ECTS CATALOGUE

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

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

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

Professor Luís Castro
Coordinator of International Relations Office

Contact Person: Ms Dália Pires
Coimbra Institute of Engineering
Rua Pedro Nunes
Quinta da Nora
3030-199 Coimbra
PORTUGAL

Tel.: (+351) 239 790 206
ri@isec.pt

Professor Verónica Vasconcelos
Electrical Engineering Department Coordinator

Coimbra Institute of Engineering
Rua Pedro Nunes
Quinta da Nora
3030 – 199 Coimbra
PORTUGAL

Tel.: (+351) 239 790 330
veronica@isec.pt

Master Electrical Engineering

Old Code	New Code	Title - Portuguese	Title - English	ECTS	Term
1.º ano / 1st Year					
677801	60013672	Matemática Aplicada à Engenharia	Mathematics Applied to Engineering	6	Autumn
677802	60013683	Sistemas de Informação Aplicados	Applied Information Systems	6	Autumn
677803	60013694	Comunicações Industriais e Empresariais	Industrial and Enterprise Communications	6	Autumn
677804	60013707	Sistemas de Automação e Controlo	Automation and Control Systems	6	Autumn
677805	60013718	Edifícios Inteligentes e Domótica	Home Automation and Intelligent Buildings	6	Autumn
677806	60013729	Energias Renováveis *	Renewable Energies *	6	Spring
677807	60013735	Mercados de Energia *	Energy Markets *	6	Spring
677808	60013746	Supervisão e Controlo de Sistemas de Energia *	Power Systems Supervision and Control *	6	Spring
677809	60013754	Tração e Veículos Elétricos *	Electric Traction and Vehicles *	6	Spring
677810	60013760	Gestão Ambiental e Desenvolvimento Sustentável *	Sustainable Development and Environmental Management *	6	Spring
677811	60013771	Sistemas Robóticos * *	Robotic Systems * *	6	Spring
677812	60013782	Sistemas Industriais Distribuídos * *	Distributed Industrial Systems * *	6	Spring
677814	60013808	Comunicações sem Fios e Mobilidade * *	Wireless Communications and Mobility * *	6	Spring
677815	60013819	Visão e Multimédia * *	Computer Vision and Multimedia * *	6	Spring
2.º ano / 2nd Year					
677816	60013825	Gestão de Empresas	Corporate Management	6	Autumn
677817	60013836	Estágio	Internship	54	Anual
	60013847	Projeto	Project	54	Anual
	60013853	Dissertação ***	Dissertation ***	54	Anual

Some courses with * may have the same timetable as courses with **

***ISEC accept student for works/researches related with these subjects without ECTS attribution. At the end of the work, student will receive an evaluation report within the total of working hours. The presentation and defence will be done at home university.

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Mestrado em Engenharia Eletrotécnica - 6778

Master Course in Electrical Engineering - 6778

Academic Year: 2018/2019

Program Contents

Course Unit ELECTRIC TRACTION AND VEHICLES (TRAÇÃO E VEÍCULOS ELÉTRICOS)

Subject type Speciality Sciences **Research Area** Electrical Engineering

Year 1st **Semester** 2nd **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures		
Practical-Laboratoty Lectures	2	28
Tutorial Orientation		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	38
Works / Group Works	60
Project	
Evaluation	2
Additional	

Total of Working Hours

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures Theoretical-Practical Lectures	Paulo José Gameiro Pereirinha	PhD	Prof. Coord.
Practical-Laboratoty Lectures Tutorial Orientation	Paulo José Gameiro Pereirinha	PhD	Prof. Coord.

Responsible(s) Lecturer (s) Paulo José Gameiro Pereirinha

Goals / Skills

The state of development of our society is closely linked to the progress of transport and the increased mobility of people and goods. However, this increase has been made mainly at the expense of non-renewable energy sources (fossil fuels, mainly oil) and with serious environmental, energy, economic and external dependence consequences. In addition, the proliferation of private cars also causes problems of urban (im)mobility.
Thus, it is firstly intended to help students become aware of these problems and sensitize them to possible solutions, which will inevitably pass through electric (pu*re and hybrid) traction and new mobility strategies.
Then, the principles and technologies used in electric traction in road and rail are presented, in order to provide students with the technical knowledge and skills to face the emerging labor market in this area. Also included are aspects of electric propulsion in the aquatic environment (electric boats).
Many references and clues are also provided to enable them to continue the study on their own and to keep up to date upon completion of the course.

Program Contents

PART 1: THE PROBLEM OF TRANSPORT AND MOBILITY
1. IMPORTANCE OF TRANSPORT
 1.1. Relationship between transport and development
 1.2. Business volumes and people involved in the sector

2. THE PROBLEM
2.1. Cost of oil, energy dependence, local and global environmental aspects; problem of urban mobility
2.2. Negative impacts associated with rapid transport growth: accidents, noise, road congestion, air pollution
2.3. Future prospects and forecasts for the number of vehicles in circulation, increased CO_2 emissions and energy needs
2.4. Effects of gases emitted by transport and industries on the environment and human health.
2.5. Kyoto Protocol and post-Kyoto Protocol.
3. POSSIBLE SOLUTIONS FOR THE ENERGY, ENVIRONMENTAL AND URBAN MOBILITY PROBLEM
3.1. Development of cleaner, more efficient and sustainable vehicles. Comparison of technologies
3.2. Encourage the use of public transport, improved energy and pollution, and diversification of fuels. Examples
3.3. New concepts of urban mobility. Examples ("car-sharing", electric bicycles and scooters, "Segway", electric boats, other electric vehicles)
3.4. Rethinking city planning (need for specific corridors, interconnection of public transport)

PART 2: ROAD ELECTRIC VEHICLES
1. ROAD ELECTRIC VEHICLES
1.1. Types of electric vehicles (EV): with batteries (BEV) and hybrids (HEV); variants
1.2. Components of an EV; Main components and choices to make for an EV
1.3. History of EV
1.4. Advantages of EV: comparison of efficiency, pollution and capital and operating costs. WTW, WTT, TTW analysis. Life Cycle Analysis
1.5. Forecast and evolution trends of sales of EVs.
2. DYNAMIC MODEL OF ROAD VEHICLE
2.1. Coordinate system, fixed land reference, vehicle reference
2.2. Forces applied to the vehicle
2.3. Total force of movement in the vehicle: Tire rolling resistance; Aerodynamic Strength; Road Tilt Force
2.4. Parameters to be used to decrease power and energy for vehicle movement. Example of actions taken by various manufacturers
2.5. Global Model. Equations of motion: dynamic wheel / electric motor; dynamics of the vehicle. Examples.
3. BATTERIES (Energy Storage Systems)
3.1. Electrochemical accumulators
3.2. Types of main batteries and features: Lead-Acid; Nickel-Cadmium; Sodium-Sulfur; Nickel-Iron; Zinc-Ar; Nickel Metal Hydrides; Lithium, ...
3.3. Battery chargers: normal charge; fast loading; Load equalization; Load infrastructures: Normal load and inductive load; energy requirements.
3.4. Charging and discharging of batteries: ratting of batteries, depending on capacity and discharge time. Battery capacity as a function of discharge speed. Ideal loading and unloading cycles; Battery capacity over the life time; relationship between voltage, charge and electrolyte density; Charging current and constant voltage. Ideal charging and common charging. Caring for the initial and final charge. Problem and need of equalization
3.5. Examples of manufacturer's catalogs for Lead-Acid, Ni-Cd, Ni-MH and Lithium Ion batteries. Technical characteristics. Lithium ions: differences between isolated cell / cell and battery (cell grouped module)
3.6. Mass of batteries required for a particular EV autonomy.
3.7. Evolution of world production and prices of EV batteries
4. CELLS AND FUEL CELLS (Energy Storage Systems)
4.1. Principle of operation: Constitution
4.2. The "Fuel Cell" system: reformer, primary fuels, current inverter
4.3. Parameters: electrolyte, electrodes, fuel
4.4. Types of Fuel Cells
4.5. Fuel: the problem of the production, transport and distribution of hydrogen. Other fuels
4.6. Applications: motor vehicles
4.7. Efficiency: comparison with BEV and ICEV (Internal Combustion Engine Vehicle)
5. SUPERCONDENSORS AND FLYING WEELS (Energy Storage Systems): Perspectives.
6. HYBRID EV
6.1. What they are; structure and components. Existing models, features, series and parallel
6.2. Operation. Strategies to increase efficiency. Operating differences between various models (Honda Civic IMA and Insight, Toyota Prius, etc.). Demonstration of operating modes
6.3. Hybrid "Plug-in"
7. MOTORS AND DRIVES
7.1. Components of the drive: power converters and their controller. Most used power semiconductors in electric traction
7.2. Direct current: motors (series, separate excitation, permanent magnets) and its drives
7.3. Alternating current: motors (induction, permanent magnet synchronous, brushless DC motors - BLDCM, switched reluctance motors) and drives. Methods of speed and torque control. Regenerative braking
8. STANDARDIZATION IN ROAD VEHICLES

