator. 3 – Vector fields: curl; divergence; Laplacian; solenoidal vector fields; Green's, Stokes' and Divergence theorems. 4 – Conservative vector field: scalar potential; circulation.					
Teaching and Learning Methods (max. 1000 characters including assessment) Lectures - using exposition, explanation and projection of slides and examples; Seminars/Problem solving classes, where the teacher complements their explanations method with solving exercises and stimulating students to solve problems; Tutorials, where students solve exercises and problems under teacher's guidance and where individual or group assignments are proposed.					
Assessment					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

The student will have to perform a test for each module with a minimum rating of 9.5. If the student does not get at least 9.5 rating values, in one of the modules will have to take a final exam when the respective module has not obtained approval. The student is approved if get a final grade equal to or greater than 10 values of the average ratings of the two modules.

Bibliography (max. 1000 characters)

Module I

- [1] Lectures' slides and Exercises handouts
- [2] Beer and Johnson, **Mecânica Vectorial para Engenheiros**, Makron Books do Brasil
- [3] Fonseca, **Curso de Mecânica**, Livros Técnicos e Científicos S.A. Rio de Janeiro
- [4] Haliday/Resnick, **Física**, Livros Técnicos e Científicos S.A. Rio de Janeiro
- [5] Sears/Zemansky, **Física**, Livros Técnicos e Científicos S.A. Rio de Janeiro
- [6] Alonso e Finn, **Física, Um Curso Universitário**, Dinalivro
- [7] Campos, Luís Braga, **Mecânica Aplicada II**, Escolar Editora

Module II

- [1] Lectures' slides and Exercises handouts
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- [5] Piskounov, N. – **Cálculo Diferencial e Integral** (vol.1), Lopes da Silva Editora (1993).
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Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

As a course of basic sciences, the study of mathematics and physics concepts taught in two modules, are essential materials in the basic training of students in electrical engineering. In this sense, the syllabus covered in this UC are arranged so that the knowledge, skills and competences acquired by the students to enable them for complement their training at other UCs, as for example in electromagnetism and understanding of oscillatory motion phenomena. The lectures will be accompanied by the resolution, in theoretical and practical lessons and tutorial guidance, of various exercises of application of theoretical principles contained in the syllabus, with approach wherever possible, the practical cases related to electrical engineering.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodology adopted in this UC is based on interconnection and switching between exposure of fundamental theoretical concepts, and of the respective physical interpretations of mathematical formulations that are involved with the discussion and resolution of practical problems involving the concepts presented. For this purpose, are taught theoretical lessons and theoretical-practical where the teacher introduces and explains in detail the contents of the UC interacting with students and solving problems which allows for a full understanding of the material. In order to consolidate and deepen the acquisition of knowledge the tutorial classes focus on solving problems, under the guidance of teaching staff, promoting the training of knowledge gained and the evaluation of the student's knowledge level

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Telecommunications Fundamentals					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications					
Teaching Language(s): Portuguese Course Unit Chair: Fernando Beirão Emídio (femidio@ualg.pt) Teaching Staff: Fernando Beirão Emídio (Lecturing load: 30 T+ 15 TP+ 35 OT);					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3	1	30 T+ 15 TP+ 35 OT	Required/Elective	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes The aim is for students to acquire the basic knowledge of telecommunications in both analog and digital communication systems/technologies. Students must learn signal analysis and processing (as well as the necessary mathematical concepts), know transmission media characteristics and learn general telecommunications concepts – modulation, distortion and noise reduction, demodulation, multiplexing, etc.					
Prerequisites Differential and Integral Calculus and Complex Analysis. Knowledge of Fourier Theory and Theory of Probability and Statistics.					
Curriculum 1- Introduction to communication systems: Basic concepts. Elements of a communication system. The electromagnetic spectrum. 2- Signals and spectra: Phasors and line spectra. Periodic signals and Fourier Series. Fourier Transform and continuous spectra. Convolution and Unit Impulse. Signal Space. Correlation and Spectral Density. Use of MATLAB software in communication Systems. 3- Transmission media. Twisted-pair wire. Coaxial cable. Waveguide. Fiber-optics. Wireless links: Satellite; Microwave and Radio. Antennas fundamentals. 4- Analog Transmission. Baseband signal transmission. Signals and noise. Signal Distortion in transmission. AM; DSB; SSB; VSB. Demodulation. FDM. Angular Modulation: FM; PM. 5- Digital Transmission: Baseband transmission. PAM. PCM. TDM. Digital hierarchy. PCM bandwidth. Regenerative repeaters. PCM waveform types. Intersymbol Interference, ISI. Additive White Gaussian Noise channel. Matched filter demodulator.					
Teaching and Learning Methods Theoretical lectures of expository nature using slide presentation and practical examples on frame. Theoretical and practical lectures where theoretical concepts are complemented by discussing and presenting methods for solving practical examples. Tutorial lectures where students clarify their doubts, solve proposed problems and group laboratory assignments under the teacher's supervision.					
Assessment Assessment is composed by two main components: theoretical and practical. Theoretical component consists of two written tests ($\geq 8,0$ points in each test) and/or a written final exam (90% of the final grade). A 10% weight of the final grade is reserved to students' lecture participation and assignment delivering. U.C. approval is obtained with a final grade $\geq 9,5$ points.					
Bibliography [1] Theacher's CU material (Lectures' slides and proposed problems with solutions); [2] Bruce Carlson, Crilly, Rutledge, Communications Systems, McGraw-Hill, 2002; [3] Bruce Carlson, Communication Systems, McGraw-Hill, 3th Edition, 1986;					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Dennis Roddy, John Coolen, Electronic Communications, 4th Edition, Prentice Hall, 1995;
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 [5] Rodger Ziemer, W. Tranter, Principles of Communications, Systems, Modulation and Noise, John Wiley & Sons, 2002;
 [6] Gerd Keiser, Optical Fiber Communications, 2nd Edition, McGraw-Hill, 1991.
 [7] John G. Proakis, Masoud Salehi, Gerard Bauch, Contemporary Communication Systems using MATLAB AND Simulink, 2nd Edition, Brooks/Cole, 2004.

Demonstration of the syllabus coherence with the curricular unit's objectives

Students learn the concepts, techniques and basic issues that characterize information transmission via electrical signals and the limitations of physical systems. In this sense, the syllabus covered in this UC are organized so that the acquired knowledge, skills and abilities enables students to attain the goals of the UC and complement their training in telecommunications in other UCs (Digital Communications, Mobile Communications, etc.).

Demonstration of the coherence between the teaching methodologies and the learning outcomes

Theoretical classes:

- Presentation of basic concepts in communication systems;
- Review and application of mathematical tools already taught on other UCs:
 - i) Fourier series and the Fourier transform as a mean of signal representation and processing in the frequency domain;
 - ii) Signal space Theory: use of concepts such as scalar product and norm in computing power, energy, and spectral density function, characterization and analysis of signals using correlation function, etc.;
 - iii) Theory of Probability and Statistics applied on the analysis of electrical noise.
- Presenting concepts of transmission media and telecommunications technologies as described on the UC objectives.

The aim is thus to present in detail the syllabus of the UC.

Theoretical and practical classes:

- Discussion and resolution of practical problems involving the concepts presented.

Tutorial/practical and laboratorial classes:

- Resolution of proposed problems;
- Using MATLAB software as a tool for the analysis and design of communication systems;
- Laboratory experiments in Telecommunications in order to familiarize the student with measuring equipment (advanced functions of digital oscilloscopes, spectrum analyzer) and verify concepts as signal spectrum, modulation / demodulation, multiplexing, etc.
- Practical work under the guidance of the teacher;
- Presentation of transmission media such as coaxial cables, waveguides, fiber optics, antennas.

OT and PT / PL classes aims promoting the training of acquired knowledge and student's self-evaluation of their theoretical knowledge level.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Management					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications / Energy Systems and Control					
Teaching Language(s): Portuguese Course Unit Chair: Carlos Manuel de Azevedo Marinho Teaching Staff: Carlos Manuel de Azevedo Marinho (Total Lecturing load: 15T+17,5OT); Ilídio da Encarnação Jesus Neto Mestre (Total Lecturing load: 15T+17,5OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2º	2º	30T+35OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 30 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 75 </div>					
Learning Outcomes (max. 1000 characters) This curricular unit consists of two parts, which are taught simultaneously: a part of "Context Management" and another of "Project Management". The part of "Context Management" aims to put students in touch with key Management concepts, providing an integrated view of processes and different areas of Management. The part of "Project Management" seeks to sensitize students to the skills required for school in terms of methods, techniques and ways of working to overcome and solve the numerous problems that arise in project development team in a real organization.					
Prerequisites					
Curriculum (max. 1000 characters) Part One – <u>Context Management</u> : 1-Basic concepts: the current context of management; 2-functional Policies: marketing, operations management, financial management, human resources, 3-The management process: planning, strategic management and competitiveness; external environment analysis, internal environmental analysis, strategy development, organization, leadership, control. Part Two - <u>Project Management</u> 1-Creating and organizing projects; 2-Plan of the project; 3- Documentation of the project, 4-Team organization and management; 5-Implementation and control.					
Teaching and Learning Methods (max. 1000 characters including assessment) <u>Theoretical and practical lessons</u> - Part of the Context Management: - Predominantly expository method, combining theoretical debate concepts and case studies. <u>Tutorials / Practical lessons</u> - Part of Project Management: - Superficial expository approach, combining the theoretical to practical application, and practical computer laboratory with elaboration of a software tool for project management (e.g. Microsoft Project).					
Assessment The Assessment consists of two parts: tests or exam (T/E) and a work (W) with the corresponding report, presentation and discussion. The two components are evaluated on a scale of 0 to 20. The final rating is 50% (T/E) + 50% (W), with a minimum grade of 8 values in each component. The students are approved if they receive final rating equal to or greater than 10.					
Bibliography (max. 1000 characters) [1] Gomez-Mejia, Luis R., David B. Balkin e Robert L. Cardy; Management and organizations, McGrawHill, 2004 [2] Hitt, M.; Strategic management . Thomson South-Western, 2003 [3] Feio, R.; Gestão de Projectos com o Microsoft Project 2003, FCA-Informática, 2003 [4] Meredith, J. R., Mantel,S. J.; Project Management: A Managerial Approach, John Wiley & Sons, 2003					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

[5] Roldão, V. S.; Gestão de Projectos: Uma Perspectiva Integrada, Monitor, 2000

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

Students reach the unit's objectives by following the syllabus sequence and by working on problems and tools. They will develop the following skills:

- 1-Ability to meet and review the main concepts, processes and areas of Management;
- 2-Ability to examine methods, techniques and ways of working in Project teams;
- 3-Understanding the operation and use of a software tool for Project Management (eg MS Project).

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The methodology is based on interactive lessons with students. Initially some concepts and case studies are introduced. Later, students solve problems, supervised by the teacher, applying and deepening the concepts.

The use of e-learning platform and the software tool for project management are very important in learning. The work is developed individually and in groups, serving the needs of solving problems / projects, and student-centred and assuming the diversity of personal learning. Students achieve the objectives, proposed above, by working according to this methodology.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Energy Management and Power Quality					
Department: Electrical Engineering Department Programme: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialisation in: Energy Systems and Control Teaching Language(s): Portuguese Course Unit Chair: Luís Manuel Ramos de Oliveira Teaching Staff: Luís Manuel Ramos de Oliveira (Total lecturing load: 30 T + 15 TP + 35 OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 rd	1 st	30 T+15 TP+35 OT	Elective		5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes The scope and objective of the course is to develop an understanding of state of the art in energy management, energy audits, and power quality.					
Prerequisites Knowledge acquired in Applied Power Engineering.					
Curriculum <ol style="list-style-type: none"> Framework of the subject of energy management. Perspective of the energy market. Market transformations of the electric sector. Environmental impacts. Tariff Systems. Energy costs and electricity prices. Rational use of energy. Energy management regulations (RGCE). Energy audits and plans for rationalization of consumption. Peak power demand control. Opportunities for rationalization of consumption and/or costs: power factor correction; efficient lighting; efficient use of electric motors. Cogeneration and trigeneration. Computer power management. Rational use of energy in buildings: RCCTE and RSECE Regulations. Power quality: Definition of power quality problem. Power quality disturbances and mitigation technologies. Quality of service regulations: RQS and Standard NP EN 50160 2001. 					
Teaching and Learning Methods Lectures: formal exposition of concepts. Seminars/Problem solving classes: problem solving classes. Tutorials/practical and laboratorial classes: Subdivided into two types <ol style="list-style-type: none"> Students solve exercises and problems under teacher's guidance Practical or laboratorial assignments. 					
Assessment <ul style="list-style-type: none"> One test at the end of the semester, or a final examination, weighting 60%, with minimum passing requirements of 50%. Laboratorial/practical assignments, weighting 40%, with minimum passing requirements of 50%. 					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Bibliography

- [1] Centro para a Conservação da Energia: "Manual do Gestor de Energia", Lisboa, 1997.
- [2] Centro para a Conservação da Energia: "Auditorias energéticas".
- [3] C. Gaspar: "Eficiência Energética na Indústria", ADENE, 2004.
- [4] Sucena Paiva: Redes de energia eléctrica, uma análise sistémica, IST Press, 2005.
- [5] A. T. Almeida: "Manual Técnico de Gestão de Energia", 2007.
- [6] A. Thumann and W. J. Younger: "Handbook of Energy Audits", 7th Edition, Fairmont Press, 2007,
- [7] D. R. Wulfinghoff: "Energy Efficiency Manual", Energy Institute Press, 2000.
- [8] EDP, ISR-UC: "Manual da Qualidade da Energia Eléctrica", 2005.
- [9] Dugan R. C. et al: "Electrical power systems quality", McGraw-Hill, 2002.
- [10] Sankaran, C: "Power Quality", CRC Press, 2001.

Demonstration of the syllabus coherence with the curricular unit's objectives

The syllabus of this course gives the student an evolutionary learning with respect to the objectives and competencies to be acquired. Thus, the first chapter, of introductory nature, stresses the importance of the subject. The second chapter presents the energy prices systems and discusses the main factors that contribute to the formation of prices of electricity. In the third chapter the tools necessary for the implementation of energy audits are provided, in accordance with the regulations. The opportunities for rationalization of consumption are also analyzed. The last chapter describes the electrical power quality disturbances and the corresponding mitigation technologies. In this way the student can acquire skills about energy management, energy audits and power quality.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

Taking into account the objectives of this course, the teaching methodology used here allows the student to have contact, in the classroom and laboratory, with educational resources enabling them to obtain the theoretical and practical skills about energy management, energy audits and power quality.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Telecommunications Infrastructure					
Department: Electrical Engineering Department Programme: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialisation in: Information Technology and Telecommunications / Energy Systems and Control Teaching Language(s): Portuguese Course Unit Chair: Vitor Vicente Madeira Lopes (vlopes@ualg.pt) Teaching Staff: Vitor Vicente Madeira Lopes (Lecturing load: 30T+15TP+35OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 st	1 nd	30T+15TP+35OT	Elective		5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes <ul style="list-style-type: none"> • Ability to troubleshoot telecommunications infrastructures in buildings, lots, residential areas and cluster of buildings. • Project in the area of telecommunications infrastructure in buildings, lots, residential areas and clusters of buildings. 					
Prerequisites Knowledge acquired in Electrical Design.					
Curriculum <ul style="list-style-type: none"> • Legislative Framework (DL 123/2009). • ITED Manual: Characterization of the ITED, materials, devices and equipment; Project, Installation, Testing. • Constitution of the ITED project: technical; disclaimer; descriptive; map measurements and budgeting; drawings. • Project ITED: licensing; execution. • Manual ITUR: Characterization of the ITUR; materials, devices and equipment; Project, Installation, Testing. • Constitution of the project ITUR: technical; disclaimer; descriptive; map measurements and budgeting; drawings. • Project ITUR: licensing; execution. 					
Teaching and Learning Methods Lectures - Theoretical analysis of content, alternating with practical examples and interacting with students. Seminars/Problem solving classes - Resolution of chips by the teacher exercises the statement after discussion with the students, the methods used and the clarification of doubts Tutorials - Resolution of chips exercises and / or execution of work (s) for evaluation by the students individually to answer questions when prompted.					
Assessment A written test (E) with a weight of 70% in the final classification (FC), or; Written exam (E) with a weight of 70% in the FC; Work Assessment (TA) with a weight of 30% in the FC; The evaluation work is required. The student obtains approval in the discipline if you pass the Work Test and Evaluation / Examination. It is considered approved when the student has at least 8 (out of 20 values) to each of the					

⁽¹⁾ Lectures (T); Seminars/Problem-solving classes (TP); Practical and laboratorial classes (PL); Fieldwork (TC); Workshops (S); Tutorials (OT); Students Individual Work (TA).

assessments, and in its sum will have to get 9.5. The
The FC will be given by: $FC = 0.7 \times E + 0.3 \times TA$.