PART 3: RAILWAY DRIVING
1. BRIEF HISTORY OF THE ELECTRICAL TRACTION: problems and technological evolution
2. EVOLUTION OF ELECTRIC TRACTION IN PORTUGAL
2.1. The electric
2.2. Metropolitano de Lisboa
2.3. Portuguese Railways: generalities; CP rolling stock
2.4. Metro Mondego Project

Signature of Teacher:

3. GENERALITY OF ELECTRIC TRACTION
   3.1. Voltages and frequencies; types of catenary
   3.2. Electrical scheme of an urban railway line
   3.3. Choice of current type (DC vs AC)
   3.4. Choice of contact line voltage value; voltage drop calculation
   3.5. Feed scheme of the "feeder"
   3.6. Calculation of the power of the transformers
   3.7. Calculation of copper conductor cross-section of the contact line
   3.8. Calculation of the inclination angle of the contact line with respect to the track axis
   3.9. Pantograph
   3.10. Catenary
4. ELASTIC MECHANICAL CONNECTION SCHEME for the bogie wheel drive
   4.1. Calculation of the transmission gear ratio
   4.2. Calculation of rail-wheel force
5. AXLE DISPOSITION AND DESIGNATION of the drive axles
6. EQUATION OF THE MOVEMENT. Resistance to advancement: force due to movement; force due to slope, force due to curves; force due to tunnels
7. TRANSMISSION OF THE MOVEMENT
8. DIMENSIONING THE POWER OF MOTOR VEHICLES
9. THERMOELECTRIC TRACTION
10. WEIGHT OF MECHANICAL AND ELECTRICAL PARTS
11. MECHANICAL BRAKING: generalities; brake shoes on wheels; disc brake
12. ELECTRIC BRAKING WITH RECOVERY
13. Direct current and alternating current drive systems: motors and drives for trains
14. HIGH SPEED TRAINS

Part 4: ELECTRIC BOATS

Work Done

A group work (two, maximum three, students per group), on different topics proposed by the teacher until the end of the fourth week of classes. Performed with accompaniment during classes, with delivery and final presentation, in the last week of classes.

Teaching Methododoly

The teaching methodology consists of:
In-class theoretical classes, with projections of presentations and films (Powerpoint and others) on the topics covered, visits to relevant web pages; presentation of published case studies of research projects carried out in DEE-ISEC.
Visit to DEE laboratories with R & D projects developed in electric vehicles.
Classroom work classes.

Bibliography

Main Bibliography

- Classroom presentations with links to relevant websites;

- selected articles from international journals and conferences.

- Mehrdad Ehsani, Yimin Gao, Stefano Longo, Kambiz Ebrahimi: Modern electric, hybrid electric, and fuel cell vehicles, 3rd ed., CRC Press, 2018.

- John G. Hayes, G. Abas Goodarzi, Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles 1st ed., Wiley, 2018, ISBN-13: 978-1119063643
- Chris Mi, M. Abul Masrur, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives (Automotive Series), 2nd ed., Wiley; 2018.
- Gianfranco Pistoia, Boryann Liaw (Editors), Behaviour of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost, Springer; 1st ed. 2018.
- Leonard J. Beck MBA, V2G-101: A text about Vehicle-to-Grid, the technology which enables a future of clean and efficient electric-powered transportation, BookSurge Publishing, 2009.
- Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, 2nd ed., CRC Press, Boca Raton, Florida, USA, 2010.
- João Pedro Fernandes Trovão, "Optimização e Gestão de Múltiplas Fontes de Energia em Veículos Eléctricos", Tese de Doutoramento, Universidade de Coimbra, Outubro de 2012 (cap.1-3).
- Pedro Granchinho, Sebenta de Tracção Eléctrica (capítulos II e III), DEE, Escola Superior de Tecnologia de Tomar, Instituto Politécnico de Tomar, Tomar, 2004.
- Fernando J. T. E. Ferreira, Aníbal T. Almeida, Licínio Moreira, "Impacto energético e ambiental associado à aplicação das células de combustível nos veículos eléctricos", Actas das II Jornadas de Engenharia Electrotécnica, Tecnologia em Movimento, DEE, Instituto Politécnico de Tomar, Tomar, 20-22 Abril 2004, pp 81-138, 2004.
- Seth Leitman, Build Your Own Electric Vehicle, 3rd ed., McGraw-Hill Education TAB; 2nd edition, 2013.
- C.P. Cabrita, "Princípios fundamentais da Tracção Ferroviária", Electricidade, nº 375, Março 2000.

- James Larminie, John Lowry, "Electric Vehicle Technology Explained", 2nd ed., John Wiley & Sons, New York, 2012.
- Andreas Steimel, Electric Traction - Motive Power and Energy Supply: Basics and Practical Experience, 2nd ed., DIV Deutscher Industrieverlag, Munchen, 2014.
- Roger Kaller, Jean-Marc Allenbach, Traction électrique, Vol. I, 2nd ed. 2008, Vol. II, 1995, Presses Polytechniques et Universitaires Romandes.
- The Railway Technical Website, A window on the world of railway systems, technologies and operations, www.railway-technical.com

Other Relevant Bibliography

- Ron Hodkinson, John Fenton, Lightweight Electric/Hybrid Vehicle Design, Society of Automotive Engineers, 2001.
- Michael H. Westbrook, The Electric Car: Development and Future of Battery, Hybrid and Fuel-Cell Cars, IEE Power & Energy Series, 38, IEE Publishing; 1st edition, 2002.
- C. C. Chan, K. T. Chau, Modern Electric Vehicle Technology, OUP, Oxford, UK, 2001.
- C.P. Cabrita, "Desenvolvimento histórico e tendências actuais da tracção eléctrica", Electricidade, nº 377, Maio 2000, pp. 120-132.
- C.P. Cabrita, "Formação em tracção eléctrica ferroviária", Electricidade, nº 378, Jun. 2000, pp. 153-164.
- C.P. Cabrita, "A comutação do motor de tracção de corrente contínua ondulada alimentado por talhadores", Electricidade, nº 386, Mar. 2001, pp. 61-68.

Evaluation Method

Final formal written exam (worth 10 points over 20, which is the total grade; minimum score: 4.2 points over 10);
Work/Project assessment with final report and oral presentation on last classes (worth 10 points over 20; minimum score: 4.2 points over 10).

Conditions for Exam Admission

Being approved at the group work and its defense.

Access Conditions and Attendance Excuse

For students of special schemes, namely those under the Worker-Student Statute, and for components with compulsory attendance and distributed assessment, it must be agreed between the responsible for the curricular unit and the student, on the initiative of the student and at the beginning of the academic semester, an alternative way of functioning of these components, when the student cannot effectively attend them at the scheduled times.
In this case, during the first two teaching weeks, the students must indicate to the teacher, their status as student worker, establishing the form of practical work. Authenticated working hours may be required from the employer.

Conditions for Results Improvement

Improvement of the Final Exam part, worth 10 points.
Exceptionally, with the agreement of the professor, the part of the Group Work, marked for 10 points, can also be improved.

Date

17/01/2019

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Mestrado - MSc Engenharia Eletrotécnica - 6778

Mestrado - MSc Electrical Engineering - 6778

Academic Year: 2018/2019

Program Contents

Course Unit POWER SYSTEMS SUPERVISION AND CONTROL (677808)

Subject type Specialty Sciences **Research Area** Electrical Engineering

Year 1st **Semester** 2nd **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures		
Practical-Laboratoty Lectures	2	28
Tutorial Orientation		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	97
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Carlos Manuel Borralho Machado Ferreira	PhD	Prof. Coordenador
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	Carlos Manuel Borralho Machado Ferreira	PhD	Prof. Coordenador
Tutorial Orientation			

Responsible(s) Lecturer (s) Carlos Manuel Borralho Machado Ferreira

Goals / Skills

The main aims of this course unit are:
To understand and explain the SCADA/EMS/DMS.
To understand the main load forecasting techniques.
To understand and explain the automatic generation control and carry out a small-signal analysis of a multi-area system.
To understand and to explain dynamic mechanisms behind angle stability problems in electric power systems, including physical phenomena, modelling issues and simulations.
To understand the weighted least-squares state estimation method of an electric power system.
To understand the main issues related to the integration of alternative sources of energy into the electric power grid

At the end of this course unit the learner is expected to be able:
To understand the main functions and issues involved in different activities associated with power systems supervision and control.
To design, conduct experiments and solve practical real-world issues in power systems control and operation.
To identify, formulate and solve engineering problems related to power system control and stability.
To communicate in a professional and technical manner, both in written and oral form, the subjects related to this course.

Signature of Teacher: _____

Program Contents

1. Supervision, control and protection of a Power System
2. Control Centres: Supervisory Control and Data Acquisition (SCADA); Energy Management Systems (EMS); Distribution Management Systems (DMS)
3. Load forecast
4. Electric Power Systems State Estimation: Introduction to State Estimation in Power Systems; Weighted Least Squares Estimation; State Estimation of an AC Network; Fast Decoupled State Estimation Methods; State Estimation by Orthogonal Decomposition; Network Observability and Pseudo-measurements, Detection and Identification of Bad Measurements
5. Electric Power Systems Stability: State Transition Diagram; Steady-state and Transient Stability; Multimachine Time Domain Solution by Numerical Integration; Classic Model and Detailed Model of the electric power network components; Techniques to Improve the Transient Stability of an EPS; Voltage Stability; Frequency Stability
6. Integration of Renewable Energy in Electric Power Systems

Work Done

Not included in this course unit.

Teaching Methododoly

The teaching methodologies, that promote active and collaborative learning, follow a temporal sequence that enables students to acquire theoretical concepts, solve a set of exercises and carry out practical case studies. In order to analyze some complex engineering problems dedicated software is introduced to the students.

Bibliography

- A. Gómez-Expósito, A. J. Conejo, C. Canizares, *Electric Energy Systems*: *Analysis and Operation*, 2nd Edition, CRC Press 2018.
- A. Wood, B. Wollenberg, G. Sheblé, *Power Generation, Operation and Control*, 3rd Edition, Wiley Interscience, 2013.
- B. Fox, et al., *Wind Power Integration: Connection and system operational aspects*, 2nd Edition, IET, 2014.
- H. Saadat, *Power Systems Analysis*, PSA Publishing, 3rd Edition, 2010.
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- R. Castro, E. Pedro, *Exercícios de Redes e Sistemas de Energia Elétrica*, 2.ª Edição, IST Press, Coleção Apoio ao Ensino, 2015 (in Portuguese).

Online Knowledge Library.
Available Support Material: lecture notes; notes of practical classes; examples of practical exercises.

Evaluation Method

The continuous evaluation implies the completion of 2 tests during the semester (TE1 and TE2). The final grade (NF) is computed as: NF = 0.5 TE1 + 0.5 TE2, the minimum grade for theoretical component as well as for the practical component is 4 points, in each partial assessment. The evaluation by final exam (FE) has a written assessment that replaces the partial tests. In this case, the final grade is given on the basis of the examination alone, NF = FE. Approbation in the curricular unit is obtained if NF >= 9.5 points (scale 0-20).
Partial Assessment Tests (Theoretical and Practical):
1st Frequency: April 12, at 18h:30m
2nd Frequency: June 14, at 18h:30m

Conditions for Exam Admission

All students enrolled in the course have access to the final exam.

Access Conditions and Attendance Excuse

For students of special schemes, namely those under the worker-student statute it should be agreed upon between the course unit and the student, on the initiative of the latter and at the beginning of the academic semester, an alternative way of functioning of these components, when the student cannot effectively attend them at the scheduled times.

Conditions for Results Improvement

In accordance with the legislation.

Date	**Signature from the lecturer responsible for the course**
21/01/2019	Carlos Machado Fenina

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature: A. Pereira

Mestrado - MsC Engenharia Eletrotécnica

Mestrado - MsC Electrical Engineering

Academic Year: 2018/2019

Program Contents

Course Unit ENERGY MARKETS

Subject type Sciences of the Specialty **Research Area** Electrical

Year 1 **Semester** 2 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	1	12
Practical-Laboratoty Lectures	1	12
Tutorial Orientation		4

Unaccompanied Working Hours

Activity Type	Total Hours
Study	47
Works / Group Works	50
Project	
Evaluation	3
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Adelino Jorge Coelho Pereira	PhD	Prof. Adjunto
Theoretical-Practical Lectures	Adelino Jorge Coelho Pereira	PhD	Prof. Adjunto
Practical-Laboratoty Lectures	Adelino Jorge Coelho Pereira	PhD	Prof. Adjunto
Tutorial Orientation			
Seminar	To be defined		

Responsible(s) Lecturer (s) Adelino Jorge Coelho Pereira

Goals / Skills

The main aims of this course unit are:
Analyze the most relevant models that have been used to form the new skeleton of power systems: restructuring of tariff systems; the Portuguese electricity sector and the MIBEL; regulation and regulatory approaches; the basic economics and engineering used to design power markets; nodal marginal pricing; and investment analysis;
Analyze the natural gas coal, oil and renewable energy market;
An important objective of this course is to contribute to develop the capacity of the students to work autonomously, to do bibliographic research, to prepare written reports and to deliver oral presentations.
At the end of this course unit the learner is expected to be able:
To understand the Market structures of electricity.
To understand the standard principles of bilateral markets, exchanges and pools.
To understand the natural gas, coal, oil and renewable energy market.
To understand the basic economics and engineering used to design energy markets.

Lecturer's signature: A. Pereira

Program Contents

1. Evolution of energy systems in a market environment.
2. Market structures of electricity.
3. Regulatory policies.
4. Methods of assessment and justification of spot prices.
5. Markets energy production.
6. Tariff systems.
7. Structure and operation of MIBEL.
8. World energy situation.
9. Natural Gas Market.
10. Coal Market.
11. Oil Market.
12. Renewable Energy Market.

Work Done

- Carrying out a set of work on topics within the scope of the curricular unit during the theoretical-practical classes and practices.
- The presentation and defense of the works will be done during the practical classes.

Teaching Methododoly

Participatory and continuous participation of students in the study and discussion in the subjects of the curricular unit. There are published notes that cover the globality of the topics covered in the curricular unit.

Bibliography

João Paulo Tomé Saraiva, J. Pereira da Silva, M. T. Ponce de Leão, Mercados de Electricidade – Regulação e Tarifação de uso das Redes, Edição da Faculdade de Engenharia da Universidade do Porto, 2002.
Daniel S. Kirschen, Goran Strbac, Fundamentals of Power System Economics, 2nd Edition, Wiley, 2018.
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J. P. Sucena Paiva, Redes de Energia Eléctrica, uma Análise Sistémica, 2.ª Edição, IST Press, Dezembro de 2007.
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Jorge Vasconcelos, Anos-Luz, A regulação da Energia Eléctrica em Portugal, Entrelinhas, Novembro de 2006.
João J. E. Santana, Maria José Resende, Reflectir Energia, ETEP - Edições Técnicas e Profissionais, Setembro de 2006.
Luís Mira Amaral, Energia e Mercado Ibérico, Booknomics, Junho de 2006.
S. Hunt, G. Shuttleworth, Competition and Choice in Electricity, Wiley, 1996.
C. Harris, Electricity Markets: Pricing, Structures and Economics, Wiley, 2006.
BP, Energy economics, https://www.bp.com/en/global/corporate/energy-economics.html
Documentação da ERSE (www.erse.pt)
IEA - International Energy Agency (www.iea.org/)
Biblioteca do conhecimento online (www.b-on.pt)
Apontamentos disponibilizados pelo docente.

Evaluation Method

Laboratory work in group (50% of the evaluation);
Final written exam (50% of the evaluation, minimum of 40%).

Conditions for Exam Admission

All students enrolled in the course unit, who have performed the proposed practical work and obtained the minimum required value, have access to the final exam.

Access Conditions and Attendance Excuse

For special regime students, namely those under the worker-student statute (Law no. 99/2003 and Law no. 35/2004), and for components with compulsory attendance and distributed evaluation must be agreed between the person responsible for the curricular unit and the student, by initiative of student and at the beginning of the semester, an alternative way of operating these components, when the student can not effectively attend them at the scheduled times.

Conditions for Results Improvement

In accordance with the legislation at the Instituto Superior de Engenharia de Coimbra.