Bibliography

- [1] Decree-Law 123/2009 of 29 May and 258/2009 of 25 September;
- [2] "Manual ITED - Requirements and Technical Specifications" - ANACOM, second edition, November 2009;
- [3] "Manual ITUR - Infrastructures for telecommunications in housing developments, urban settlements and Buildings" - ANACOM, first edition, November 2009;
- [4] "AutoCAD - The Complete Reference," Nelson Johnson, McGraw-Hill.

Demonstration of the syllabus coherence with the curricular unit's objectives

In order to achieve the desired goals in this course, students must have knowledge of the law, and apply it to real situations.

The real situations, mentioned above, are described in the manual and refer to buildings, lots, residential areas and cluster of buildings.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

Students achieve goals through the various teaching methodologies proposed. . In lectures theoretical knowledge is analyzed and explained in order to achieve the support knowledge, supplemented by exercises in T/P classes.

In classes Lectures / Tutorials Practice and students learn to scale telecommunications networks to integrate the building projects, lots, residential areas and cluster of buildings.

⁽¹⁾ Lectures (**T**); Seminars/Problem-solving classes (**TP**); Practical and laboratorial classes (**PL**); Fieldwork (**TC**); Workshops (**S**); Tutorials (**OT**); Students Individual Work (**TA**).



Course Unit: Measurements and Instrumentation					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications / Energy Systems and Control					
Teaching Language(s): Portuguese Course Unit Chair: Paulo Jorge Maia dos Santos (pjsantos@ualg.pt) Teaching Staff: Paulo Jorge Maia dos Santos (Lecturing load: 15T+30PL+105OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2 nd	1 st	15T+30PL+35OT	Required		5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) This course aims to study the working principle of the measuring instruments (ammeter, voltmeter, ohmmeter and wattmeter) and provide students the ability to decide which equipment to use, when to perform certain measures. Use and distinguish the different commands and the constituent blocks of oscilloscope as well as perform measurements of voltage, time and frequency of waveforms. Studying the mistakes and how diminishes them, when performing electrical measurements. Students should be able to apply the theoretical knowledge acquired in laboratory work, by collecting various electrical measurements in the laboratory, in order to make reports about a particular subject. Discussion and analysis on data obtained in the laboratory and drawing of conclusions. Ability to work in a team.					
Prerequisites No prerequisites.					
Curriculum (max. 1000 characters) 1 – The analogue oscilloscope – Study the constitution of cathode ray tube, study of vertical and horizontal channel controls, operation of the oscilloscope in X-Y mode. 2 – Analogue and digital measuring instruments – Mobile framework instruments, Electrodynamics, electromagnetic and electrostatic. 3 – Measurement techniques and metrology principles. 4 – The Impedance measurement principles and techniques: ohmmeter, voltmeter-ammeter and bridge circuit. 5 – The power measurement: single-phase and three-phase circuits.					
Teaching and Learning Methods (max. 1000 characters including assessment) Lectures - using exposition, explanation and projection of slides and examples; Laboratory classes, where the students complements their explanations method with experimental circuits and measurements; Tutorials, where students solve analytical exercises and problems under teacher's support and where individual or group assignments are proposed.					
Assessment The evaluation has two components: -5 laboratory work performed in group, for the application of concepts acquired during the lectures. After the work, students will have to elaborate a report (R) in each group. -Realization of 3 Mini tests (MT), with a minimum of 8 values in each, or final exam, with a minimum of 9.5 values, about the subject under discussion in lectures and practical work carried out. The final grade in the discipline is calculated by: rating = 60% (MT or exam) + 40% (R) The student is approved when get rating equal to or greater than 10 in the final grade.					
Bibliography (max. 1000 characters) [1] Teacher's c.u. material, lectures' slides, Sebenta de Instrumentação e Medidas, ISE/UAlg.					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

- [2] Aurélio Campilho, **Instrumentação Electrónica. Métodos e Técnicas de Medição**, FEUP Edições.
 [3] Borges da Silva, **Instrumentação e Medidas**, IST.
 [4] Borges da Silva, **Medidas Eléctricas**, IST.
 [5] Stanley Wolf & Richard Smith, **Student Reference Manual for Electronic Instrumentation Laboratories**, Ed. McGraw-Hill.
 [6] António Dourado, **Sistemas Electrónicos de Medida**, FCTUC.

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

One of the main goals of this course is related to students' contact with the laboratory and handling of various measuring instruments. Thus, the contents are related to the acquisition of theoretical principles, description of several measuring instruments as well as its correct application in different measures. In addition, students should be prepared for use and distinguish the several measuring instruments, as well as learn to handle errors that are associated when electrical measurements are performed.

The lectures will be accompanied by performing in various tutorial guidance lessons exercises of application of theoretical foundations as well as preparation of laboratory work. In the laboratory classes, the students must perform several practical work in order to consolidate the several contents.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

In the case of a curricular unit which is the basis for the practical implementation of concepts acquired in this and other units, is fundamental a good interconnection and alternation between theoretical concepts and practical applications. For this purpose, are taught theoretical lessons where the teacher introduces and explains in detail the contents of the C.U. At the same time, the tutorial classes focus on solving problems of a practical nature and proposed theoretical-practice that allows the full understanding of the contents.

In order to consolidate and deepen the acquisition of jurisdiction are taught laboratory classes with work in group, related to the syllabus, under the guidance of teaching staff, promoting the training of knowledge gained and the evaluation of the student's knowledge level.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Introduction to Operating Systems					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications					
Teaching Language(s): Portuguese Course Unit Chair: João Miguel Fernandes Rodrigues Teaching Staff: João Rodrigues (Lecturing load: 15T+30TP+30OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3rd	2nd	15T+30TP+30OT	Elective	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes Understanding the structure and functionality of an operating system. Perform administrative operations on an operating system. Acquire basic knowledge of systems programming.					
Prerequisites Elementary knowledge of informatics and programming.					
Curriculum Theory component - basic concepts about the operating system and its functions: 1. General concepts: 1.1 Architecture of a computer and computational model; 1.2 Functions of an operating system; 1.3 Structure of the operating systems. 2. Processes management: 2.1 Processes; 2. Tasks; 2.3 CPU scheduling; 2.4 Processes synchronization; 2.5 Deadlocks. 3. Memory management: 3.1 Main memory; 3.2 Virtual memory. 4. File management; 4.1 File system; 4.2 I/O Systems; 5. Topics about safety and security: 5.1 Protection; 5.2 Security. Practice component - Configuration, administration and programming of a operating systems: 1. Characteristics, installation, configuration and administration of operating systems: Windows, Linux Ubuntu (Shell Script,...) and Windows Server 2008 (Active Directory, rules, group policies,...). 2. Application development tools and basic programming systems (Low-level File Access, Threads, Sockets,...).					
Teaching and Learning Methods This course is essentially practical. After the introduction of theoretical basic concepts about the operating systems, the students are led to resolve the tasks for which they are proposed by researching in books and on the Internet.					
Assessment Written test or exam (20% endnote) and practical work including presentation (80% endnote); with minimum score on each component 7 values (0-20). The practical work has the following quotation: Administration and configuration of operating systems (60%), systems programming (40%).					
Bibliography					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

- [1] João Rodrigues, Acetatos das aulas teóricas-práticas, UAIG/ISE-DEE, 2012
- [2] José Alves Marques, Paulo Ferreira, Carlos Nuno da Cruz Ribeiro, Luís Veiga e Rodrigo Rodrigues, Sistemas Operativos., Oct 2012, FCA, ISBN 978-972-722-756-3.
- [3] Fernando Pereira e Rui Guerreiro, Linux – Curso Completo (7ª Ed.). FCA, 2011, ISBN: 978-972-722-701-3
- [4] António Rosa, Windows Server 2008, Curso Completo. FCA, 2008, ISBN: 978-972-722-210-0
- [5] Abraham Silberschatz, Peter Galvin, and Greg Gagne, Operating System Concepts. 7th edition, John Wiley & Sons, 2005

Demonstration of the syllabus coherence with the curricular unit's objectives

The operating systems are one of the most nuclear areas in informatics, with several tens of years of evolution. It is fundamental to understand today's computer systems. Its role in the overall performance of applications, security, networking or mobile, in many cases, the main condition for the success or failure of a project. The program details the relevant operating systems, subsystems and features two views that are complementary and equally relevant: the interfaces that allow developers to invoke the functions of the operating system, and the internal structure of each of the subsystems that make up the operating system. This dual vision, "as it uses and how it is conducted," extends to two reference market operating systems: Unix (using Ubuntu Linux 12) and Windows (using Win 7/8 and Server 2008), seeking to illustrate similarities, differences, specificities and complementarities between these systems.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

This course runs in parallel with the UAIG/ISE course of Information and Communication Technologies. In the case of Electronic and Electrical Engineering the UC have one more weekly theoretical hour, with the objective of complementing theoretical concept of essential base for a course of Engineering. Theoretical concepts are presented with the use of oral exposure from the teaching staff, being always accompanied by practical examples and illustrations. Additionally, justified comments are made by comparing the various operating systems with regard to their efficiency, and applicability.

In the remaining 4 weekly hours, learning employs the fundamental methodology of Problem Based Learning (PBL); grows on group work, serving the needs of solving problems, being student-centered and assuming the diversity of personal learning models. Fits among other goals of the UC, is to install and administer operating systems. The practical component begins by installing and configuring a Windows Server (duration of 5 weeks), simulating for the needs of a small/average hotel, where the "clients" are Windows XP machines, 7 or 8. Then, enters the OS Linux Ubuntu 12, which makes its installation and administration, also by carrying out a Shell Script programming project (duration 5 weeks). Ending (last 5 weeks), with the acquisition of the basic concepts of systems programming, for this is proposed and implemented a set of traditional games (e.g. 4-on-online), using the contents of the program such as "thread" and "sockets" (on Linux).

Electronic tutoring platform of UAIG is used during the course of discipline with the following objectives: a) Publication of materials of practical classes; b) publication of evaluations; c) publishing notices of discipline; d) creation of an area of communication (discussion forum) for questions, which aims to stimulate the communication Professor/ student and student/students.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Electrical Machines I					
Department: Electrical Engineering Department Programme: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialisation in: Energy Systems and Control Teaching Language(s): Portuguese Course Unit Chair: Carlos Manuel Aguiar Rodrigues Cabral Teaching Staff: Carlos Manuel Aguiar Rodrigues Cabral (Lecturing load: 30T+15TP+ 60OT), João Manuel Martins Gomes (Lecturing load: 15TP+30OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 rd	1 st	30T+15TP+35OT	Required	15241057	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes Develop necessary skills for operation and maintenance of electrical machines, namely transformers and induction machines. Develop necessary skills for analysis and selection of those electrical machines for specific applications.					
Prerequisites Electromagnetism; Vector Analysis; Circuit Analysis I and II; Mathematics I; Applied Electrical Engineering					
Curriculum <ol style="list-style-type: none"> 1. <u>Introduction to Electrical Machines</u> 2. <u>Transformers</u> <ol style="list-style-type: none"> 2.1. Constructive aspects 2.2. Principle of operation 2.3. Ideal single-phase transformer 2.4. Real single-phase transformer 2.5. Equivalent circuits 2.6. Equivalent circuit parameter evaluation 2.7. Voltage regulation 2.8. Power flow and efficiency 2.9. Three-phase transformers 2.10. Parallel operation of transformers 2.11. Autotransformers 3. <u>AC electrical machines fundamentals</u> <ol style="list-style-type: none"> 3.1. Constructive aspects 3.2. Windings 3.3. Magnetomotive force 3.4. Rotating magnetic field 3.5. Induced electromotive forces 3.6. Torque developed 4. <u>Induction electrical machines</u> 					

⁽¹⁾ Lectures (T); Seminars/Problem-solving classes (TP); Practical and laboratorial classes (PL); Fieldwork (TC); Workshops (S); Tutorials (OT); Students Individual Work (TA).

- 4.1. Constructive aspects
- 4.2. Principle of operation
- 4.3. Equivalent circuits
- 4.4. Equivalent circuit parameter evaluation
- 4.5. Power and torque equations
- 4.6. Power flow and efficiency
- 4.7. Operation as a generator
- 4.8. Starting methods
- 4.9. Double-cage motors
- 4.10. Speed control
- 4.11. Single-phase motors

Teaching and Learning Methods

Theoretical lectures: using exposition and explanation, supported by visual resources (video projector)
 Theoretical-practical classes: solving problems in order to complement the teacher's explanations.
 Tutorial orientation classes: under teacher's guidance, the students solve problems and execute a set of laboratorial works.
 Field trips.

Assessment

Two tests during the semester, or a final examination, weighting 70%; and a Laboratory examination, weighting 30%.

$$\text{Final Grade} = 70\% \times \text{Tests grade's average} + 30\% \times \text{Lab examination grade}$$

or $\text{Final Grade} = 70\% \times \text{Examination grade} + 30\% \times \text{Lab examination grade}$

Students fulfil minimum passing requirements if one of the previous formulas reaches 9,5 out of 20, unless they don't meet the minimum 8 out of 20 in one of the items (test/exam or Lab examination).

Bibliography

- [1] Teacher's texts on Electrical Machines I.
- [2] Syed A. Nasar, "Máquinas Eléctricas", McGraw-Hill, 1984.
- [3] Dino Zorbas, "Electric Machines", West Publishing Company, 1989.
- [4] Stephen J. Chapman, "Electric Machinery Fundamentals", McGraw-Hill, 2005.
- [5] P. C. Sen, "Principles of Electric Machines and Power Electronics", 1997.
- [6] Theodore Wildi, "Electrical Machines, Drives and Power Systems", Prentice Hall, 1991.

Demonstration of the syllabus coherence with the curricular unit's objectives

Electric machines play a crucial role in electricity production and in the vast majority of existing industries. Therefore, there is a need for technicians who not only know how to analyze and select electrical machines for certain applications, but also how to provide for their correct operation and maintenance. The syllabus above aims to provide students and future technicians with all of these skills, including theoretical and practical knowledge of the most common types of electric machines on the market. In this course, students learn from a theoretical and practical point of view, the constructive aspects, principles of operation, operating characteristics and performance of two types of electric machines: transformers and induction machines.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

For the development of competencies in the field of electric machines, i.e. to achieve the learning objectives of this course, students must:

- 1- Learn all the theoretical aspects of transformers and induction machines (constructive aspects, principle of operation, operating characteristics, performance, etc.), what they achieve through theoretical lectures and theoretical-practical classes.
- 2- Apply and consolidate theoretical knowledge by solving specific problems, what they achieve through theoretical-practical classes and tutorial orientation classes.
- 3 – Complement theoretical knowledge with practical knowledge, what they achieve through tutorial classes in the laboratory of electrical machines and field trips.

⁽¹⁾ Lectures (T); Seminars/Problem-solving classes (TP); Practical and laboratorial classes (PL); Fieldwork (TC); Workshops (S); Tutorials (OT); Students Individual Work (TA).



Course Unit: Electrical Machines II					
Department: Electrical Engineering Department Programme: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialisation in: Energy Systems and Control Teaching Language(s): Portuguese Course Unit Chair: Carlos Manuel Aguiar Rodrigues Cabral Teaching Staff: Carlos Manuel Aguiar Rodrigues Cabral (Lecturing load: 30T+30TP+ 90OT), João Manuel Martins Gomes (Lecturing load: 30OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 rd	2 nd	30T+15TP+35OT	Required	15241057	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes Develop necessary skills for operation and maintenance of electrical machines, namely synchronous machines and direct current machines. Develop necessary skills for analysis and selection of those electrical machines for specific applications.					
Prerequisites Electromagnetism; Vector Analysis; Circuit Analysis I and II; Mathematics I; Applied Electrical Engineering					
Curriculum <ol style="list-style-type: none"> 1. <u>Synchronous electrical machines</u> <ol style="list-style-type: none"> 1.1. Constructive aspects 1.2. Principle of operation 1.3. Magnetic field and induced electromotive force 1.4. Armature reaction 1.5. Cylindrical rotor alternator 1.6. Operating characteristics 1.7. Salient-pole alternator 1.8. Power and torque equations 1.9. Synchronous motors 1.10. Parallel operation of alternators 1.11. Electromechanical stability 2. <u>DC electrical machines fundamentals</u> <ol style="list-style-type: none"> 2.1. Constructive aspects 2.2. Windings 2.3. Magnetomotive force 2.4. Induced electromotive force 2.5. Torque developed 3. <u>DC electrical machines</u> <ol style="list-style-type: none"> 3.1. Constructive aspects 3.2. Principle of operation 3.3. Armature reaction 					

⁽¹⁾ Lectures (T); Seminars/Problem-solving classes (TP); Practical and laboratorial classes (PL); Fieldwork (TC); Workshops (S); Tutorials (OT); Students Individual Work (TA).

- 3.4. Commutation
- 3.5. DC generators
- 3.6. DC motors
- 3.7. Operating characteristics
- 3.8. Starting methods
- 3.9. Speed control

Teaching and Learning Methods

Theoretical lectures: using exposition and explanation, supported by visual resources (video projector)
 Theoretical-practical classes: solving problems in order to complement the teacher's explanations.
 Tutorial orientation classes: under teacher's guidance, the students solve problems and execute a set of laboratorial works.
 Field trips.

Assessment

Two tests during the semester, or a final examination, weighting 70%; and a Laboratory examination, weighting 30%.

$$\text{Final Grade} = 70\% \times \text{Tests grade's average} + 30\% \times \text{Lab examination grade}$$

or $\text{Final Grade} = 70\% \times \text{Examination grade} + 30\% \times \text{Lab examination grade}$

Students fulfil minimum passing requirements if one of the previous formulas reaches 9,5 out of 20, unless they don't meet the minimum 8 out of 20 in one of the items (test/exam or Lab examination).

Bibliography

- [1] Teacher's texts on Electrical Machines II.
- [2] Syed A. Nasar, "Máquinas Eléctricas", McGraw-Hill, 1984.
- [3] Dino Zorbas, "Electric Machines", West Publishing Company, 1989.
- [4] Stephen J. Chapman, "Electric Machinery Fundamentals", McGraw-Hill, 2005.
- [5] P. C. Sen, "Principles of Electric Machines and Power Electronics", 1997.
- [6] Theodore Wildi, "Electrical Machines, Drives and Power Systems", Prentice Hall, 1991.

Demonstration of the syllabus coherence with the curricular unit's objectives

Electric machines play a crucial role in electricity production and in the vast majority of existing industries. Therefore, there is a need for technicians who not only know how to analyze and select electrical machines for certain applications, but also how to provide for their correct operation and maintenance. The syllabus above aims to provide students and future technicians with all of these skills, including theoretical and practical knowledge of the most common types of electric machines on the market. In this course, students learn from a theoretical and practical point of view, the constructive aspects, principles of operation, operating characteristics and performance of two types of electric machines: synchronous machines and direct current machines.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

For the development of competencies in the field of electric machines, i.e. to achieve the learning objectives of this course, students must:

- 1- Learn all the theoretical aspects of synchronous machines and direct current machines (constructive aspects, principle of operation, operating characteristics, performance, etc.), what they achieve through theoretical lectures and theoretical-practical classes.
- 2- Apply and consolidate theoretical knowledge by solving specific problems, what they achieve through theoretical-practical classes and tutorial orientation classes.
- 3 – Complement theoretical knowledge with practical knowledge, what they achieve through tutorial classes in the laboratory of electrical machines and field trips.

⁽¹⁾ Lectures (T); Seminars/Problem-solving classes (TP); Practical and laboratorial classes (PL); Fieldwork (TC); Workshops (S); Tutorials (OT); Students Individual Work (TA).



Course Unit: Mathematics Applied to Electrical Engineering					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications / Energy Systems and Control Teaching Language(s): Portuguese Course Unit Chair: <i>Paulo Alexandre da Silva Felisberto</i> Teaching Staff: <i>Paulo Alexandre da Silva Felisberto</i> (Lecturing load: 15 T+ 30 TP+ 35 OT); <i>António Fernandes Marques de Sousa</i> (Lecturing load: 15 TP+ 30 OT); ...					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2	1	15T+30TP+35OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) The student further develops the concept of complex numbers and complex functions. Understands the basics of the Fourier series and transform and Laplace transform. Master transforms techniques between time and frequency domain. Understand and apply the basic properties of transforms. Knows how to solve differential equations using the Laplace transform. Know and apply the transforms and Fourier series to circuit analysis.					
Prerequisites Background in complex numbers, limits and series. Background in derivatives and integration.					
Curriculum (max. 1000 characters) Introduction to complex analysis: complex numbers revisited, complex functions, derivatives and integration of complex function. Laplace transform: The Laplace transform. Properties of Laplace transform. Inverse Laplace transform. Using Laplace transform to solve differential equations and electrical circuit analysis. Fourier series: Representing a periodic function in Fourier series. Complex and trigonometric series. Frequency spectrum of a periodic signal. Using Fourier series to electrical circuit analysis. Fourier transform. Fourier transform of signals. Signal's frequency spectrum. Properties of the Fourier transform. Using Fourier transform to electrical circuit analysis.					
Teaching and Learning Methods (max. 1000 characters including assessment) The concepts are explained in lecture classes. During practical classes are presented problems and analytical solved. The students are encouraged student to discuss the steps leading to problem resolution. In tutorial classes students individually or in small groups solve problems analytically and using Matlab. The e-learning software platform is used to make available courses materials, assign homework and facilitate communication with students.					
Assessment The assessment comprises 2 parts: -Theoretical: 2 tests or exam (85% of the final grade, minimum of 8 in 20); -Practical: 3 homework (15% of final grade)					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Bibliography (max. 1000 characters)

- [1] Carreira, M.^a Adelaide, M.^a S.M. Nápoles, *Variável Complexa – Teoria Elementar e Exercícios Resolvidos*, McGraw-Hill.
- [2] Spiegel, Murray R., *Transformadas de Laplace*, Schaum's Series, McGraw-Hill
- [3] Bajpai, A.C., et al, *Mathematics for engineers and scientists* (vol.2), John Wiley & Sons.
- [4] LePage, Wilbourn R., *Complex variables and the Laplace Transform for engineers*, Dover Publications
- [5] Spiegel, Murray R., *Complex variables*, Schaum's Series, McGraw-Hill

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

This course addresses one of the fundamental mathematical tools used in electrical engineering, the transforms. The syllabus covers the fundamental of transforms, appropriate to the maturity of the students, being the basis for different forthcoming courses. Calls to the basics of circuit analysis to illustrate the application of the transforms. The introductory part of complex analysis begins with a thorough review of complex complex, and an elementary introduction to complex analysis as the foundation of transforms.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

It is intended that students completing this course master the complex numbers and complex functions in sufficient depth to cover the needs of forthcoming courses at 1st cycle. Complex numbers have been discussed in previous courses in general; this course focuses on those aspects, representations and typical methods used in electrical engineering. Transforms and Fourier series are discussed for the first time in the course, and a pragmatic approach is used attain the needs of electrical engineering. Learning is strongly based on the active participation of students in problem solving, both at group-level class during practical classes, either individually or in small groups in tutorial guidance. Students are also faced with the resolution of an individual set of problems to consolidate acquired skills and help students to focus on the essentials. The proposed exercises are of low to medium complexity, and discourage the use of the calculator as a basic tool. The calculator should be used to compare results. The use of e-learning platform allows better communication between students and teachers, facilitating clarify questions at any time.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: MECHATRONICS					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Power and Control Systems Teaching Language(s): Portuguese Course Unit Chair: <i>Isménio Lourenço Eusébio Martins</i> Teaching Staff: <i>Isménio Lourenço Eusébio Martins</i> (Lecturing load: 30 T+ 15 TP+35 OT);					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 st	1 st or 2 nd	30 T+15TP+30 OT	Optional	--	10
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 30 Fieldwork: 0 Individual Work and Assessment: 65 </div>					
Learning Outcomes (max. 1000 characters) 1. Understanding of the concept of mechatronics and its industrial and social framework 2. Ethical and moral attitudes development 3. Knowledge of the operation and use of the most relevant mechatronic equipment 4. Development of mechatronic systems design capabilities 5. Development of numerical control machine programming skills 6. Development of teamwork skills 7. Development of team work exhibition capabilities					
Prerequisites Knowledge of electronics, power electronics, electric machines, programming, microprocessors and automatic control.					
Curriculum (max. 1000 characters) 1. Introduction to mechatronics 2. Mechanical actuators 3. Hydraulic and pneumatic actuators 4. Electric actuators 5. Sensors, transducers and signal conditioning 6. Industrial electronics 7. Industrial automation 8. Mechatronic industrial equipment 9. Computer numerical control machines					
Teaching and Learning Methods (max. 1000 characters including assessment) 1. – Lectures (T) – theoretical exposition of the contents, using multimedia “PowerPoint” presentations, alternated with practical examples and interacting with students. 2. – Practical classes (TP) - Resolution by the Professor of exercise sheets after discussion with students about the solving methods to be used and doubts clarification. 3. – Tutorial classes (OT) – Laboratory work, intended for the practical knowledge of the operation and the operation of different devices and equipment. Teamwork: mechatronic systems projects’ development.					
Assessment 1. – 2 Mini-Tests (2x25%) or Exam - 50%					

(1) Ensino teórico (T); Teórico-prático (TP); Prático e laboratorial (PL); Trabalho de campo (TC); Seminário (S); Orientação tutorial (OT); Trabalho individual do aluno (TA).

2. – Project – 50%. (required) – 50%

Bibliography (max. 1000 characters)

- [1] Clarence W. De Silva, "Mechatronics: An Integrated Approach", CRC Press, 2005, ISBN 0-8493-1274-4.
- [2] Newtown C. Braga, "Robotics, Mechatronics, and Artificial Intelligence: Experimental Circuit Blocks for Designers", Butterworth - Heinemann, 2002, ISBN 0-7506-7389-3.
- [3] Sergey E. Lyshevski, "Electromechanical Systems, Electric Machines, and Applied Mechatronics", CRC Press, 2000, ISBN 0-8493-2275-8.
- [4] Mohamad A. El- Sharkawi, "Fundamental of Electric Drives", Brooks Cole, 2000, ISBN 0-534-95222-4.
- [5] Yoram Koren, "Computer Control of Manufacturing Systems", ISBN 0-07-035341-7.
- [6] Acar, M., "Mechatronics challenge for the higher education world". IEEE transactions on Components, Packing, and Manufacturing Technology. Vol. 20, no. 1, pp. 14-20. 1997

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The concept of Mechatronics and its industrial and social framework, as well as the development of ethical and moral attitudes are transversal objectives of all syllabuses taught at UC. The capability of knowledge and understanding is obtained from study of the operation and use of the most relevant mechatronic equipment: mechanical systems of action; hydraulic and pneumatic actuators; the electric actuators; sensors, transducers and signal conditioning circuits. The mechatronics' systems project capabilities are developed with the study of industrial electronics and industrial automation, knowledge of mechatronics' equipment and programming practice of computer numerical control machines.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodologies used in curricular unit fit in theoretical classes where is made the theoretical exposition of the contents, using multimedia slides, presentation of practical examples, interacting with students and promoting the critical discussion.

In the practical classes the teacher teaches the paths leading to the resolution of problems, presents case studies and examples, and shows projects already carried out students of other courses of Mechatronics, motivating the search for innovation and knowledge.

The learning is completed in tutorial classes, where practical cases are resolved and where are discussed the targeted projects. These classes are also conducted under laboratory work required for the implementation of projects. The projects are carried out in groups in order to promote teamwork capabilities. The projects are presented by each group, developing capabilities for public exhibition of the work carried out and presented as a team.

Evaluation methodologies adopted allow knowing the developments in the acquisition of skills by the students motivate the study; promote the consolidation of knowledge and know-how.

⁽¹⁾ Ensino teórico (T); Teórico-prático (TP); Prático e laboratorial (PL); Trabalho de campo (TC); Seminário (S); Orientação tutorial (OT); Trabalho individual do aluno (TA).



Course Unit: Microprocessors

Department: Electrical Engineering Department

Program: 1st Cycle in Electrical and Electronics Engineering

Scientific Area: Electrical Engineering

Specialization in: Information Technology and Telecommunications / Energy Systems and Control

Teaching Language(s): Portuguese

Course Unit Chair: António João Freitas Gomes da Silva (asilva@ualg.pt)

Teaching Staff: António João Freitas Gomes da Silva (Lecturing load: 30T+15TP+105OT)

Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2 nd	1 st	30T+15TP+35OT	Required	--	5

Workload (hours): 140

Classes: 45

Tutorials: 35

Fieldwork: 0

Individual Work and Assessment: 60

Learning Outcomes (max. 1000 characters)

Generic Objectives: It is intended that in this course students acquire skills in idealizing, designing and implementing embedded systems within programmable logic devices (PLDs) and microprocessors.

Specific Objectives:

- 1- Understanding the differences between: non-programmable digital circuits; digital circuits programmable hardware (PLDs), digital circuits programmable with software (microprocessors).
- 2- Ability to use hardware description languages, in particular VHDL.
- 3- Ability to design digital systems using programmable logic devices, including FPGAs and CPLDs.
- 4- Knowledge of the structure and functioning of a computer system based on microprocessors.
- 5- Knowledge of concepts relating to the operation, internal structure and programming of microcontrollers.
- 6- Ability to develop programs in Assembler for microcontrollers
- 7- Ability to design small embedded systems using microcontrollers

Prerequisites

Knowledge acquired in the subjects Mathematics Secondary Education

Curriculum (max. 1000 characters)

PART 1: PROGRAMMABLE LOGIC DEVICES

1.1. Introduction to Programmable Logic Devices

1.4. Top-Down projects and implementation of embedded systems

1.3. Development Tools: Altera University Program Design, MaxPlus II

1.2. Hardware description languages: VHDL

1.5. Design and implementation of Microprocessors in VHDL

PART 2: MICROCONTROLLERS

2.1. Introduction to Microprocessor systems

2.2. Introduction to Microcontrollers PICmicro ®

2.3. PIC16F84A microcontroller

2.4. Programming in Assembly

2.5. Development Tools: MPLAB

Teaching and Learning Methods (max. 1000 characters including assessment)

For the explanation of theoretical concepts there will be T classes using slides and examples on the board; for presenting and solving practical problems there will be TP classes; for the design and implementation of codes for programmable logic devices and assembler programs for microprocessors, with teacher support, there will be OT class, where in addition there will be practical group works in the lab for experimentation and evaluation.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Assessment:

There are 2 components to the assessment:

- 3 Practical works
- 2 Tests and / or Exam for a T and TP evaluation.