Date	**Signature from the lecturer responsible for the course**
18/01/2019	Adelino Jorge Coelho Pereira

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher: P. F. Ceisim-Ag

Mestrado em Engenharia Eletrotécnica

MSc in Electrical Engineering
Academic Year: 2018/2019

Program Contents

Course Unit RENEWABLE ENERGIES

Subject type Engineering Sciences **Research Area** Electrical Engineering

Year 1 **Semester** 2 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures		
Practical-Laboratoty Lectures	2	24
Tutorial Orientation		
Seminar		4

Total of Working Hours 156

Unaccompanied Working Hours

Activity Type	Total Hours
Study	61
Works / Group Works	40
Project	
Evaluation	3
Additional	

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Cristina Isabel Ferreira Figueiras Faustino Agreira	PhD	Professor
Theoretical Lectures	Paulo Jorge Ribeiro da Fonte	PhD	Professor
Theoretical-Practical Lectures			
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	Cristina Isabel Ferreira Figueiras Faustino Agreira	PhD	Professor
Practical-Laboratoty Lectures	Paulo Jorge Ribeiro da Fonte	PhD	Professor
Tutorial Orientation			

Responsible(s) Lecturer (s) Cristina Isabel Ferreira Faustino Agreira
Paulo Jorge Ribeiro da Fonte

Goals / Skills

The main aims of this course unit are: Understanding modern energy paradigm; To be able select the best solutions for any situation.

Work Done

At the end of this course unit the learner is expected to be able Solve any problem related to Renewable Energies

Module I (P.F.)

Teorical
A minimum of thermodynamics

The physical nature of energy
Principles of thermodynamics

Main variables and thermodynamic transformations
Thermal cycle performance
Pratctical termal cycles

Global renewable energy resources.

Practical

Troubleshooting illustrative Programmatic Content

Module II (C.F.A)

Theoretical

Conventional electricity generation
Mini-hydro plants
Wind Energy
Solar energy,
Photo-electricity.
Nuclear energy.
Energy biomass,
Geothermal energy,
Energy Sea Term (OTEC).
Tidal power.
Hydrogen and fuel cells.

Practical

Elaboration of practical exercises on an installation of a mini - hydro for energy production.
Elaboration of practical exercises on a wind farm for energy production.
Elaboration of practical exercises on solar energy for energy production.

Teaching Methododoly

Elaboration of Practical Work related to Renewable Energies.
These works will be carried out in a group by the students and guided by the teacher in the practical and theoretical - practical classes.
The presentation and defense of these works will be done during the theoretical - practical classes.

The Seminar will take place in the week of May 13 to 17, 2019

Bibliography

Teacher Lecture Slides and Laboratory Papers

- Renewable energy resources, John Twidell, Anthony D. Weir, Tony Weir, Taylor & Francis, 2006, ISBN 0419253203, 9780419253204.
- Renewable Energy, Godfrey Boyle, Open University, Oxford University Press, ISBN 0199261784, 9780199261789.
- Fundamentals of renewable energy processes, Aldo Vieira Da Rosa, Academic Press, 2005, ISBN 0120885107, 9780120885107.
- Renewable energy: technology, economics, and environment, Martin Kaltschmitt, Wolfgang Streicher, Andreas Wiese, Springer, 2007, ISBN 3540709479, 9783540709473.
- Renewable energy: its physics, engineering, use, environmental impacts, economy, and planning aspects, Bent Sørensen, Academic Press, 2004, ISBN 0126561532, 9780126561531.
- Handbook of Energy Efficiency and Renewable Energy, Frank Kreith, D. Yogi Goswami, CRC Press, 2007, ISBN 0849317304, 9780849317309.

- TERMODINÂMICA
  - Fundamentals of renewable energy processes, Aldo Vieira Da Rosa, Academic Press, 2005, ISBN 0120885107, 9780120885107.
  - Termodinâmica Técnica / U. A. Kirillin, V. V. Sichev, A. E. Sheindlin. - Moscú : Mir, 1976.
  - Fundamentals of Engineering Thermodynamics, M. Moran and H. Shapiro, John Wiley & Sons.
  - TEST – The Expert System for Thermodynamics, http://www.thermofluids.net/.
- ENERGIA NUCLEAR

Nuclear energy technology: theory and practice of commercial nuclear power / Ronald Allen Knief. - Washington : Hemisphere Publishing Corporation, 1981.

Signature of Teacher:_____

Evaluation Method

Module I
Final written exam: 6 values.

Module II
Final Written for theoretical and practical parts: 8 values.
Group work: 6 Values.
The works are realize by groups of 2 students, and will be the subject of 15-minutes presentation (each group) to be held in the last practice session of the module.

Conditions for Exam Admission

For the student to have access to the final exam will be enough that he / she is enrolled in the course unit.
In accordance with the academic regulations and applicable laws.

Access Conditions and Attendance Excuse

In accordance with the academic regulations and applicable laws.

Conditions for Results Improvement

In accordance with the academic regulations and applicable laws.

Date	Signature from the lecturer responsible for the course
21-01-2019	Cristina Fonseca PAULO J. N. FONTE

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:_____

Mestrado - MSc em Engenharia Eletrotécnica - 6778

Mestrado - MSc in Electrical Engineering - 6778

Academic Year: 2018/2019

Program Contents

Course Unit HOME AUTOMATION AND INTELLIGENT BUILDINGS - 677805

Subject type Sciences of speciality **Research Area** Electrical Engineering

Year 1st **Semester** 1st **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures		
Practical-Laboratoty Lectures	2	28
Tutorial Orientation		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	56
Works / Group Works	42
Project	
Evaluation	2
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	António Manuel Ferreira Simões de Almeida	MSc	Adjunct Professor
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	António Manuel Ferreira Simões de Almeida	MSc	Adjunct Professor
Tutorial Orientation			

Responsible(s) Lecturer (s) António Manuel Ferreira Simões de Almeida

Goals / Skills

The main aims of this course unit are:
To familiarize students with the concepts in design, automatization and supervision of buildings in residential and commercial sectors.

At the end of this course unit the learner is expected to be able:
To know how to develop projects of automation in buildings.
To choose the best options and solutions for a rational use of energy in buildings and increase the occupants comfort and commodity.

Program Contents

Concepts and Objectives of Intelligent Buildings and Home Automation.
Intelligent Buildings and Inmótica.
Development of Automation Systems for Buildings in Terms of Technology and Systems Architecture.
Techniques of Energy Management in Buildings: Architecture and the Sun; Efficient Lighting; Efficient HVAC.
Integrated Project of Buildings.

Signature of Teacher:_____

Solutions for Applications in Home Automation and Intelligent Buildings: The X10 Technology; The Active Home Pro Software; The KNX/EIB Technology; Applying KNX/EIB Technology; Addressing in the KNX/EIB Technology.
Services in Intelligent Buildings.
Structured Cabling Projects.
Open Systems.
Future and Present of Intelligent Buildings.
Implementation of Small Installations in Home Automation.

Work Done

Based on modules that use X10 technology, small home automation facilities will be developed by the students.
Based on modules that use KNX technology, small home automation systems will be developed by the students.
From a case study of a residential building, the students will be invited to design a home automation installation for that building.

Teaching Methododoly

Theoretical classes: expository sessions with interaction between teacher and students. Case-studies presentation.
Practical classes: sessions of information research, followed by analysis and synthesis. Laboratory work, work group and applied research. Practical applications through the configuration of modules used in building automation.

Bibliography

"Advanced Energy Design Guide for Small to Medium Office Buildings", ASHRAE.

"Conceitos Bioclimáticos para os Edifícios em Portugal", Hélder Gonçalves e João Mariz Graça.

"ActiveHome Pro, Owner's Manual", Marmitek.

"KNX Handbook for Home and Building Control", KNX Association.

"Light's Labour's Lost", IEA.

"A Guide to Energy-Efficient Heating and Cooling", Energy Star.

"Building Services Handbook", Elsevier.

"European Standards Reference Guide", ANIXTER.

"Manual ITED, 3ª Edição", ANACOM.

"Investigating Open Systems", STRATA.

"Open Systems Design Guide", ECHELON.

Various documents to be provided by the teacher throughout the semester.

Evaluation Method

Continuous evaluation: written assignment, oral presentation, class participation and attendance (50%); Written test (50%).

Conditions for Exam Admission

Participation in at least 75% of the practical classes and delivery of the final report for the practical work until the end of the last theoretical class week (2019-01-25).

Access Conditions and Attendance Excuse

In the case of student-worker students the conditions of participation in the classes will be combined between the teachers and students, in the first week of classes, and according to the current legislation.