Final grade = $0.6 \times (\text{mean of tests or exam}) + 0.1 \times (\text{grade of 1st practical work}) + 0.1 \times (\text{grade of 2nd practical work}) + 0.2 \times (\text{grade of 3rd practical work})$

Each evaluation components have a minimum score of 9 values.

Bibliography (max. 1000 characters)

1. I. Martins, A. Silva; "Acetatos de apoio à cadeira de Microprocessadores 1"
2. I. Martins, A. Silva; "Roteiro prático de apoio à cadeira de Microprocessadores 1"
3. Altera Corporation, "Max+Plus II, Programmable Logic Development System, Getting Started"
4. Altera Corporation, "University Program Design Laboratory Package User Guide"
5. V. P. Nelson; Prentice Hall; "Digital Logic Circuit Analysis and Design"
5. E. O. Hwang; Digital Logic and Microprocessor Design with VHDL
6. Microchip Technology inc.; "PIC16F84A Data Sheet"
7. Microchip Technology inc.; "MPASM and MPLINK PICmicro Quick Reference Guide"
8. Microchip Technology inc.; "MPASM User's Guide with MPLINK and MPLIB"
9. Microchip Technology inc.; "MPLAB IDE, Simulator, Editor User's Guide"
10. Microchip Technology inc.; "Pic Start Plus User's Guide"
11. Michael Predko, Myke Predko; Paperback; "Programming & Customizing PICmicro Microcontrollers"
12. Carl J. Bergquist; Paperback; "Guide to PICmicro Microcontrollers"

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

This course's contents are students' first contact with the development of embedded systems and aims to endow them with the ability to design and implement medium complexity digital circuits using programmable logic devices and microcontrollers.

For this, are taught initially: the Top-down and Bottom-up methodologies, the hardware programming language, VHDL; and the typology of programmable logic devices, namely FPGAs and CPLDs.

Secondly are taught the methods of designing and implementing embedded systems on microcontrollers. Between these two phases are taught the concepts of developing dedicated microprocessor in VHDL. The T and TP classes will be accompanied by practical works built during OTs, those works will involve embedded circuits of growing complexity both in project and implementation.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

As this is a course that serves as a basis for the implementation of many of the electronic systems which have the biggest socioeconomic visibility and on which students have the biggest expectations, it is essential to have a good interconnection and alternation between the theoretical concepts and the practical applications. In such context this course aims at providing the students with the necessary skills for projecting and implementing embedded systems involving PLDs and Microcontrollers. Next, we will expose the adopted teaching methods, relating them to the course main learning goals.

The adopted teaching methodology will assume the Top-down and Bottom-up project methodologies as the basic tools for conceiving and implementing embedded systems; and during the teaching/learning process such methodologies will be intensively used.

In the first stage, the themes that serve as a basis for the development of embedded systems with PLDs will be addressed, namely: Programmable Logic Devices (from PALs to CPLDs and FPGAs); hardware description language, VHDL; instantiation, concurrent programming and sequential programming.

During the learning process students experiment what they learn implementing small embedded systems in the MAXPLUS II development kit. This stage ends with a lab work where students demonstrate what they learn by implementing in a CPLD or in FPGA a project developed in VHDL.

In the second stage we will approach the implementation of dedicated Microprocessors in VHDL. This stage starts with the microprocessor architecture definition and the development of the Microprocessor basic components; and ends with integration of all components in a single system which also includes interface components. The theoretical exposition will be complemented with practical implementations where the students experiment what they learn. This stage ends with an evaluation work where the

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

students implement in a FPGA a dedicated microprocessor developed in VHDL.

The third stage will approach the embedded systems development with microcontrollers, the differences between Microprocessors and Microcontrollers will be established, the assembler language issues will be exposed and the development tools will be presented. The theoretical exposition will be complemented with practical implementations where the students experiment what they learn. This stage ends with an evaluation work where the students implement a microcontroller based system.

During the course the growing complexity of the works and the systematic use of the Top-down methodologies will provide the students with the abilities for designing and implementing any medium complexity embedded system based on PLD's and Microcontrollers.

⁽¹⁾ Theoretical (**T**); Theoretical and practical (**TP**); Practical and laboratorial (**PL**); Field work (**TC**); Seminar (**S**); Tutorial (**OT**); Individual student work (**TA**).



Course Unit: Probability and Statistic

Department: Electrical Engineering Department

Programme: 1st Cycle in Electrical and Electronics Engineering

Scientific Area: Electrical Engineering

Specialisation in: Information Technology and Telecommunications / Energy Systems and Control

Teaching Language(s): Portuguese

Course Unit Chair: Maria Gabriela Figueiredo de Castro Schütz

Teaching Staff: Maria Gabriela Figueiredo de Castro Schütz (Total lecture loading: 50T + 25TP + 105OT)

Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2 st	2 nd	30T+15TP+35OT	Required		5

Workload (hours): 140

Classes: 45

Tutorials: 35

Fieldwork: 0

Individual Work and Assessment: 60

Learning Outcomes

To develop abstract and critical reasoning and the ability to deepen the knowledge.

To obtain a good knowledge of the concepts involved in the syllabus and the ability in their use.

To obtain the capacity to apply the concepts involved in the syllabus to other problems and fields, namely to telecommunication.

Prerequisites

Knowledge acquired in: Secondary Education Mathematics, Mathematic I and Mathematic II.

Curriculum

I - Probability

1. General concepts: Venn diagrams and algebra of sets. Sample space and probabilities. Conditional probability, Bayes theorem and independence.
2. Discrete and continuous random variables.
3. Expected value. Variance and standard deviation. Moment generating function. Characteristic function.
4. Distributions: Bermoulli, Binomial, Geometric, Poisson, Uniform, Exponential and Gaussian.
5. Central limit theorem. Theorem De Moivre-Laplace.
6. Joint distribution function. Marginal distributions. Independence. Conditional distributions. Correlation and covariance.
7. Functions of one and two random variables.

II - Stochastic Processes

1. General concepts: Introduction. n-th order distribution.
2. Expected value, autocorrelation, autocovariance. Cross-correlation, cross-covariance.
3. Stationary stochastic process: Definitions and properties.

Teaching and Learning Methods

Theoretical (T) - Theoretical presentation of contents, using power point and practical examples while interacting with students.

Theoretical and Practical (TP) - Exercises solving by the professor after discussion of each problem and solving methods with the students. Answer to students questions.

Tutorial (OT) - Presentation by the students of the solutions found for the proposed exercises. Correction of exercises and answering students' questions.

Assessment

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Parceled assessment: two written tests with a minimum grade of 8 points in each one and rating is equal to their average.

Or Continuous assessment: parceled assessment (90%) and participation in TP and OT (10%). Students have to choose one of the above assessments in the semester beginning.

Final Assessment: Written exam.

All evaluations are done on a scale of 0 to 20.

The student is approved having at least 9.5 points in continuous/parceled or final assessment.

Bibliography

Lectures' slides and worksheets of exercises for TP and OT are available.

[1] ASH, C The Probability Tutoring Book IEEE Press, 1993.

[2] BARKAT, M. Signal Detection and Estimation Ed. Artech House, 1991.

[3] COOPER, G. MCGILLEN, C. Probabilistic Methods of Signal and System Analysis HRW, International Editions, 1986.

[4] LEON GARCIA, A. Probability Random Processes for Electrical Engineering, Addison-Wesley, 1989.

[5] LIPSCHUTZ, S. Probabilidade, McGraw-Hill, 1984.

[6] MURTEIRA, B. Probabilidades e Estatística, vol. I, McGraw-Hill, 1979.

[7] PAPOULIS, A. Probability Random Variables and Stochastic Processes McGraw-Hill, 1984.

[8] SPIEGEL, M. Probabilidades e Estatística, McGraw-Hill, 1984.

[9] WENTZEL, E. e OCHAROV, L. Applied Problems in Probability Theory Mir Publishers, 1986.

Demonstration of the syllabus coherence with the curricular unit's objectives

The proposed contents introduce the fundamental concepts of Probability and the basics of stochastic processes, allowing the development of analysis and reasoning skills. The contents, namely combinatorial analysis, theoretical distributions application and moments and distributions interpretation, develop reasoning and criterious analysis abilities, allowing the application of the contents in several quotidian problems and in other areas. This knowledge of working with probabilities and the basics of stochastic processes are important tools to the study of telecommunications.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

Theoretical lectures methodology consists in the concepts presentation, illustrated with several examples covering quotidian problems, while interacting with students in order to make them analyze, relate, induce and deduce. This interaction is deepened in the Theoretical and Practical lessons, where exercises related to the taught subjects are solved. Tutorial focus on the students individual work and the difficulties found in solving a set of exercises. Their resolution requires the assimilation of contents. The objective of this approach is to develop the students cognitive, operational and critical analysis abilities autonomously, albeit supervised.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit:: ELECTRIC POWER GENERATION AND TRANSMISSION					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Energy Systems and Control Teaching Language: Portuguese Course Unit Chair:: José Manuel do Livramento (jliv@sapo.pt) Teaching Staff: José Manuel do Livramento (30T); José Manuel Guerreiro Gonçalves (15TP+35OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 rd	1 st	30T+15TP+35OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 10 Individual Work and Assessment: 50 </div>					
Learning Outcomes <ol style="list-style-type: none"> 1. Students are supposed to learn the different energy sources; 2. Analyzing the conventional methods for conversion into electrical energy; 3. Students are supposed to learn and understand the alternative methods of conversion into electricity; 4. Differentiate subsystems of production, transmission, distribution and use of electricity. 5. Calculation of an Electric Transmission Line Electric Power; 6. Electrical phenomena specific: Effect of Crown and Skin Effect 7. Apply the knowledge gained in the analysis and study of the various fields of electrical engineering, namely the Electrical Installations Production, Transmission and Distribution Project. 					
Prerequisites Knowledge of Mathematical Analysis I and II, Linear Algebra and Analytic Geometry, Circuit Analysis, Instrumentation and Measurement Technology, Electricity and Electronics, Mathematics Applied Electromagnetics, Numerical Analysis and Design of Electrical Installations I.					
Curriculum <ol style="list-style-type: none"> 1. Energy Reserves and Resources and Electrical Energy Conversion; 2. Renewable Energy and Alternative Energies; 3. Conventional Energies; 4. Electrical Energy; 5. Electrical Power Systems; Diagrams Loads; 6. Special charges: Driving Force and Electromechanical Equipment; 7. Transmission-Line of Electric Power; 8. Calculations of Transmission-Line parameters and constants; 9. Diagrams of the Transmission Regulation; 10. Economic approach; 11. Crown effect and skin effect; 12. Study Visits <ol style="list-style-type: none"> a. - National Driving and Control Center (REN). (REN - Sacavém); b. -Sines- Thermoelectric Power Plant; 					
Teaching and Learning Methods -Theoretical classes: formal exposition of the matter and, where possible, accompanied by illustrative examples. -Theoretical and practical classes: exercises selected and performed by the teacher. -Tutorial guidance: resolution of exercises and development work. Answering questions individually or Trabalho de Campo: elaboração de relatórios relativos a Visitas de Estudo. -Fieldwork: study visits and compiling their reports					
Assessment					

(1) Ensino teórico (T); Teórico-prático (TP); Prático e laboratorial (PL); Trabalho de campo (TC); Seminário (S); Orientação tutorial (OT); Trabalho individual do aluno (TA).

1- Continuous assessment: 2 written tests + 1 Report (Study Visits);

2- Aproval:

-Necessary conditos

- the arithmetic mean of the two tests must be equal or greater than 50%;
- Delivery and acceptance of the Report of the Study Visit;

- Under these conditions the student may opt out of the written examination

- If the average of the tests is below 50% the student should be subjected to exam, since that has made and been accepted, the Report of the Study Visit.

- The ratings exam prevails over the subsequent.

Bibliografia

1 - Domingos Moura, **Apontamentos de Produção e Transporte de Energia Eléctrica**, UTL/IST, 1983.

2 - José Pedro Sucena Paiva, **Redes de Energia Eléctrica. Uma Análise Sistemática**, IST Press, 2005.

3 - Luis Maria Checa, **Linhas de Transporte de Energia**, Editores Marcombo Barcelona, 1973

4 - **Olle I. Elgerd**, Introdução à Teoria de Sistemas de Energia Eléctrica, **McGraw-Hill**, 1976.

5 - Olle I. Elgerd, **Control Systems Theory**, International Student Edition, 1967.

6 - **William D Stevenson Jr**, Elementos de Análise de Sistemas de Potência, **McGraw-Hill**, 1976.

7 - L. Bessonov, **Electricidade Aplicada para Engenheiros**, 1ª Ed., Editora Lopes da Silva, 1976.

8 - **Fernando Chagas Gomes**, Produção e Transporte de Energia I, II e III, **Edição da Associação de Estudantes do ISEL**, 1994.

9 - José Manuel Guerreiro Gonçalves, **Apontamentos de Produção e Transporte de Energia Eléctrica**, 3º Ano de Electrotecnia, BEEE, ADEE, UAlg/EST, 1998.

Demonstration of the syllabus coherence with the curricular unit's objectives

It is intended to impart theoretical and practical knowledge to enable students to understand the connection between theoretical concepts of Electrical Engineering, under the Electricity and its actual application in the Production, Transmission and Distribution of Electric Energy in order to design appropriate solutions at Project, Construction, Inspection and Maintenance of Power Lines.

The contents begin with the issue of abortion at Planet Energy and their socio-economic implications and technological development.

Will be addressed the issue of Systems and Subsystems Production, Transmission and Distribution Systems with focus on National.

Will explained the whole theory of Transmission-Line will be found where their explanations of electromagnetic phenomena inherent.

Demonstration of the coherence between the teaching methodologies and the learning

This u.c. has a predominantly theoretical nature. The application of the theory can be made only with examples taken from real cases (concrete) and adapted to the calculation possible in a classroom.

Consequently, the methodology applied to the teaching of the subject has to be the classic, consisting in its oral explanation, supported, where deemed appropriate, projections of acetates, or, occasionally, a power-point.

How powerful supplement the methodology of u.c. are performed

two study visits to facilities related to the syllabus:

- Thematic Energy Production: Sines Thermal Power Plant;
- Thematic Transmission and Control: National Driving Center (REN - Sacavém)

⁽¹⁾ Ensino teórico (T); Teórico-prático (TP); Prático e laboratorial (PL); Trabalho de campo (TC); Seminário (S); Orientação tutorial (OT); Trabalho individual do aluno (TA).



Course Unit: Programming					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications / Energy Systems and Control					
Teaching Language(s): Portuguese Course Unit Chair: <i>Carlos Manuel de Azevedo Marinho</i> Teaching Staff: <i>Carlos Manuel de Azevedo Marinho</i> (Total Lecturing load: 15T+ 60 TP+ 70 OT); <i>William Mendonça Santos</i> (Total Lecturing load: 15T+ 15 TP+ 35 OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
1 ^o	1 ^o	15T+30TP+35OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) This unit is mainly to introduce the techniques of algorithmic problem solving in imperative programming computers. To teach the general characteristics of programming C Language. To initiate students in the analysis, formal techniques, coding and solving typified problems.					
Prerequisites					
Curriculum (max. 1000 characters) 1-Algorithmics and programming techniques; 2-General Characteristics of C Language; 3-C-Programming: 3.1-Mechanisms of control (sequences, selections and iterations); 3.2-Functions; 3.3-Arrays; 3.4-Strings; 3.5-Pointers; 3.6-Structures; 3.7-Dynamic memory allocation; 3.8-Files.					
Teaching and Learning Methods (max. 1000 characters including assessment) Theoretical and Practical lessons: -Method of exposition, explanation and projection of the objectives and contents for each week. Placing and answering questions. -Practical laboratory computer. Resolution and coding in C language, typed problems, selected in accordance with the weekly theoretical content. Tutorials: Practical laboratory in computer. Resolution of additional problems.					
Assessment The Assessment consists of two parts: a test or exam (T/E) and a work (W) with the corresponding report, presentation and discussion. The two components are evaluated on a scale of 0 to 20. The final rating is 50% (T/E) + 50% (W), with a minimum grade of 8 values in each component. The students are approved if they receive final rating equal to or greater than 10.					
Bibliography (max. 1000 characters) [1] Portal da UC de Programação - Tutoria eletrónica: https://www.ualg.pt/moodle2012/login [2] Damas, Luís; Linguagem C, FCA-Informática, 2010 [3] Sá, Joaquim Marques; Fundamentos de programação usando C, FCA-Informática, 2005 [4] Gonçalves, João; Programação com Linguagem C, Edições Sílabo, 1993					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

Students reach the unit's objectives by following the syllabus sequence and by working on problems.

They will develop the following skills:

1-Ability to solve problems using algorithmic techniques and imperative programming;

2-Ability to learn how to code, in C language, problems with the various control mechanisms, functions and data structures.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The methodology is based on interactive lessons with the students. Initially some concepts and problems are introduced. Later, the students solve problems, supervised by the teacher, applying and deepening the concepts.

The use of e-learning platform, software tools and laboratory practice are essential in computer learning.

The work is developed individually and also in groups, serving the needs of solving problems / projects, and student-centred and assuming the diversity of personal learning. The students achieve the objectives, proposed above, by working according to this methodology.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Electrical Engineering Project					
Department: Electrical Engineering Department Programme: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialisation in: Energy Systems and Control / Information Technologies and Telecommunications Teaching Language(s): Portuguese/English Course Unit Chair: Carlos Manuel Aguiar Rodrigues Cabral Paulo Gustavo Martins da Silva Teaching Staff: Project's supervisor					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 rd	2 nd	15 OT	Optional	15241057	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 0 Tutorials: 15 Fieldwork: 0 Individual Work and Assessment: 125 </div>					
Learning Outcomes To develop the student's skills like initiative, autonomy, decision-making, and communication thorough a final objectives-oriented work involving various course units, in order to consolidate and/or complement knowledge achieved in the Electrical Engineering course.					
Prerequisites The basic disciplines needed for the final work's development, and the specific disciplines whose syllabi match the work's subject.					
Curriculum Curriculum is dependent on the final work's subject.					
Teaching and Learning Methods - Bibliographical research: the teacher provides the bibliography to the student, related to the work's subject, so that he can improve and update his theoretical knowledge. - OT sessions: the supervisor is responsible for monitoring and orienting the work developed by the student, teaching and giving him all the elements to achieve the learning outcomes. - Writing the final report with further oral presentation and discussion: the supervisor guides the student through the report's execution and the preparation for presentation and discussion.					
Assessment A jury will assess the final work taking into consideration the scientific and solving competence of the proposed problem, the work's method, the summarizing competence, the final report and the oral presentation and discussion. The final grade will be the grades' average of the following items: - Supervisor teacher's grade (1/3); - Final report's grade assigned by the jury (1/3); - Oral presentation and discussion's grade assigned by the jury (1/3).					
Bibliography Bibliography is dependent on the final work's subject and is suggested by the supervisor.					
Demonstration of the syllabus coherence with the curricular unit's objectives The student uses the knowledge and the competences achieved during the course to do a final work (project, lab work, software development, etc.). Besides that, this course unit's syllabus, guided for the					

⁽¹⁾ Lectures (T); Seminars/Problem-solving classes (TP); Practical and laboratorial classes (PL); Fieldwork (TC); Workshops (S); Tutorials (OT); Students Individual Work (TA).

work to be done, aims to complement those competences and knowledge so that the student can carry out the proposed final work successfully. As he carries out the various stages of the work and overcomes the difficulties successfully, the student achieves those competences defined on the learning outcomes. At the end of the work, having written the report and done the oral presentation and discussion, the student will have got not only those competences but also he will have consolidated and updated the knowledge achieved during the course.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

The teaching methodologies certainly contribute to develop the student's competences defined above: Through an exhaustive bibliographical research the student gets a deep understanding of the theoretical aspects related to the task to be done, thus enriching the knowledge achieved during the course.

Through tutorial orientation sessions the supervisor teaches and guides the student through the theoretical and laboratory stages, so that the student can overcome some difficulties that are unavoidable in such works. This contributes to increase his self-confidence and consequently to improve his autonomy and decision-making skills.

Through writing the final report and further oral presentation, the student will develop communication skills that will be a very important asset in his engineering career.

⁽¹⁾ Lectures (**T**); Seminars/Problem-solving classes (**TP**); Practical and laboratorial classes (**PL**); Fieldwork (**TC**); Workshops (**S**); Tutorials (**OT**); Students Individual Work (**TA**).



Course Unit:: ELECTRICAL INSTALLATIONS DESIGN I					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Energy Systems and Control Teaching Language: Portuguese Course Unit Chair:: José Manuel do Livramento (jliv@sapo.pt) Teaching Staff: José Manuel do Livramento (45TP+35OT)					
Ano	Semestre	Carga Horária ⁽¹⁾	Tipo	Código da UC	ECTS
2º	2º	45TP+35OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 10 Individual Work and Assessment: 50 </div>					
Learning Outcomes Transfer the theoretical and practical knowledge enabling to design appropriate solutions for different applications at the Project, Work and Supervision under the Electricity. So the student: <ul style="list-style-type: none"> • are supposed to learn the different energy Regulations and the Technical Standards governing the making of Projects and facilities use of Electrical Energy in Low Voltage (Residential and Commercial Facilities) • theoretical-practical knowledge will acquire on the application of matter in calculations relating to the practice of Electrical Engineering, and gain knowledge on materials and equipments, particularly for low voltage, through showcases, specific installations, technical and commercial documentation and study visits; • should be able to execute projects Facilities Electricity Usage Type-C (RLIE) and lighting technique, taking into account energy efficiency. • During project making, students are familiarized with a project making methodology and ways to implement corresponding legal acts. 					
Prerequisites Knowledge of Mathematical Analysis I and II, Linear Algebra and Analytic Geometry, Circuit Analysis, Instrumentation and Measurement Technology, Electricity and Electronics, Mathematics Applied Electromagnetics.					
Curriculum <ol style="list-style-type: none"> 1. Applicable Law <ol style="list-style-type: none"> a. Guardianship Entities or related to Electricity; b. Technical Rules for Low Voltage Electrical Installations (portuguese rules); c. Standards and Specifications; d. Regulations for Electrical Installations Licenses; 2. Definitions under the Electricity; Constitution of the different types of Electrical Projects; drawings; descriptive and supporting texts; Designed Parts; Sheets. 3. Calculations related to: 4. Voltage drop; short circuit currents; electrical protections. 5. Cable installation methods (raceways cable; surface/ flush installations; ducts) 					

(1) Ensino teórico (T); Teórico-prático (TP); Prático e laboratorial (PL); Trabalho de campo (TC); Seminário (S); Orientação tutorial (OT); Trabalho individual do aluno (TA).

<p>6. Grounding System; Protection Direct and Indirect Contacts.</p> <p>7. Technical Criteria used for the Execution of Projects; Equipments;</p> <p>8. Lighting technique; Applications concrete; Calculations, Tables and Catalogs</p>
<p>Teaching and Learning Methods</p> <p>-Theoretical classes: formal exposition of the matter and, where possible, accompanied by illustrative examples.</p> <p>-Theoretical and practical classes: Exposure of matter together with examples; selected solving practical problems. Providing information about the project to be implemented;.</p> <p>-Tutorial guidance: solving and answering questions. Preparation of Project.</p> <p>-Fieldwork: study visits and compiling their reports</p>
<p>Assessment</p> <p>1- Continuous assessment: 2 written tests (T) + 1 Project (P) + 1 Report (Study Visits) (R);</p> <p>2- Approval:</p> <p>. Arithmetic mean (M) of 'T' should be equal to or greater than 50%;</p> <p>. Delivery and Acceptance of 'P' and 'R'.</p> <p>Under these conditions the student may opt out of the written examination.</p> <p>-If 'M' <50% students should be subjected to exam.</p> <ul style="list-style-type: none"> • The ratings exam prevails over the subsequent. • Classification Project will involve, at a final note, an additional 0, 1 or 2, whichever evaluated Enough, Good or Very Good. A Project or Report considered Insufficient not be accepted.
<p>Bibliography</p> <p>- Technical Rules of Low Voltage Electrical Installations (RTIEBT)</p> <p>- Regulations for Electrical Installations Licenses (RLIE);</p> <p>- Technical Guides of DGEG and CERTIEL;</p> <p>- Standards indicated in RTIEBT;</p> <p>- Shopping Catalogues;</p> <p>- Documentation Diverse;</p> <p>- José Manuel Gonçalves Guerreiro, Notes Production and Transport of Electricity, 3rd year Electrical Engineering, Departmental Area Electrical Engineering, UAlg / EST, Faro, 1998.</p>
<p>Demonstration of the syllabus coherence with the curricular unit's objectives</p> <p>It is intended to convey the theoretical and practical knowledge to enable students to design appropriate solutions for different applications at the Project, Work and Supervision under the Electricity, according to two aspects:</p> <p>Theoretical Aspect:</p> <p>Based on concrete examples of projects and facilities, are taught theoretical and practical processes used in its making regulatory. Use Regulations and Standards is accompanied by explanation and analysis of the same, allowing the technically aware of them.</p> <p>Practical Aspect:</p> <p>We aim to teach the practical side of this u.c. with as much realism as possible, it is always based on real issues of electrical engineering, in two sub-sections: The Calculations and Design.</p> <p>The calculations are used in solving 'real problems and real' carefully selected. The Project consists of a real case, usually a Block Housing (8-12 housings), with Comercial and Parking.</p>
<p>Demonstration of the coherence between the teaching methodologies and the learning</p> <p>Given the specificity of this u.c., is given a great emphasis on 'real examples' of existing facilities that integrate equipment and solutions of interest for what you want to teach.</p> <p>Thus, acetates are often designed for projects already undertaken that show the appropriate application of raw versed.</p> <p>The development of the Project is the focal point of this u.c.</p> <p>In addition to a comprehensive explanation of similar examples, provided substantial documentation rules and regulations as well as drawings and specification and justification examples of other projects. Projects will be developed with all the precepts which such regulations necessary for delivery in CERTIEL for certification.</p> <p>Part of this curriculum u.c. Study Visits to Facilities Housing Industries and quality, where we highlight the ETA Alcantarilha e a ETAR Vale Faro (both of Águas do Algarve, SA). During these visits will highlight important aspects of the solutions (the Premises) and is seized the occasion to make several considerations.</p>

(1) Ensino teórico (T); Teórico-prático (TP); Prático e laboratorial (PL); Trabalho de campo (TC); Seminário (S); Orientação tutorial (OT); Trabalho individual do aluno (TA).



UNIVERSIDADE DO ALGARVE – INSTITUTO SUPERIOR DE ENGENHARIA
1ST /2ND CYCLE IN ELECTRICAL AND ELECTRONICS ENGINEERING
SCHOOL YEAR 2012/2013

Course Unit:: ELECTRICAL INSTALLATIONS DESIGN II					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Energy Systems and Control Teaching Language: Portuguese Course Unit Chair:: José Manuel do Livramento (jliv@sapo.pt) Teaching Staff: José Manuel do Livramento); Luis Miguel Borges Pereira (45 TP+ 35OT);					
Ano	Semestre	Carga Horária ⁽¹⁾	Tipo	Código da UC	ECTS
3º	1º	45TP+35OT	Obrigatória	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 10 Individual Work and Assessment: 50 </div>					
Learning Outcomes <p>Transfer the theoretical and practical knowledge enabling design appropriate solutions for different applications at the Project, Work and Supervision under the Electricity (EE). So the student:</p> <ul style="list-style-type: none"> -are supposed to learn the different Electrical Regulations, Technical Standards and Technical Recommendations governing low-voltage electrical installations;electrical distribution network; outdoor lighting; transformer load-center. -theoretical-practical knowledge will acquire on the application of matter in calculations relating to Electrical Engineering, and gain knowledge on materials and equipment, for electrical distribution network; outdoor lighting; transformer load-center, through showcases, technical and commercial documentation and study visits; -should be able to execute electrical distribution network and outdoor lighting projects taking into account energy efficiency. -Students are familiarized with a project making methodology and ways to implement corresponding legal acts. 					
Prerequisites Knowledge of Mathematical Analysis I and II, Linear Algebra and Analytic Geometry, Circuit Analysis, Instrumentation and Measurement Technology, ELECTRICAL PROJECT INSTALLATIONS - I Electricity and Electronics, Mathematics Applied Electromagnetics, Projecto de Instalações Eléctricas I.					
Curriculum <ol style="list-style-type: none"> 1. Applicable Law <ol style="list-style-type: none"> a. Guardianship Entities or related to Electricity; b. Technical Rules for Low Voltage Electrical Installations (portuguese rules); c. Standards and Specifications; d. Regulations for Electrical Installations Licenses; e. Technical Guide for Condos Closed; f. Regulations for transformer stations; 2. Definitions under the Electricity; Constitution of the different types of Electrical Projects; drawings; descriptive and supporting texts; Designed Parts; Sheets. 3. Calculations related to: 					

⁽¹⁾ Ensino teórico (T); Teórico-prático (TP); Prático e laboratorial (PL); Trabalho de campo (TC); Seminário (S); Orientação tutorial (OT); Trabalho individual do aluno (TA).