Conditions for Results Improvement

The conditions for improvement of classification are those expressed in the law.

Date

2018/10/12

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Mestrado - MSc Engenharia Eletrotécnica - 6778

Mestrado - MSc Electrical Engineering - 6778

Academic Year: 2018/2019

Program Contents

Course Unit AUTOMATION AND CONTROL SYSTEMS - 677804

Subject type Sciences of Specialty **Research Area** Electrical + Maths

Year 1 **Semester** 1 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures		
Practical-Laboratoty Lectures	2	26
Tutorial Orientation		
Seminar		2
Total of Working Hours		156

Unaccompanied Working Hours

Activity Type	Total Hours
Study	40
Works / Group Works	28
Project	30
Evaluation	2
Additional	

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Nuno Miguel Fonseca Ferreira	PhD	Prof. Adj.
	Rui Manuel Carreira Rodrigues	PhD	Prof. Coord.
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	Nuno Miguel Fonseca Ferreira	PhD	Prof. Adj.
	Rui Manuel Carreira Rodrigues	PhD	Prof. Coord.
Tutorial Orientation			

Responsible(s) Lecturer (s) Nuno Miguel Fonseca Ferreira
Rui Manuel Carreira Rodrigues

Goals / Skills

The course unit of Automation and Control Systems intends to offer students an overview of the themes and technologies involved in the design and application of industrial systems. Students will understand these topics through the implementation of real systems.

Program Contents

Part I (lecturer: Rui Manuel Carreira Rodrigues)
Dynamic continuous-time and discrete-time mathematical models
1. Z-transform: definition and properties; Inverse Z-transform; application of the Z-transform in the determination of the solution of problems with initial conditions for linear difference equations with constant coefficients
2. Representations of a time-invariant linear control system in the form SISO: input-output representation, transfer function and state-space model; matrix A^k; solution of the homogeneous system and solution of the complete system.
Part II (lecturer: Nuno Miguel Fonseca Ferreira)
Implementation of Controllers
1. Identification of the system to be controlled; 2. Continuous PID controller; 3. Performance indicators.
Computer Controlled Systems

Signature of Teacher:

1. Selection of sampling period; 2. Discretization of the system; 3. Discretization of the PID controller; 4. Equation of controller differences.
Introduction to Industrial Automation, Industrial Control, characterization and classification of industrial systems
Introduction to computer integrated production
Flexible production systems
1. Line balancing; 2. Automatic Warehouses; 3. AGV system.

Work Done

TP1 - System Identification, beginning 6th week and ending 7th week, TP2 - Continuous control, beginning 8th week and ending 9th week, TP3 - Discrete control, beginning 10th week and ending 11th week), as well as implementation of a SCADA system, using the ZENON computer application (TP4 - Manufacturing process, beginning 12th week and ending 14th week).

Teaching Methodology

The method of teaching is conventional, exposing the themes in the theoretical classes, solving problems in practical classes and laboratory demonstrations. The main textbook is the book [2] of the bibliography, which is accessible reading and covers the whole program of the discipline. Exposure of matter is preferably done in the board. The material is accompanied by works carried out in the PC, in the laboratory, allowing the execution of numerous control works.

Bibliography

Part I
1. Glyn James, Advanced Modern Engineering Mathematics, Addison-Wesley
2. Maria Isabel Ribeiro, Análise de Sistemas Lineares, volumes 1 e 2, IST Press
Part II
1. Katsyhiko Ogata, System Dynamics, Prentice-Hall
2. J. L. Martins de Carvalho, Sistemas de Controlo Automático, LTC Editora, 2000.

Evaluation Method

Module I - Written test that represents 8 values, in which it is necessary to obtain a final classification equal or superior to 40%.

Module II - This module has two assessment components: Written test that represents 4 values, in which it is necessary to obtain a final classification equal or superior to 40% and the practical work done represent 8 values.

There are two opportunities to take the written examination exam, within the deadlines set by the Pedagogical Council.

Conditions for Exam Admission

Have attended the laboratory classes (up two fouls) and have held and defended with approval the laboratory work.

Access Conditions and Attendance Excuse

For students under the Worker-Student Statute, and for components with compulsory attendance and distributed assessment, it may be agreed upon by the teacher responsible for the curricular unit and the student, adjustments to the functioning of these components.
In this case, during the first two teaching weeks, the students must indicate to their respective teacher their status as student worker, establishing immediately how to adjust the functioning of the referred components. The presentation of the employer's work schedule or other relevant information may be required.

Conditions for Results Improvement

The improvement of classification will be done through a global evaluation process, in order to allow the improvement of all evaluation components. Through a research work to improve the practical component and final exam in one of the allowed times.

Date

12-10-2018

Signature from the lecturer responsible for the course

Rui Rodrigues.

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Mestrado em Engenharia Eletrotécnica - 6778

Master Course in Electrical Engineering - 6778

Academic Year: 2018/2019

Program Contents

Course Unit 677803 - INDUSTRIAL AND ENTERPRISE COMMUNICATIONS

Subject type Sciences of Speciality **Research Area** Electrical Engineering

Year 1 **Semester** 1 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures		
Practical-Laboratoty Lectures	2	26
Tutorial Orientation		
Seminar	2	2
Total of Working Hours		156

Unaccompanied Working Hours

Activity Type	Total Hours
Study	60
Works / Group Works	38
Project	
Evaluation	2
Additional	

Lecturer

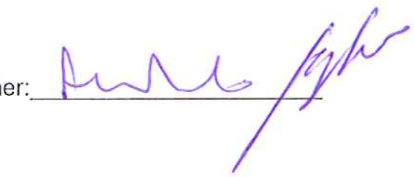
Activity Type	Name	Qualifications	Category
Theoretical Lectures	Alexandre Miguel d´Orey Gouveia e Melo	MSc	Professor
Theoretical Lectures	João Carlos Ramos Perdigoto	MSc	Invited Professor
Practical-Laboratoty Lectures	Alexandre Miguel d´Orey Gouveia e Melo		Professor
Practical-Laboratoty Lectures	João Carlos Ramos Perdigoto		Invited Professor
Tutorial Orientation			

Responsible(s) Lecturer (s) Alexandre Miguel d´Orey Gouveia e Melo / João Carlos Ramos Perdigoto

Goals / Skills

It is intended to introduce a broad set of concepts and technologies of communication and telecommunications systems used in industrial and business environments. The teaching will address aspects that provide an integrated view of these different technologies in order to ensure the qualitative interpretation and correct and comprehensive planning of communication systems in industrial and business environments.
The skills to be acquired by the students are:

- To know and understand the technologies available in the market.
- To know and understand industrial communication systems, using equipment available in the market.
- To know and understand, choose, design, execute and maintain local networks, using equipment available in the market.
- To understand and execute diagnosis of communication problems in local and industrial networks.
- To know and understand telecommunication systems and services.
- To know, to understand the telephone systems: PCM and multiplexing as well as the systems of communication by wireless microwave beams.
- To know, understand optical communications systems.
- To know, understand data networks and the Internet.
- To know, understand the telecommunications services.

Signature of Teacher: 

Program Contents

Technologies for long-distance transmission: introduction to telecommunications systems and services;
Telephone systems; PCM and multiplexing; radio-relay systems;
Optical communications systems;
Voice communication services in an enterprise environment;
Telecommunications and Internet services;
Data and Internet networks and their essential services: WEB, EMAIL, VOIP, file sharing
Physical means for networks in business and industrial environment
Protocols of industrial and corporate networks and TCP / IP: technologies, integration, network interconnection and routing.
Operating systems and network communication functionalities
Mobility, security and privacy in communications.

Work Done

Communications Module (lecturer Alexandre Melo):

Transmission of an analog signal at 64kbps by simulation using Matlab / Simulink;
Companion – A-law and μ-law - simulation using Matlab / Simulink;
PSK and QAM Modulation Techniques;
Fiber Optic Transmission Systems.

Network Module (lecturer João Perdigoto):

Implementation of a small business local area networks.
Implementation of IP services for enterprise application: VoIP and SNMP.
Bibliographic research work.

Teaching Methododoly

Classes will be taught in both theoretical and laboratory classes. Theoretical classes will be expositive and will be used examples and guidance for laboratory classes. External entities (companies or consultants) may be invited to present topics in seminars or the seminars will be presented by the students, after previous research, followed by an open discussion on the subject.