<ul style="list-style-type: none"> a. Voltage drop; short circuit currents; electrical protections; b. Busbar; c. Cable installation methods (raceways cable; underground electrical networks) <ul style="list-style-type: none"> 4. Technical Criteria used for the Execution of Projects; Equipments; 5. Project of underground electrical networks with transformer load-center (urbanization). 6. Grounding System; Protection Direct and Indirect Contacts 7. Lighting technique; Outdoor Lighting; Applications concrete; Calculations, Tables and Catalogs
<p>Teaching and Learning Methods</p> <p>-Theoretical classes: formal exposition of the matter and, where possible, accompanied by illustrative examples.</p> <p>-Theoretical and practical classes: Exposure of matter together with examples; selected solving practical problems. Providing information about the project to be implemented;.</p> <p>-Tutorial guidance: solving and answering questions. Preparation of Project.</p> <p>-Fieldwork: study visits and compiling their reports</p>
<p>Assessment</p> <p>1- Continuous assessment: 2 written tests (T)+1 Project (P)+1 Report (Study Visits) (R);</p> <p>2- Approval:</p> <ul style="list-style-type: none"> . Arithmetic mean (M) of 'T' should be equal to or greater than 50%; . Delivery and Acceptance of 'P' and 'R'. <p>Under these conditions the student may opt out of the written examination.</p> <ul style="list-style-type: none"> -If 'M' <50% students should be subjected to exam. <ul style="list-style-type: none"> • The ratings exam prevails over the subsequent. <p>Classification Project will involve, at a final note, an additional 0, 1 or 2, whichever evaluated Enough, Good or Very Good. A Project or Report considered Insufficient not be accepted.</p>
<p>Bibliography</p> <ul style="list-style-type: none"> - Regulations Distribution Network Low Voltage -Technical Rules of Low Voltage Electrical Installations (RTIEBT) - Regulations for Electrical Installations Licenses (RLIE); - Technical Guides of DGEG and CERTIEL; - Standards indicated in RTIEBT; - Documentation Diverse; <ul style="list-style-type: none"> - José Manuel Gonçalves Guerreiro, Notes Production and Transport of Electricity, 3rd year Electrical Engineering, Departmental Area Electrical Engineering, UAlg / EST, Faro, 1998.
<p>Demonstration of the syllabus coherence with the curricular unit's objectives</p> <p>It is intended to convey the theoretical and practical knowledge to enable students to design appropriate solutions for different applications at the Project, Work and Supervision under the Electricity, according to two aspects:</p> <p>Theoretical Aspect:</p> <p>Based on concrete examples of projects and facilities, are taught theoretical and practical processes used in its making regulatory. Use Regulations and Standards is accompanied by explanation and analysis of the same, allowing the technically aware of them.</p> <p>Practical Aspect:</p> <p>We aim to teach the practical side of this u.c. with as much realism as possible, it is always based on real issues of electrical engineering, in two sub-sections: The Calculations and Design.</p> <p>The calculations are used in solving 'real problems and real' carefully selected. The Project consists of a real case Low Voltage Distribution Network and Outdoor Lighting of an urbanization.</p>
<p>Demonstration of the coherence between the teaching methodologies and the learning</p> <p>Given the specificity of this u.c., is given a great emphasis on 'real examples' of existing facilities that integrate equipment and solutions of interest for what you want to teach.</p> <p>Thus, acetates are often designed for projects already undertaken that show the appropriate application of raw versed.</p> <p>The development of the Project is the focal point of this u.c.</p> <p>In addition to a comprehensive explanation of similar examples, provided substantial documentation rules and regulations as well as drawings and specification and justification examples of other projects.</p> <p>Projects will be developed with all the precepts which such regulations necessary for delivery in CERTIEL for certification.</p> <p>Part of this curriculum u.c. Study Visits to National Driving and Control Center (REN - Sacavém) and Sines- Thermoelectric Power Plant. During these visits will highlight important aspects of the solutions</p>

(1) Ensino teórico (T); Teórico-prático (TP); Prático e laboratorial (PL); Trabalho de campo (TC); Seminário (S); Orientação tutorial (OT); Trabalho individual do aluno (TA).

(the Premises) and is seized the occasion to make several considerations.

⁽¹⁾ Ensino teórico (**T**); Teórico-prático (**TP**); Prático e laboratorial (**PL**); Trabalho de campo (**TC**); Seminário (**S**); Orientação tutorial (**OT**); Trabalho individual do aluno (**TA**).



Course Unit: Electromagnetic Wave Radiation and Propagation					
Departement: Electrical Engineering Department Programme: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialisation in: Information Technology and Telecommunications					
Teaching Language(s): Portuguese Course Unit Chair: Paulo Gustavo Martins da Silva (psilva@ualg.pt) Teaching Staff: Paulo Gustavo Martins da Silva (Lecturing load: 30T+15TP+35OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 rd	1 st	30T+15TP+35OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) Develop student's abilities to handle and interpret the physical meaning of Maxwell's equations as well as to formulate wave equations for uniform plane waves. Know how to characterize simple isotropic media in electromagnetic terms. Analyse and interpret the propagation and behaviour of electromagnetic waves, including wave incidence in different media interfaces, as well as their polarization. Recognize different types of transmission lines, identifying the advantages/disadvantages depending on the application in question. Characterize and interpret guided TEM propagation mechanisms in RF transmission lines. Learn to use Smith chart to solve transmission lines problems, namely, impedance matching. Provide student's abilities to characterize, calculate and design the main antennas' parameters depending on its application, including linear array antennas.					
Prerequisites Knowledge in vector analysis and electromagnetics.					
Curriculum (max. 1000 characters) 1 - Introduction- Basic concepts of vector algebra. Conservative vector fields. Theorems of divergence, Stokes and Green. 2 - Electromagnetic Waves- Maxwell's equations. Wave equations and their solutions for plane waves. Power and Poynting vector. Behaviour of electromagnetic plane waves incidence in different media interfaces. Standing waves. Uniform plane waves polarization. 3 - Transmission Lines- Introduction. Voltage and current equations in transmission lines and their solutions. Reflections on transmission lines. Standing waves. Line impedance. Propagation characteristics and frequency dependence. Impedance matching. Smith chart. 4 - Antennas- Introduction. Antennas' fundamental concepts: radiation pattern, directivity, gain, side lobes, resolution, radiation intensity, efficiency, effective area and height, polarization. Study of various types of antennas and their practical applications. Linear array antennas and their applications.					
Teaching and Learning Methods (max. 1000 characters including assessment) Theoretical lectures of expository nature using slide presentation and practical examples on frame. Theoretical and practical lectures where theoretical concepts are complemented by discussing and presenting methods for solving practical examples. Tutorial lectures where students clarify their doubts, solve proposed problems and/or execute individual or group laboratory assignments under the teacher's supervision.					
Assessment Assessment is composed by two main components: theoretical and practical. Theoretical component consists of two written tests ($\geq 8,0$ points in each test) and/or a written final exam (70% of the final grade). Practical component consists of laboratory and/or written assignments (20% of the final grade). A 10% weight of the final grade is reserved to students' lecture participation and assignment delivering.					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

U.C. approval is obtained with a final grade $\geq 9,5$ points.

Bibliography (max. 1000 characters)

- [1] The teacher's c.u. material (Lectures' slides and proposed problems with solutions);
- [2] Clayton Paul, Syed Nasar, "Introduction to Electromagnetic Fields", 3th Edition, Mc-Graw-Hill, 1997.
- [3] John Kraus, "Electromagnetics", Mc-Graw-Hill, 1988.
- [4] William Hayt Jr., "Engineering Electromagnetics", 4th Edition, Mc-Graw-Hill, 1985.
- [5] Steven Schwartz, "Electromagnetics for Engineers", Mc-Graw-Hill, 1990.
- [6] John Kraus, Daniel Fleisch, "Electromagnetics with Applications", 5th Edition, Mc-Graw-Hill, 1999.
- [7] Syed A. Nasar, "200 Solved Problems in Electromagnetics", Mc-Graw-Hill, 2000.
- [8] Joseph Edminister, "Electromagnetismo – Problemas Resueltos", Mc-Graw-Hill, 1995.
- [9] Constantine Balanis, "Antenna Theory, Analysis and Design", John Wiley & Sons, 1982.

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The study of concepts and basic principles of guided and free space electromagnetic wave propagation, as well as those related with antennas, are indispensable and essential basic subjects for a student in the area of telecommunications. In fact, the ability to understand, analyse and design modern telecommunication systems necessarily involves acquiring a solid education in these matters. In this sense, the syllabus covered in this UC is organized so that the knowledge, skills and abilities to be developed by students allows them to complement their training in other UCs where telecommunication systems as radio broadcasting, communications via satellite, mobile communications, wireless network, etc., are studied.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodology adopted in this UC relies on the interconnection between exposition of fundamental theoretical concepts, and respective physical interpretations of the mathematical formulations involved, with discussion and resolution of practical problems involving the concepts presented. To that end, theoretical and practical classes are taught where the teacher introduces and thoroughly explains the UC syllabus, interacting with students, and solving practical problems enabling a complete understanding of the subjects. In order to consolidate and deepen the acquisition of knowledge, tutorial and laboratory classes are taught, focusing on solving proposed problems and laboratory assignments, under the teacher's supervision, promoting the training of acquired knowledge and student's self-evaluation of their knowledge level.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Access Networks					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications					
Teaching Language(s): Portuguese Course Unit Chair: Paula Raquel Viegas dos Santos Nunes Laurêncio (plarenc@ualg.pt) Teaching Staff: Paula Raquel Viegas dos Santos Nunes Laurêncio (Lecturing load: 30TP+35OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3	2	30TP+35OT	Elective	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 30 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 75 </div>					
Learning Outcomes (max. 1000 characters) After successfully completing this course students should be able to: - Distinguish the applications of the various solutions used to ensure access of wireless broadband and cable. - Describe the key technologies of mobile communications, wireless and cable for private and public networks and analyze the respective architectures and protocols - Sizing and designing passive optical networks. - Develop network architectures fixed and mobile WiMAX and its performance for different types of applications - Make reports on work carried out respecting the rules concerning the form, writing correctly and fluently, with critical analyzes of results.					
Prerequisites Background Knowledge in digital communications and optical communications systems					
Curriculum (max. 1000 characters) Introduction: Evolution of telecommunications and standardization in telecommunications structure of telecommunications networks; topology, structure and types of networks, types of services and their requirements. Transmission in optical fiber: general; optical fibers; polarization; optical amplifiers; draft systems with and without optical amplifiers, optical network topology, sizing passive optical networks. Multiple access techniques. Techniques and systems for optical video distribution. Passive optical networks. Prospects for future developments of optical access network. DSL Access Technologies. Networks Hybrid Fiber / Coax (HFC). Wireless access networks: WPAN, WMAN and WLAN. WiMAX.					
Teaching and Learning Methods (max. 1000 characters including assessment) 1. Theoretical and Practical classes - Theoretical analysis of content, alternating with practical examples and interacting with students. Resolution of exercises after discussion with students of the statement, using the methods and clarify their doubts. 2. Tutorials classes - Resolution of chips exercises and / or execution of work (s) of evaluation by students individually to answer questions when asked.					
Assessment - A written test (1 test and / or examination) with a 50% weight in the final grade; - work evaluation with a weight of 40% in the final grade; evaluation work OT with a 10% weight in the final grade. The student obtains approval in discipline when you have a final grade equal to or higher than 10 (on a scale of 0 to 20). In the case of written test and are required to work a minimum score of 10 points (on a scale of 0 to 20).					
Bibliography (max. 1000 characters) [1] Diapositivos da disciplina, Paula Laurêncio [2] Gerd Keiser, <i>FTTX Concepts and Applications</i> , Wiley [3] Jeff Hecht, <i>Understanding Fiber Optics</i> , Pearson-Prentice Hall [4] Rajiv Ramaswami, Kumar N. Sivaragan, <i>Optical Networks a practical perspective</i> , Morgan Kaufmann [5] R. Freeman, <i>Telecommunication Systems Engineering</i>					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

- [6]M. Clark, *Networks and Telecommunications - design and operation*, Wiley
- [7]Gerd Keiser, *Optical Fiber Communications*, McGraw-Hill
- [8] N. Kashima, *Optical Transmission for the Subscriber Loop*, Artech House
- [9]Academic.Press.Optical.Fiber.Telecommunications.V.Volume.B.Systems.and.Networks.Feb.2008
- [10]Amitabh Kumar, *Mobile Broadcasting with WiMAX*, Focal Press
- [11]Deepak Pareek, *WiMAX taking wireless to the MAX*, Auerbach Publications
- [12]Syed Ahson, Mohammad Ilyas, *WiMAX Applications*, CRC Press
- [13]Ramjee Prasad, Fernando Velez, *WiMAX Networks- Techno-Economic Vision and Challenges*, Springer

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The course starts with a general presentation of the various access network technologies. Following is the detailed study of the respective architectures and protocols. Examples are given and solved problems of increasing complexity classes of OT. At the end of UC students should learn to design network architectures of wireless mobile and fixed networks as well as passive optical fiber and measure their performance for different types of applications.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The methodology intends that the student acquires, progressively a comprehensive theoretical and practical knowledge of the technologies used in access networks for broadband, so that the objectives of the course are fully achieved.

The teaching methodology classes TP uses multimedia slides for exposure to theoretical concepts and practical examples, interacting with students and promote critical discussion. The complete learning on the orientation classes tutorial where matter is applied to specific cases where it is held and the guidance of work application, using the MATLAB to facilitate the necessary calculations. In these classes work is carried out within the various technological solutions for access networks both at practical or theoretical level with the internet search.

The UC culminates with the completion of reports on work performed which should show the practical application of acquired knowledge and a presentation of the work you want to prepare the student for displaying content to audiences comprised of specialized audiences. This capability is critical to the engineering background and is obtained with the individual work of the student, prepared the lessons tutorials.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Communication Networks					
Department: Electrical Engineering Department Program: 2 nd Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications					
Teaching Language(s): Portuguese Course Unit Chair: Jânio Miguel Evangelista Ferreira Monteiro Teaching Staff: Jânio Miguel Evangelista Ferreira Monteiro (Lecturing load: 15 T+ 30 TP+ 35 OT);					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3 rd	2 nd	15T+30TP/L+35OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) Within this course we consider relevant for the student: <ol style="list-style-type: none"> 1. to know and be able to distinguish the major Transmission Mediums and the different topologies used in computer networks; 2. to know how to evaluate the quality of different transmission mediums using their specific evaluation parameters; 3. to know the architectural elements and standards used in structured cabling systems; 4. to be able to categorize and distinguish the protocol layers of the OSI model by analyzing their properties; 5. to know the major properties of the data link layer; 6. to know the protocol architecture, network architecture, medium access control mechanism and functional characteristics of the IEEE802.3 and IEEE802.11 networks, 7. to be able to design each of these networks, install them, detect and solve their problems; 8. to be able of identifying the application layer protocols; 9. to be capable of configuring network equipment and terminals; 10. to be capable of implement socket programming over IP. 					
Prerequisites Numbering Systems; Background knowledge in Electric Circuits; Background knowledge in Digital Circuits; Background knowledge in Telecommunications; C programming.					
Curriculum (max. 1000 characters) <ol style="list-style-type: none"> 1. Basic Concepts: Transmission Mediums, Evaluation Parameters, Topologies, Structured Cabling Systems, Standardization and Reference Models. 2. Physical Layer: Communication versus Transmission modes, Maximum Transmission Rate in a Channel, Signal Modulation, Baseband versus Broadband, Transmission and Switching. 3. Data Link Layer: Frame Delimiting, Data compression and coding, Forward Error Control, Sliding Window Flow Control. 4. Major Local Area Networks: Global aspects, Ethernet (IEEE802.3) and Wi-Fi Networks (IEEE802.11), Project and Link Budget Computation. 5. Network Layer protocols: The Internet Protocol (IP), IPv4 and IPv6 Headers, IPv4 and IPv6 addressing, Related Protocols, Sub-netting. 6. Transport Layer Protocol: UDP protocol: Header, supported services. TCP protocol: Header, session Establishment and Congestion Control mechanisms. 7. Most Common Application Layer protocols: Domain Name System, HTTP, Telnet e Secure Shell, File Transfer Protocol, e-mail protocols. 					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Teaching and Learning Methods (max. 1000 characters including assessment)

- T/P classes of problem solving,
- Laboratorial classes with professional equipment,
- Tutorial classes using E-learning content and self-studying.
- Individual and in group classes.
- Group and individual laboratorial works.

Assessment

In terms of grading, the final score will consider the following components and percentages:

Theoretical: 65%

Practical: 35%

Students will need to achieve a minimum classification 9, in each of these components. The score of theoretical component will result from a written test or exam.

Written tests or exams will have two parts, one of them having access to the class content (CC) and the other without that access (SC), both with equal weights. The classification of the Theoretical Component will therefore be obtained through:

Theoretical Component = $50\% \times CC + 50\% \times SC$

In the practical component students will have to implement one or more projects and lab based implementations previously agreed with the teacher.

Bibliography (max. 1000 characters)

[1] Course Text prepared by the instructor.

[2] Edmundo Monteiro, Fernando Boavida, "Engenharia de Redes Informáticas", FCA

[3] Andrew S. Tanenbaum, "Computer Networks", Prentice-Hall

[4] William Stallings, "Data and Computer Communications", Prentice Hall International Editions

[5] Paulo Loureiro, "TCP/IP em redes Microsoft para Profissionais", FCA Editores

[6] Carig Hunt, "Servidores de Redes com Linux", Marker Books Brasil

[7] Frank Ohrtman, Konrad Roeder, "Wi-Fi Handbook", McGraw-Hill Networking

[8] Breyer & Riley, "Switched, Fast and Gigabit Ethernet", Third Edition, Macmillan Network Architecture & Development, Macmillan Technical Publishing

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

Regarding the objectives that require an increment of theoretical knowledge, the syllabus of the curricular unit includes the objectives in a nearly univocal basis. Regarding the knowledge of professional equipment configuration and application programming in network, they are met through laboratory classes and tutorial classes, from points 3 to 7 of the syllabus.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

Students achieve the objectives through the different proposed methodologies. In theoretical classes, theoretical knowledge is analyzed and explained that, when complemented with T/P problems, enable the understanding of the background knowledge. In the laboratory classes students learn: to detect problems in communication networks; configure network equipment; understand, design, install these equipments; and program applications that communicate over IP. In tutorial classes problems and self-learning resources are given to students that enable them to work individually and in groups.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Signals and systems					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications / Energy Systems and Control					
Teaching Language(s): Portuguese Course Unit Chair: <i>Paulo Alexandre da Silva Felisberto</i> Teaching Staff: <i>Paulo Alexandre da Silva Felisberto</i> (Lecturing load: 30 T+ 15 TP+ 70 OT); <i>Paulo Gustavo Martins Silva</i> (Lecturing load: 15T+ 15 TP+ 35 OT); ...					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2 ^o	2 ^o	30T+15TP+35OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) The student should be able to analyse continuous and discrete time signals and systems in time domain; to apply the convolution method; analyse systems and signals in the frequency domain, to apply the Fourier, Laplace and Z transforms. Having a concrete problem at hand the student should be able to choose the best suited tool (domain of analysis, transform). The student should be able to use Matlab (or similar software package) to analyse signal and systems.					
Prerequisites Course of Mathematics applied to electrical engineering.					
Curriculum (max. 1000 characters) Intoduction: Basic concepts of continuous and discrete-time signals and systems. Basic signals, operations and transformations. Introduction to LTI systems: Linear time invariant systems (LTI). Continuous and discrete-time systems. Impulse response (IR) and convolution. Stability. Systems interconnections. Sinusoidal response. Methods of system analysis. Fourier series: Periodic signals. Fourier series. Gibbs phenomenon. Spectrum. Power of a period signal. Applications. Fourier transform: Motivation. The Fourier transform. Parseval's theorem. LTI system analysis: frequency response (FR). The sampling theorem. Aplications. Laplace transform: Motivation. The Laplace transform (LT). Transfer function (TF), impulse response (IR), region of convergence (ROC), causality and stability. FR. Applications. Z transform: Motivation. The Z transform (ZT). Relation between LT and ZT. TF, IR, FR, ROC, causality and stability. Applications.					
Teaching and Learning Methods (max. 1000 characters including assessment) The concepts are explained in lecture classes. During practical classes are presented problems and analytical solved. The students are encouraged to discuss the steps leading to problem resolution. In tutorial classes students individually or in small groups solve problems analytically and using Matlab. The e-learning software platform is used to make available courses materials, assign homework and facilitate communication with students.					
Assessment					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

The assessment comprises 2 parts:

-Theoretical: Test or exam (60% of the final grade, minimum of 8 in 20);

-Practical:

1) 3 Mini-tests (25% of final grade, a mini-test has a maximum grade of 20, the student should sum at least 24 in all min-tests),

2) 2 homework (15% of final grade)

Bibliography (max. 1000 characters)

[1] Isabel Lourtie, **Sinais e Sistemas**, Escolar Editora

[2] Charles Phillips, **John Parr, Signals, Systems and transforms**, Prentice Hall.

[3] Bernard Girod, Rudolf Rabenstein, Alexander Stenger, **Signal and Systems**, Wiley

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

This is a fundamental course of actual electrical engineering curricula. The student applies and examines thoroughly the skills of transforms and series introduced in previous courses. The subjects covered are commonly considered for actual students' background in a system and signals analysis course. The continuous and discrete-time systems are presented using a common framework, emphasizing their similarities and interrelations, but their particularities.

The different themes are always introduced by a motivation and a context of use based on examples of applications in different real systems, which will be developed during exposure of different techniques.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

Learning is based on solving problems of continuous and discrete system analysis in time and frequency domain. Analytical and numerical approaches to the solution are followed. The problems focus not only in typical applications encountered in electrical and communications engineering, but more generic aspects of application to other domains. The aim is a symbiosis between analytical and numerical resolution. The use of auxiliary means (calculator, software package) to obtain analytical solutions efficiently is encouraged. In many of the problems resolution is required via the Matlab, and is encouraged to understand the results obtained by interpreting the graphs (impulsive response, frequency responses, ...). Apart from participating in problem solving during practical classes, students solve individually or in small groups, problems in tutorial guidance. Students should also carry out 2 small projects that solve analytically and using Matlab and discuss the results.

The use e-learning platform allows easy communication between students and teachers, facilitating clarify questions when they happen.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Digital Systems					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications / Energy Systems and Control					
Teaching Language(s): Portuguese Course Unit Chair: António João Freitas Gomes da Silva (asilva@ualg.pt) Teaching Staff: António João Freitas Gomes da Silva (Lecturing load: 30 T+15 TP+105 OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
2 nd	1 st	30 T+15 TP+35 OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) This course aims at approaching the basics of digital systems from a theoretical and practical point of view involving conception, project and implementation. Students are supposed to learn the basic fundamentals of Boolean Algebra and its importance in projecting Digital Systems. Besides projecting, students should also be capable of implementing small scale integration (SSI) and medium scale integration (MSI) Circuits of combinatory Logic. After consolidating what was learned about Combinatory circuits, the project and implementation of Sequential Logic will be approached. At the end of this course, students should be able to project and implement any combinatory or sequential circuit that uses SSI and MSI circuits, as well as to understand the workings and to begin studying Large Scale Integration (LSI) and Very Large Scale Integration (VLSI) digital circuits, namely devices of programmable logic and microprocessors.					
Prerequisites Contents acquired in Math courses during High School					
Curriculum (max. 1000 characters) 1. Numbering Systems and Boolean Algebra: Numbering Systems, Arithmetic Operations in Binary, Binary Codes, Boolean Algebra, Simplification of Boolean Functions 2. Basic Concepts of Digital Electronics and Systems: Basic Logical Functions, Positive and Negative Logic, Electrical Characteristics of Digital Circuits, Digital Technologies and Integrated Circuits, Elimination of Glitches in Karnaugh Maps, Basic Notions of Digital Data Communication 3. Combinatory Logic and MSI Circuits: Code Converter Circuits, Multiplexer and Demultiplexer, Encoders and Decoders, Arithmetic Circuits 4. Sequential Logic: Combinatory Circuits versus Sequential Circuits, Basic Bistable Memory Devices, Flip-Flops' Specifications, Registers, Counters and Synchronous Sequential Circuits – Project and Implementation of Moore and Mealy circuits. 5. Practical works.					
Teaching and Learning Methods (max. 1000 characters including assessment) For the explanation of theoretical concepts there will be T classes using slides and examples on the board; for the presentation of problems of analytical solving there will be TP classes; the students will, with the teacher's support in OT classes, solve analytical problems and practical group works in the lab.					
Assessment There are 3 components to the assessment: <ul style="list-style-type: none"> - 3 Practical works - 3 Mini-Tests - Single Test and/or Exam for a T and TP evaluation Practical Grade = 0.7 * Mean of the Practical Works + 0.3 * Mean of the Mini-tests Theoretical Grade = MAXIMUM (Test and/or Exam) Final Grade = 0.3 * Practical Grade + 0.7 * Theoretical Grade					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Each assessment component (Practical Grade and Theoretical Grade) has a minimum of 9 points.

Bibliography (max. 1000 characters)

- [1] Acetates from the theoretical classes and worksheets
- [2] R.S. Sandice, **Modern Digital Design**, McGraw-Hill
- [3] Pestopnik, **Digital Electronics**, Saunders College Publishing
- [4] Carlos Pedro Baptista, **Sistemas Digitais**, FCA - Editora de Informática
- [5] Morgado Dias, **Sistemas Digitais Princípios e Prática**, FCA – Editora de Informática

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

This course's contents are students' first contact with the development of digital circuits and systems and aims to endow them with the ability to project and implement circuits of medium complexity. Besides, students should be prepared to learn about circuits of high complexity made with programmable logic devices and microprocessors. To do so, the basics of numbering Systems, Binary Codes, Boolean Algebra and Digital Circuits Technology will be taught and they will serve as foundations for the projecting of standard combinatory circuits or on demand of specific problems. Afterwards, the project and implementation of sequential circuits will be approached, as well as their standard implementations and project methods. The T and TP teaching will be accompanied by practical works built during OT, works that will involve digital circuits of growing complexity both in project and implementation.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

As this is a course that serves as a basis for the implementation of many of the electronic systems which have the biggest socioeconomic visibility and on which students have the biggest expectations, it is essential to have a good interconnection and alternation between the theoretical concepts and the practical applications. Next, we will expose the adopted teaching methods, relating them to the course main learning goals.

In the first stage, the themes that serve as a basis for the development of digital systems will be approached, namely: Numbering systems, binary Codes and Boolean Algebra. The teaching method, at this stage, is based on the exposition of the subject matter through slides and the solving of analytical problems, both by the teacher and the students, dedicated to the project of digital systems from algebraic formulations and/or true tables. At the end of this stage students will face the technological implementation of Boolean algebra's basic functions in Integrated Circuits (IC) and the limitations that are due to its electrical features. This stage ends with a mini-test and a lab work called "Basic notions of Digital Systems" where students demonstrate and experiment what they learn, as well as improve their skills when it comes to using lab instruments.

In the second stage we will approach the implementation of combinatory digital systems using MSI IC. The teaching methods in this stage will be based on the exposition of the subject matter through slides that present the standard MSI IC and its applications. During the exposition of the subject matter, the Top-Down project methods will be intuited through the systematic presentation of both the "Entity" and the "Architecture" of those circuits. The project of digital circuits will be elaborated from a unique true table when the "Architecture" coincides with the "Entity" and from multiple true tables when it's the other way round. This stage ends with a Mini-Test and the project and implementation of the lab work "Combinatory Logic" where the students used MSI IC, *dip-switchs*, leds and 7-segments displays.

In the third stage, using slides, the following will be approached: the notions of basics of digital memories (*latch e Flip-Flop*); the standard implementation of synchronous assemblies and asynchronous ones such as registers and counters; the synchronous sequential circuits architectures and project methods. Simultaneously, several analytical exercises will be solved by the teacher and the students. This stage ends with a mini-test and the project and implementation of the lab work "Flip-Flops and their applications" where students will have the opportunity to experiment the contents they learned. During the 3 stages previously explained, whenever opportune, examples of the application of the digital systems when building Microprocessors and other embedded systems will be given.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Telecommunications Systems I					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications Teaching Language(s): Portuguese Course Unit Chair: Paulo Gustavo Martins da Silva Teaching Staff: Paulo Gustavo Martins da Silva (Lecturing load: 30 T+ 15 TP+ 35 OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3	1	30T+15TP+35OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) The main goal of this CU is to provide an overview of optic and satellite communication systems and TV broadcast. The skills to be developed are: <ul style="list-style-type: none"> - Know how to characterize the propagation mechanisms of light in optical fibers and determine the effects of attenuation and time dispersion on the transmissions quality. - Understand the functioning of optical sources (LEDs and LASERS), detectors (PINs and APDs) and amplifiers. - Perform the performance study of optical systems in the presence of noise. - Provide a perspective of satellite communications evolution, the type of services, the satellites orbits and their impact on communications. - Learn to analyze a satellite link in the presence of noise and interferences, and study their performance. - Provide the concepts associated with the human visual system and know how analog and digital monochromatic and polychromatic TV broadcasted signals are constructed, transmitted and received. - Provide knowledge on DVB standards. 					
Prerequisites Knowledge acquired in the following CUs: Telecommunications Fundamentals, Signals and Systems and Digital Communications.					
Curriculum (max. 1000 characters) 1- Introduction- Evolution of telecommunications systems. Transmission aspects: transmission media, attenuation and distortion. Logarithmic units: the dB, dBw, dBm, dBi and EIRP. 2- Optical Communication Systems- Introduction to optical systems. The optical fiber as transmission medium. Optical sources. Optical receivers. Optical amplifiers. Optical communication systems with intensity modulation and direct detection. 3- Satellite Communications Systems - Evolution of satellite technology and applications. Satellite orbits. Analysis of satellite links. Noise equivalent temperature and figure of merit. Interferences. Modulations. 4- TV Broadcasting Systems - Monochromatic and polychromatic TV. Basics of color formats. Basics of digital video. Digital television systems: DVB-T, DVB-S, DVB-C, DVB-H. High-definition television (HDTV).					
Teaching and Learning Methods (max. 1000 characters including assessment) Theoretical lectures of expository nature using slide presentation and practical examples on frame. Theoretical and practical lectures where theoretical concepts are complemented by discussing and presenting methods for solving practical examples. Tutorial lectures where students clarify their doubts, solve proposed problems and execute individual or group research assignments on various topics in the field of telecommunications.					
Assessment					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Assessment is composed by two main components: theoretical and practical. Theoretical component consists of two written tests (≥ 8.0 points in each test) and/or a written final exam (80% of the final grade). Practical component consists on research assignment(s) (20% of the final grade) which assessment is based on a written report and its oral presentation and discussion. CU approval is obtained with a final grade ≥ 9.5 points.

Bibliography (max. 1000 characters)

- [1] Theacher's c.u. material (Lectures' slides and proposed problems with solutions);
- [2] Ajoy Ghatak, K. Thyagarajan, "Introduction to Fiber Optics".
- [3] John Senior, "Optical Fiber Communications", Prentice Hall.
- [4] Joseph C. Palais, "Fiber Optic Communications".
- [5] Max Liu, "Principles and Applications of Optical Communications", IRWIN.
- [6] B. Elbert, "Introduction to Satellite Communication", Artech House.
- [7] B. Elbert, "The Satellite Communication Applications", Artech House.
- [8] S. Ohmori, H. Wakana, S. Kawase, "Mobile Satellite Communications", Artech House, 1998.
- [9] Hervé Benoit, "Digital Television", Focal Press, 2006.
- [10] Walter Ciciora, *et al*, "Modern Cable Television Technology", Elsevier, 2004.