Bibliography

- Carlson, B. A., *Communication Systems*: *An introduction to Signals and Noise in Electrical Communication*, 4th Ed., McGraw-Hill, 2002. ISBN: 007009960X.
- Haykin, Simon, *An Introduction to Digital and Analog Communications*, John Wiley & Sons, 1989. ISBN: 0-471-85978-8.
- ISEC, "Cablagem Estruturada CCNA1", DEIS, ISEC, Outubro 2007.
- Monteiro, E., Boavida, F. "Engenharia de Redes Informáticas", FCA.
- Lammle, Todd, "CCNA Cisco *certified network associate: study guide*", Sybex.
- Geier, Jim, "*Wireless Lans: implementing interoperable networks*", MacMillan.
- Slides handouts of the theoretical classes and manuals of the equipment used.

Evaluation Method

Communications Module (lecturer Alexandre Melo):

- Specific section at the final exam - 7 points being necessary to obtain a minimum of 50%
- Practical Work (report delivery and oral presentation) - 3 points, minimum of 50%. Deadline: 04/DEC/2018

Network Module (lecturer João Perdigoto):

Signature of Teacher:

- Specific section in the final exam - 7 points being necessary to obtain a minimum of 50%
- Practical Work (report delivery and oral presentation) - 3 points, minimum of 50%. Deadline: 12/JAN/2019

Final grade consists of the sum of the previous components to a maximum of 20 points.

Conditions for Exam Admission

Regular attendance of at least 50% of laboratory classes.

Access Conditions and Attendance Excuse

In accordance with the academic regulations and applicable laws.

Conditions for Results Improvement

In accordance with the academic regulations and applicable laws.

Date	Signature from the lecturer responsible for the course
15-October-2018	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher: _____

Mestrado - MSc em Engenharia Eletrotécnica - 6778

Mestrado – MSc in Electrical Engineering - 6778

Academic Year: 2018 / 2019

Program Contents

Course Unit 677802 - APPLIED INFORMATION SYSTEMS

Subject type Specialty Sciences **Research Area** Electrotechnical

Year 1 **Semester** 1 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures		
Practical-Laboratoty Lectures	2	28
Tutorial Orientation		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	38
Works / Group Works	60
Project	
Evaluation	2
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Inácio Sousa Adelino Fonseca	PhD	Prof. Adjunto
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	Inácio Sousa Adelino Fonseca	PhD	Prof. Adjunto
Tutorial Orientation			

Responsible(s) Lecturer (s) Inácio Sousa Adelino Fonseca

Goals / Skills

Understanding the role of Database Management Systems (DBMS) in Information Systems
Understand the need for modeling in the design of databases
Understand the basics in relational databases: relational model, integrity, normalization, relational operations
Model, design and implement a relational database
Manipulate and extract data in Relational Databases using Structured Query Language (SQL)
Develop and structure application interfaces with database management systems
Understanding flow control in PHP programs
Understand the different hypothesis of accessing the database from the PHP language
The different programming philosophies for the WEB: program to execute in the server, and program to execute in the browser of the client. Learn the basic commands of Javascript and HTML and CSS.

Program Contents

1. Interaction Language - HTML, CSS, JavaScript, PHP, C ++, JAVA, Python
2. Vision on the new paradigms of application development for information systems - Desktop / Web
3.Introduction to databases
4. Database management systems
5. Relational Model

Signature of Teacher: I Fonseca

6. Database modeling
7. Data manipulation, integrity and security
8. Database design
9. The SQL language and its applications
10. Documentation of an information system through graphic language

Work Done

Development of a data management system via Web. Statement made available on 2018/10/15 on the moodle platform, deadline for final delivery on January 25, 2019.

Teaching Methododoly

Theoretical classes

Exposition of theoretical concepts.
Presentation and analysis of examples, stimulating discussion of solutions with students throughout the class.

Laboratory classes

The understanding of the acquired knowledge is promoted through the analysis, discussion and realization of practical examples in the laboratory.

Bibliography

- José Luís Pereira, "Database Technology", FCA - Editora de Informática, 1998.
- Luís Damas, "SQL - Structured Query Language", 14th Edition ", FCA - Editora de Informática, 2017, ISBN: 978-972-722-829-4.
- Frederico Tavares, "PHP with Object Oriented Programming", FCA, 2016, ISBN: 978-972-722-837-9.
- Pedro Coelho, "Programming in Java", 5th Edition, FCA - Editora de Informática, 2016, ISBN: 978-972-722-840-9.
- Luís Abreu, - "Javascript 6", FCA - Editora de Informática, 2015, ISBN: 978-972-722-815-7.
- Luís Abreu, - "HTML5", 4th Edition, FCA - Editora de Informática, 2015, ISBN: 978-972-722-821-8.
- In the moodle platform are available: the presentations used during the theoretical classes, proposals of exercises, support software, as well as a practical statement for each laboratory class explaining the various topics covered.
- R. Ramakrishnan and J. Gehrke, "Database Management Systems", McGraw-Hill Science / Engineering / Math; 3rd edition, 2002.
- C. J. Date, "An Introduction to Database Systems," Addison-Wesley Publishing, 8th Edition, 2004.
- W. Jason Gilmore, "Beginning PHP and MySQL: from novice to professional", Berkeley, CA: Apress, ISBN: 978-1-59059-862-7

Evaluation Method

Written exam quoted for 12 values. Minimum of 30% on the written exam.
Practical work for 7 values + 1 individual value of participation in laboratory classes - mini exercises.

Conditions for Exam Admission

Attend a minimum of 75% of laboratory classes.

Access Conditions and Attendance Excuse

For students under the Worker-Student Statute, and for components with compulsory attendance and distributed assessment, it may be agreed upon by the teacher responsible for the curricular unit and the student, adjustments to the functioning of these components.
In this case, during the first two teaching weeks, the students must indicate to their respective teacher their status as student worker, establishing immediately how to adjust the functioning of the referred components. The presentation of the employer's work time or other relevant information may be required.

Conditions for Results Improvement

In accordance with the legislation in force.

Date	Signature from the lecturer responsible for the course
15/10/2018	Inácio Sousa Fonseca

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Mestrado - MSc Engenharia Eletrotécnica - 6778

Mestrado - MSc Electrical Engineering - 6778

Academic Year: 2018/2019

Program Contents

Course Unit 677801 - APPLIED MATHEMATICS

Subject type Basic Sciences **Research Area** Mathematics

Year 1 **Semester** 1 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	1	14
Practical-Laboratoty Lectures	1	14
Tutorial Orientation		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	95
Works / Group Works	
Project	
Evaluation	5
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Deolinda Maria Lopes Dias Rasteiro	Doutoramento	Prof. Adjunto
Theoretical-Practical Lectures	Deolinda Maria Lopes Dias Rasteiro	Doutoramento	Prof. Adjunto
Practical-Laboratoty Lectures	Deolinda Maria Lopes Dias Rasteiro	Doutoramento	Prof. Adjunto
Tutorial Orientation			

Responsible(s) Lecturer (s) Deolinda Maria Lopes Dias Rasteiro

Goals / Skills

Learn efficient network representations;

Implement and determine exact solutions to optimal path problems using labeling algorithms or algorithms obtained from those;

Recognize when a network problem verifies the optimality principle and act accordingly in order to determine its solution.

Solve queuing theory problems; To be able to recommend more efficient organization plans in terms of servers and/or policy queues.

Binary morphology: Structuring element, basic element, and basic operators: Erosion, Dilation, Opening, Closing, Properties of the basic operators.

Program Contents

Network Optimization; Queuing Theory; Mathematical Morphology

Signature of Teacher: DiRastemo

Work Done

Not applied

Teaching Methododoly

Mainly expositive (theoretical part) although students solve practical by themselves with guidance from the lecturer.

Bibliography

The Optimal Path Problem - Ernesto Q. Vieira Martins, Marta Margarida B. Pascoal, Deolinda Maria L. Dias Rasteiro and José Luis E. Santos, (*Investigação Operacional*, 19:43-60, 1999)

Image analysis using mathematical morphology. Haralick, R M | Sternberg, S R | Zhuang, X,IEEE PATTERN ANAL. MACH. INTELLIG. Vol. PAMI-9, no. 4, pp. 532-550. 1987

Lecturer notes

Evaluation Method

One written test after each module or final written exam. Distributed assessment will be done on:
1st test: November 22nd, 2018; (10 out of 20)
2nd test: January 07th, 2019; (5 out of 20)
3rd test: January 24th, 2019. (5 out of 20)
To be dismissed of the correspondent part on the final exam student has to obtain at least half of each test value.

Conditions for Exam Admission

To be a course student.

Access Conditions and Attendance Excuse

To be a course student.

Conditions for Results Improvement

Be enrolled in the exam whenever improvement results are permitted.

Date

15-10-2018

Signature from the lecturer responsible for the course

Deolinda Maria Lopes Dias Rasteiro

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:_____

Mestrado - MSc Engenharia Eletrotécnica - 6778

Mestrado - MSc Electrical Engineering - 6778

Academic Year: 2018/2019

Program Contents

Course Unit 677816 - CORPORATE MANAGEMENT

Subject type Sciences of Speciality **Research Area** Industrial Engineering and Management

Year 2 **Semester** 1 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	4	28
Theoretical-Practical Lectures	4	28
Practical-Laboratoty Lectures		
Tutorial Orientation		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	30
Works / Group Works	68
Project	
Evaluation	2
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	José Luís Ferreira Martinho	Doutoramento	Prof. Adjunto
	Joaquim Alexandre Macedo de Sousa	Doutoramento	Prof. Adjunto Convidado
Theoretical-Practical Lectures	José Luís Ferreira Martinho	Doutoramento	Prof. Adjunto
	Joaquim Alexandre Macedo de Sousa	Doutoramento	Prof. Adjunto Convidado
Practical-Laboratoty Lectures			
Tutorial Orientation			

Responsible(s) Lecturer (s) José Luís Ferreira Martinho

Goals / Skills

Provide an overview of organizations and management in the context of contemporary societies.
At the end of this course, students should be able to:

- Understand the main characteristics of the business firms, applying some analysis models
- Understand the importance of the marketing management
- Analyze the markets and his mains stakeholders. Identify the set of marketing tools that the firm uses to influence market behavior.
- Propose a brief marketing plan of a given business.
- Understand the different theoretical approaches to leadership and motivation in the context of a firm.
- Develop communication skills that are fundamental teams and organizational management.
- Foster strategic, comprehensive and global management.
- Build Gantt diagrams
- Understand different approaches to inventory management
- Understand and combine the information contained in the different financial statements
- Analyze the different types of information required to report and judge the overall economic and financial situation

Signature of Teacher:_____

of the company,

- Identify the main taxes levied on companies and explain their major impacts on financial reports.
- Identify and explain the main investment appraisal methods used in practice and apply each method to reach a decision on an investment opportunity;
- Identify a business opportunity and to independently develop its value proposition within a brief business plan.
- Collect, select and interpret relevant information in the management field and formulate justify their own opinions.

Program Contents

1. Organizations and Management
   Organizations and Society. Organizational Resources. Stakeholders and organizational objectives. Management and managers. Organizational cycle and management level.
2. Strategic Management
   Strategic thinking. Strategic analysis: internal and external; SWOT matrix. Structural business analysis: value chain, critical success factors and Porter's 5 forces model. Strategic formulation: vision, missions and objectives. Corporate strategy and business strategic. Strategic implementation and strategic control: organizational structure; management policies and management control systems.
3. Marketing
   Marketing and society: create value, satisfy human needs and market trades. Markets and segmentation. Different roles of market stakeholders. Marketing-mix: product, price, place and promotion. Marketing plan.
4. Human resource management and organizational Behaviour
   Integrated Human resource management: an overview. Level of analysis of organizational behavior: individual, team, organization and society. Human Motivation and Leadership.
5. Entrepreneurship
   The role of innovation in entrepreneurship and business idea generation. Value proposition, business model canvas and business plan.
6. Project Planning and Management.
   Project life cycle. PERT method. Gantt Diagrams. CPM method.
7. Inventory Management.
   Deterministic models and stochastic models.
8. Corporate Finance and Accounting.
   Accounting Standards - SNC. Sheet dynamics. Study of the accounts. Balance Sheet. Income Statement. Statement of Changes in Equity. Statement of Cash Flows. Annex.
9. Financial Analysis
   Methods and Techniques. Profitability ratios. Financial position and solvency. Risk analysis
10. Making capital investment decisions
    The cash flow of the investment project. Methods of investment appraisal: Net present value; Internal rate of return and Payback.

Work Done

See evaluation methods.

Teaching Methododoly

The teaching/learning process uses the lecture method, case study analysis and exercises solving.

Bibliography

- Atrill, P. e McLaney, E. - Accounting and finance for non-specialists, Prentice Hall, 5th ed ,2006
- Almeida, Filipe (2016). Introdução à Gestão de Organizações, 4ª Edição, Escolar Editora
- Bilhim, João A. F. – Gestão Estratégica de Recursos Humanos – 3ª Ed. Lisboa, UTL ISCSP: 2007.
- Brealey, R. e Myers, S. - Principles of corporate finance, McGraw-Hill/Irwin, cop., 7th ed., International ed., 2003
- Cunha, Miguel Pina; [et al.] – Manual de Comportamento Organizacional e Gestão – 3ª Ed. Editora RH, Lda. 2004.
- Dionísio, Lendrevie & Jindon. Mercator 2000 - Teoria e prática do Marketing. Publicações Dom Quixote, 2000.
- Drury, C. – "Management and cost accounting", Thomson Learning, cop., 5th ed, 2000
- Fernandes, R. F. - Contabilidade para não contabilistas, Almedina, 2ª ed, 2008.
- Freire, Adriano – Estratégia – Sucesso em Portugal – Editorial Verbo, 1997

Signature of Teacher:_____

- Kotler, Philip – Marketing Management – 8 th Edition Prentice Hall International, 1994
- Lisboa, João *et al.* (2011). Introdução à Gestão de Organizações. 3ª ed. Vida Económica.
- Lisboa, João e Gomes, Carlos F (2008). Gestão de Operações. 2ª edição, Vida económica.
- Lopes, Ilídio Tomás (2013). Contabilidade financeira: preparação das demonstrações financeiras, sua divulgação e análise. Escolar Editora.
- Mota, António Gomes & et al. (1997). Gestão financeira: casos práticos. 2ª ed., Centro de Investigação de Mercados e Activos Financeiros
- das Neves, J. C. - Análise financeira: métodos e técnicas, Texto Editora, 5ª ed., 1991
- Osterwalder, Alexander & Pigneur, Yves (2010) – Criar Modelos de Negócio – 5ª Edição, Publicações Dom Quixote.
- Teixeira, Sebastião (2001). Gestão das Organizações. Mc Graw Hill, 2001.
- Quelhas, Ana Paula & Correia, Fernando (2009). Manual de matemática financeira. Almedina.
- The slides used in the class will be available for downloading at the course website.

Evaluation Method

Student may choose among two different evaluation methods:

- Continuous evaluation
  - Business plan assignment – 50%
    - Preliminary presentation on November 5, delivery of the final report on 21 of December (business model, business plan and financial plan) and final presentation on 4 or 7 of January
  - Attendance (minimum 75%) and class participation – 20%
  - Written test – 30%
  - Minimum 40% in each component
- Final Exam

Conditions for Exam Admission

See evaluation method

Access Conditions and Attendance Excuse

See evaluation method

Conditions for Results Improvement

Those in current use

Date

15/10/2018

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Mestrado em Engenharia Eletrotécnica - 6778

Master Course in Electrical Engineering - 6778

Academic Year: 2018 / 2019

Program Contents

Course Unit COMPUTER VISION AND MULTIMEDIA - 677815

Subject type Specialisation Sciences **Research Area** Electrical Engineering

Year 1 **Semester** 2 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures		
Practical-Laboratoty Lectures	2	26
Tutorial Orientation		
Seminar		2
Total of Working Hours		156

Unaccompanied Working Hours

Activity Type	Total Hours
Study	65
Works / Group Works	32
Project	
Evaluation	3
Additional	

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Fernando José Pimentel Lopes	PhD	Prof. Coordenador
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	Fernando José Pimentel Lopes	PhD	Prof. Coordenador
	Inácio Sousa Adelino da Fonseca	PhD	Prof. Adjunto
Tutorial Orientation Seminar	To be defined		
Responsible Lecturer	Fernando José Pimentel Lopes		

Goals / Skills

To understand the principles of the formation, acquisition and representation of images;
To understand and apply the most representative spatial image processing techniques, including spatial filtering and simple segmentation;
To understand basic techniques for color and texture representation;
To propose and develop industrial vision applications using specific development software.

To understand the basic principles of information theory;
To understand the digital representation of audio and video signals;
To know the main techniques and standards for compression, coding, storage and transmission of image, audio and video signals.

Ability to use image acquisition and processing devices to develop industrial vision solutions using dedicated software;

Ability to participate in the development and installation of multimedia systems, involving audio and video equipment in a network, such as video surveillance applications.