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The ability to understand, analyze and design modern telecommunications systems involves the knowledge and application of a wide range of topics, many of which are addressed separately in other CUs. This is the case of electromagnetic waves, modulation techniques, concepts associated to signals and systems, among others. Moreover, it is necessary to introduce the study of specific techniques and technologies, and introduce appropriate methodologies to understand, analyze and design such systems. For example, the study of optical devices and satellite, TV concepts, the performance analysis in presence of noise and/or interference, etc. The syllabus of this CU, whose focus is directed to fiber optic, satellite and TV broadcast systems, is organized to promote the link between all these skills and apply them to the study of these systems, providing a global perspective on their functioning.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodology adopted in this CU relies on theoretical, problem-oriented and tutorial lectures, as well as research assignment(s) on different topics in the field of telecommunications. In theoretical lectures a detailed exposition of theoretical concepts and interpretation of the mathematical models involved is carried out using slides presentation. At this stage, discussion with students about the concepts presented is privileged in order to promote their motivation and learning. This approach is a first step in constructing a global perspective on the operation of the different telecommunication systems addressed. Alternation between theoretical exposition and practical applications complements this goal.

Problem-oriented lectures resort to solving practical problems in order to consolidate the theoretical knowledge acquired by students. Problem statements are discussed with the teacher and between students. The students are invited to submit suggestions for addressing the problem in question. After solving the problem the solution is discussed and analyzed. The proposed problems involve simple calculations of different devices parameters within the systems (fiber optics, LEDs, LASERS, PINs, APDs, optical amplifiers, antennas, noise parameters, etc.), and more elaborate calculations involving, among others, performance analysis and systems viability (signal/noise + interference, bit error rates (BER), data rates, connections range, etc.).

In order to develop and enhance students' skills, tutorial classes are used for solving problems under the teacher supervision. Moreover, these classes are also used to clarify students' doubts about the CU contents, as well as those related to the research assignment. The goal of these classes is to promote the training of acquired knowledge and to self-assess students' knowledge levels. In order to enhance the interest for the vast and complex world of telecommunications, in this CU is requested a research assignment on topics in the field of telecommunications. In addition to encouraging contact with specialized literature and to broaden the base of knowledge in other subjects, assessment oral presentation allows the student to prepare public presentations on expertise topics.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Telecommunication Systems II					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications Teaching Language(s): Portuguese Course Unit Chair: Paula Raquel Viegas dos Santos Nunes Laurêncio (plaurenc@ualg.pt) Teaching Staff: Paula Raquel Viegas dos Santos Nunes Laurêncio (Lecturing load: 30T+15TP+35OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
3	2	30T+15TP+35OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) This course aims to complement the knowledge of telecommunications systems acquired in UC Telecommunication Systems I. After successfully completing this course students should be able to: <ul style="list-style-type: none"> - Calculate the received power in a radio communications system - Check the quality of service design in a digital radio relay verifying compliance with the quality standards of the ITU-R. - Develop a complete project engineering radio, according to the requirements and complying with quality standards, specifying the necessary materials and optimizing costs. - Make a report of a project within the rules concerning the form, writing correctly and fluently, and with considerations and reflections on the proposed solutions; - Spell out and demonstrate basic knowledge of radar position and frequency. - Designing architectures, mobile cellular networks scale and measure their performance for different application scenarios. 					
Prerequisites Background Knowledge in digital communications and propagation and radiation					
Curriculum (max. 1000 characters) <ol style="list-style-type: none"> 1.Introduction to communication systems for radio frequency Microwave radio links: general; propagating elements; passive repeaters; fading; modulations used, quality of service; project of microwave links. 2.Radar position and frequency. 3.Mobile Communication Systems: general; propagation models; fading and reduction methods; calculating the probability of error in fading environments; operating modes of mobile communications systems. Features and components of mobile communications systems; co-channel interference and adjacent channel interference, multiple access techniques, frequency planning, traffic capacity, system expansion, GSM and UMTS. 					
Teaching and Learning Methods (max. 1000 characters including assessment) <ul style="list-style-type: none"> -Theoretical lessons - theoretical content exposition, alternating with practical examples and interacting with students. -Theoretical and Practical lessons - Resolution of chips exercises and/or work(s) of the statement after discussion with the students, using the methods and clarify their doubts. -Tutorial lessons - Resolution of exercises and/or execution of evaluation work(s) by students individually to answer questions when asked. These works aim at the realization of a project of a digital microwave radio link. 					
Assessment Continuous Assessment: <ul style="list-style-type: none"> - 2 partial written tests with a 70% weight in the Final Classification (FC); - A microwave link project required with a weight of 20% in the FC; - Class participation Theoretical and practical tutorials with a weight of 10% in the FC. Final Assessment: <ul style="list-style-type: none"> - Written exam with a weight of 70% in FC; - A microwave link project required with a weight of 20% in the FC; - Class participation Theoretical and practical tutorials with a weight of 10% in the FC. 					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Bibliography (max. 1000 characters)

- [1] Carlos Salema, Feixes Hertzianos
- [2] Paul F. Combes, Microwave Transmission for Telecommunication
- [3] John S. Seybold, Introduction to RF Propagation
- [4] M. I. Sholnik, Introduction for Radar System
- [5] R. Freeman, Telecommunication Systems Engineering
- [6] R. Steele, Mobile Radio Communication
- [7] W. Lee, Mobile Communications Design Fundamentals
- [8] Shrader, Electronic Communication
- [9] Freeman, Radio System Design for Telecommunications
- [10] Apontamentos da Disciplina
- [11] Slides da Disciplina

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

It is intended that this UC students gradually acquire a comprehensive knowledge of theoretical and practical syllabus, so that the objectives of the course are fully achieved. Thus, the course starts with the characterization of communication systems by radio and their applications. Below is the study of factors that affect the propagation of the signal propagation in real conditions. It analyzes the various modulation techniques and viability. Taking into account the different profiles are discussed proposed links between students and teaching alternatives that pass through the use of repeaters. Through the verification of compliance with the recommendations of the ITU-R students will be able to discuss the feasibility of a digital connection by radio, with simultaneous optimization of project costs. For mobile communication systems are provided the information necessary to enable the student's ability to scale and design a cellular system.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

In the lectures on microwave links are introduced progressively all the elements needed to complete the design of a digital microwave radio link, this knowledge is solidified in theoretical with practical examples of the implementation and enforcement problems. The examples are made by the teacher and the problems are performed in class tutorial guidance by students and discussed therein. In recent lessons devoted to the project are carried out in MATLAB functions aimed at the attainment of the final project. They are divided in groups of two students, which is assigned a project by radio to perform in orientation classes tutorial that should culminate in a report to be carried out outside the classroom. This project will be the subject of discussions between teachers and students after undertaking. The aim is to equip students with critical skills, ability to choose between multiple solutions to more than the one that best suits each situation keeping in view an optimization of the costs of conducting a telecommunications project.

The evaluation continues in orientation classes tutorial aims to motivate students to participate more actively in class, encouraging knowledge exchange and debate of the issues under study.

The UC culminates with the completion of a report by an engineering project that should show the practical application of acquired knowledge and a presentation of the project work which aims to prepare the student for displaying content to audiences comprised of specialized audiences. This capability is critical to the engineering background and is obtained with the individual work of the student, prepared the lessons tutorials.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Communication Techniques					
Department: Electrical Engineering Department Program: 1 st Cycle in Electrical and Electronics Engineering Scientific Area: Electrical Engineering Specialization in: Information Technology and Telecommunications / Energy Systems and Control					
Teaching Language(s): Portuguese Course Unit Chair: Carlos Manuel de Azevedo Marinho Teaching Staff: Carlos Manuel de Azevedo Marinho (Total Lecturing load: 15T+ 7.5 TP+ 35 OT); John Voyce (Total Lecturing load: 15T+ 7.5 TP+ 35 OT)					
Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
1 ^o	2 ^o	30T+15TP+35OT	Required	--	5
Workload (hours): 140 <div style="text-align: right;"> Classes: 45 Tutorials: 35 Fieldwork: 0 Individual Work and Assessment: 60 </div>					
Learning Outcomes (max. 1000 characters) This curricular unit consists of two parts that are taught in parallel: Part 1 of "Communication" and Part 2 of "English". In the part of "Communication" is intended to provide students with development tools and techniques of oral, written and mixed communication. The part of "English" complements the communication and searches to equip students with the necessary skills for a more efficient and quicker understanding of texts, related to the present life and its scientific area, and develop their skills at lexical, grammatical and rhetorical levels, stimulating their critical spirit and preparing them for a gradual autonomy based on self-confidence.					
Prerequisites					
Curriculum (max. 1000 characters) Communication: 1-Oral communication: characteristics of oral communication, facilitators and disturbing elements of oral communication; practices of oral communication: conversation; debate; interview; meetings; round tables; reporting. 2-Written communication: characteristics of written communication: writing practices, summary; report; dissertation; argumentative text; application, correspondence, <i>curriculum vitae</i> . 3-Mixed Communication: The oral and written wordings; information and communication technologies; mixed communication practices. English: 1 Grammatical structures. 2- Business English. 3- Technical English.					
Teaching and Learning Methods (max. 1000 characters including assessment) <u>Lectures and practical classes</u> - lecture method, combining theoretical concepts to the debate and case studies. <u>Tutorials / Practical classes</u> - development and application of concepts.					
Assessment <u>Assessment by Frequency:</u> 1-Written tests (Communication Part 25%, English Part 25%), 2-Practical works (Communication 25%, English 25%). <u>Assessment by Examination:</u> Written examination (Communication 50%, English 50%).					
Bibliography (max. 1000 characters) [1] Adler, R. e Rodman, G.; Comunicação Humana, Livros Técnicos e Científicos Editora, 2005 [2] Monteiro, A.; Fundamentos da comunicação, Edições Sílabo, 2008 [3] Crystal, D.; Language and the Internet. Cambridge: Cambridge University Press, 2001 [4] Thomas, L.; Language, Society and Power: an introduction, Routledge, 2004 [5] Pereira, A. e Poupá, C. ; Como apresentar em público, Edições Sílabo SA, 2004 [6] Murphy, R.; English Grammar in Use, Cambridge University Press, 2004 [7] Swan, M.; Practical English Usage, Oxford University Press, 1995 [8] Pincott, M.; English for Business Students, Longman, 1973					

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

Students reach the unit's objectives by following the syllabus sequence and by working on problems. They will develop the following skills: 1-Ability to understand and examine the key concepts and processes in communication techniques; 2-Ability to apply the tools of communication in interpersonal relationships; 3-Capabilities and necessary skills to a more efficient and quicker understanding of texts related to modern life and scientific area, encouraging critical thinking and preparing students for a progressive autonomy based on self-confidence.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The methodology is based on interactive lessons with students. Will be read and analyzed texts on subjects related to the technical-scientific area of the course and on matters dealt in other disciplines. They will be examined various types of business letters, letters of job application and curriculum vitae, memos, reports, telephone interviews, attendance at meetings, agendas, minutes, etc.. The oral presentation of assignments, the use of e-learning platform and the use of software tools are fundamental in learning. The work is developed individually and in groups, serving the needs of solving problems / projects, and student-centred and assuming the diversity of personal learning. Students achieve the objectives, proposed above, by working according to this methodology.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).



Course Unit: Electric and Electronic Technologies

Department: Electrical Engineering Department

Program: 1st Cycle in Electrical and Electronics Engineering

Scientific Area: Electrical Engineering

Specialization in: Information Technology and Telecommunications / Energy Systems and Control

Teaching Language(s): Portuguese

Course Unit Chair: Jorge Filipe Leal Costa Semião (jsemiao@ualg.pt)

Teaching Staff: António Fernando Marques de Sousa (Lecturing load: 15 T); Luís Borges Pereira (Lecturing load: 30 PL+ 30 OT); Celestino Virtudes Dias Martins (Lecturing load: 60 PL+ 60 OT); Rui Fernando da Luz Marcelino (Lecturing load: 30 PL+ 30 OT).

Year	Semester	Hours ⁽¹⁾	Type	CU Code	ECTS
1 st	2 nd	15T+30PL+35OT	Required		5

Workload (hours): 140

Classes: 45

Tutorials: 35

Fieldwork: 0

Individual Work and Assessment: 60

Learning Outcomes (max. 1000 characters)

Interpret electric and electronic schematics and its normalization. Use components and equipment to develop techniques of construction and simulation of electric boards with industrial automatisms, including automatisms with PLCs. Use components and equipment to develop techniques of construction and simulation of electronic circuits, including printed circuits. Guide the student in the development of simple projects of automatisms and electronic circuits, concentrating on its concept and ability to solve problems. Use rationally existing resources and equipment in the lab, focusing organization standards, hygiene and safety.

Prerequisites

None.

Curriculum (max. 1000 characters)

Electric boards with industrial automatisms and their components. Types of power-up schemes for asynchronous three-phase motors. Programmable automats and their use in automatisms. Programming elements. Technological study of electronic circuit components. DC power-supply voltage and amplifier with bipolar junction transistor in common emitter configuration. Layout design of printed circuit boards with dedicated software. Project and test of electronic circuits in printed circuit boards.

Teaching and Learning Methods (max. 1000 characters including assessment)

Lectures lasting 1h, using exposition, explanation and projection of slides and examples; Laboratory classes lasting 2h, where the students develop practical assignments which include connection and assembly of electric boards with industrial automatisms, conventional and programmable, and also the development and test of printed circuit boards for electronic equipment; Tutorials lasting 2h, where students solve exercises and laboratory assignments under teacher's guidance.

Assessment

Final Grade = (2 x PG + TG) / 3 em que:

TG = Grade of the theoretical part (final examination or a test), which cannot be less than 9 out of 20;

PG = Grade of the practical part (set of assignments to be developed by the students), which cannot be negative.

If a student wants to improve their passing grade, a practical test in the lab will be required, for the practical grade, and a final examination or exam will be required, for the theoretical grade.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).

Bibliography (max. 1000 characters)

- [1] Lectures' slides – Eng. António F. Marques de Sousa
- [2] Práticas Oficinais – Instalações Eléctricas, Automatismos e Electrónica Industrial, Vítor Martins, Plátano Editora, 2ª Ed.
- [3] Electrónica Programável – Autómatos TSX, Télémecanique
- [4] Schematheque Electrotechnique - Télémecanique
- [5] RTIEBT – Regras Técnicas das Instalações Eléctricas de Baixa Tensão
- [6] NP5076 – Norma Portuguesa
- [7] Manuals and support files to the use of dedicated software for PCB project and construction
- [8] Several other files available

Demonstration of the syllabus coherence with the curricular unit's objectives (max. 1000 characters)

The syllabus was defined according with the curricular unit objectives, and the contents are introduced gradually, according with the initial prerequisites. The chapters include two parts: one on electrical technologies and another on electronic technologies. In the electrical part we start to introduce the electric boards and their components, then the main start-up motor schemes, and then the electric boards are programmed. In the electronic part, we start to study and identify the main electronic components, and then we study the design of printed circuit boards and its construction. The progressive introduction of the content eases subject comprehension, and allows students to achieve the expected outcomes.

Demonstration of the coherence between the teaching methodologies and the learning outcomes (max. 3000 characters)

The teaching methodologies include 2 different approaches, namely: (1) a theoretical approach, where the fundamental concepts are transmitted and precise hints are given on how to use these concepts to achieve the unit outcomes; (2) a practical approach, which includes laboratory assignments, to allow experimental verification of curricular unit's key concepts and resolution of applied problems, under the guidance of the teacher. These two different approaches complement themselves, and allow students to have different perspectives on the same content, so their knowledge is reached in a consistent way, allowing to achieve the curricular unit's outcomes easier.

⁽¹⁾ Theoretical (T); Theoretical and practical (TP); Practical and laboratorial (PL); Field work (TC); Seminar (S); Tutorial (OT); Individual student work (TA).