Signature of Teacher: _____

Program Contents

Part I – Computer Vision
Objectives of computer vision
The Human Visual System
Sensors and imaging
Fundamentals of digital imaging
Binary image analysis
Processing of images in the spatial domain
Gray Level Transformations
Histogram-based processing
Processing using logical operators
Spatial filtering - smoothing and sharpening
Elements of digital morphology: dilation, erosion, aperture and closure
Notions of color and texture
Introduction to segmentation
Application examples.

Part II - Multimedia
Multimedia concept
Digital representation of audio and video signals
Principles of information theory
Image compression techniques
Principles of audio compression
Principles of video compression
Main techniques and standards for representation, compression, coding, storage and transmission of multimedia signals.
Application examples.

Work Done

Practical work in computer vision laboratory classes:
- Matlab Image Processing;
- Spatial Domain Filtering
- Feature Detection and Segmentation;
- Several applications using the Sherlock software tool.

2 Practical work in multimedia laboratory classes
1 Project (Using Sherlock/ Matlab / OpenCV / DLib tools)

Teaching Methododoly

Motivation and presentation of the topics in theoretical classes, including small practical examples.
Detailed application exercises with real application.
A practical evaluation component through the execution of laboratory work.

Bibliography

Linda G. Shapiro and George C. Stockman - Computer Vision
J. R. Parker - Algorithms for Image Processing and Computer Vision
N. S. Jayant and Peter Noll, "Digital Coding of Waveforms", Prentice-Hall Signal Processing Series, 1984
Mohammed Ghanbari , "Video Coding: An Introduction to Standard Codecs", Dec. 1999
Barry G. Haskell, Atul Puri, Arun N. Netravali Digital Video: An introduction to MPEG-2
http://www.imageprocessingplace.com/
https://jpeg.org/
https://mpeg.chiariglione.org/
Texts by teachers supporting laboratory work.
Manuals of the software tools to be used (Matlab, Sherlock, etc.).

Evaluation Method

Exam - 12 points (for 20), minimum of 8 (in 20)
Realization of work in laboratory classes, report and defense of 2 of them - 2 points.
Execution and examination of the laboratory project - 6 points (for 20, minimum 3 points).

Conditions for Exam Admission

Have attended laboratory classes (up to 2 absences).
Have made and defended with approval the multimedia works.
Have carried out and defended with approval the laboratory project.
Have attended theoretical classes (up to 3 absences - 2h lectures)

Signature of Teacher: _____

Access Conditions and Attendance Excuse

For students under the of Worker-Student Statute, and for components with compulsory attendance and distributed evaluation, it may be agreed between the teacher responsible for the course and the student, on his / her own initiative, adjustments to the functioning of these components.
In this case, during the first two weeks of teaching, students should indicate to the teacher their status as student-worker, establishing immediately how to adjust the functioning of the referred components. The presentation of the employer's work timetable or other relevant information may be required.

Conditions for Results Improvement

In accordance with the regulations and legislation.

Date	Signature from the lecturer responsible for the course
21-01-2019	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher: Dany

Mestrado em Engenharia Electrotécnica – 6778 (Português)

Master Course in Electrical Engineering – 6778 (Inglês)

Academic Year: 2018/2019

Program Contents

Course Unit WIRELESS COMMUNICATIONS AND MOBILITY – 677814

Subject type Specialization Sciences **Research Area** Electrical Engineering

Year 1st **Semester** 2nd **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures		
Practical-Laboratory Lectures	2	26
Tutorial Orientation		
Seminar		2
Total of Working Hours		156

Unaccompanied Working Hours

Activity Type	Total Hours
Study	30
Works / Group Works	27
Project	40
Evaluation	3
Additional	

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Victor Daniel Neto dos Santos	PhD	Assistant Prof.
Theoretical-Practical Lectures			
Practical-Laboratory Lectures	Victor Daniel Neto dos Santos	PhD	Assistant Prof.
Tutorial Orientation			
Seminar	to be defined		
Responsible(s) Lecturer (s)	Victor Daniel Neto dos Santos		

Goals / Skills

The main goals of this course unit are:

- To understand mobile communication systems principles with emphasis on GSM and UMTS;
- To understand and apply propagation models to access wireless systems radio coverage;
- To understand and apply the trunking theory to evaluate wireless systems performance;
- To understand the basics of satellite navigation systems in order to develop navigation applications using GPS receivers.

The course aims to provide training on radio technologies on the following sub-areas: mobile communications systems, data wireless networks and satellite navigation systems.

Students who successfully complete this course should be able to install and configure GPS receivers, develop radio location applications; understand and develop communications applications on mobile networks and /or wireless networks.

Furthermore, it is intended that students have a global overview of these systems to allow them in the future, in the selection of the most appropriate technical solutions that fulfill the employer requirements.

Signature of Teacher: _____

Program Contents

Introduction

- Radio systems: classification; frequency bands; services;
- Wireless communications history;
- Radio access technologies;
- The future towards a 5G wireless communication systems.

Radio Wave Propagation Introduction

- Electromagnetic wave propagation fundamentals;
- Interference; reflection; refraction; diffraction; scattering; absorption; etc.;
- Free-space propagation model; ground reflection (two-ray) model;
- Okumura-Hata propagation model;
- Fading and multipath.

Cellular Systems

- Cellular and pre-cellular systems;
- Frequency reuse concept;
- Interference and system capacity;
- Cell split; sectorization; frequency hopping; dynamic power control; DTX and antennas tilting;
- Channel assignment strategies. Fixed and dynamic;
- Handoff strategies and mobility.

Modern Cellular Communication Systems

- GSM (Global System for Mobile Communications) e IS-95 (Interim Standard 95);
- GRPS (General Packet Radio Service) and EDGE (Enhanced Data rate for Global Evolution);
- UMTS (Universal Terrestrial Telecommunications System);
- Topics of LTE (Long Term Evolution).

Trunking Theory

- GoS (Grade of Service) and QoS (Quality of Service);
- Traffic intensity, Erlang definition;
- Arrival calls distribution (Poisson);
- Service distributions: Exponential and lognormal;
- Markov chains applied to trunking systems;
- Erlang B and Erlang C formulas.

Global Navigation Satellite Systems

- GPS (Global Positing System) and Galileu systems overview;
- Satellite orbits and constellation fundamentals;
- Navigation by satellite basics;
- GPS receptor configuration;
- NMEA (National Marine Educators Association) Protocol.

Wireless Data Networks

- WLANs based on the IEEE 802.11.x. family protocol;
- WPANs Bluetooth and ZigBee based on IEEE 802.15.x.

Proprietary radio solutions and applications

- Topics of RFID;
- Sensor networks;
- Topics of fleet management, virtual toll road, security and access control.

Work Done

The following practical assignments:

- Radio propagation models;
- Mobile communication systems (investigation work - portfolio);
- Loss and delay systems;

A hardware project applying the concepts of a given radio technology and respective radio modules.

The implementation of the project is carried out in the last two lab classes being completed out of that period.

Laboratorial assignments reports deliver deadline: Last week of classes (Friday).
Project report deliver deadline: Last week of classes (Friday.

Teaching Methodology

The course will be taught through lectures, laboratory classes and a seminar.
Laboratory classes will be taught in a laboratory with computers, power supplies, signal generators, oscilloscopes, and other electronic components allowing the practical application of the theoretical contents presented in classes.

Bibliography

- Victor Santos, "Wireless Communications and Mobility" course unit slides, ISEC, 2017;
- Rappaport, T. S., "Wireless Communications: Principles and Practice", 2nd Edition, 2002;
- Wireless Communications: A.F. Molisch 2005 John Wiley, Chichester, UK;
- Mobile Communications; Jochen Schiller, 2nd edition, Pearson Education, 2003;
- C. A. Balanis, "Antenna Theory: Analysis and Design", 4th edition, John Wiley & Sons, Inc., 2016;
- Elliott D. Kaplan, C. Hegarty, "Understanding GPS: Principles and Applications", 2nd Edition, Artech House, 2005.

Evaluation Method

Formal evaluation exams, laboratory works and a project that should be implemented.
Weigh: final written theoretical exam (70%); Laboratory works (15%); hardware project (15%).

Approval conditional on obtaining a grade grater or equal than 9.0 values (9.0/20.0) on the final written exam.
The laboratorial component grade is subject to the minimum attendance of 75% of the effective number of classes.

Conditions for Exam Admission

Have access to exam students with a minimum attendance of 75% of the laboratory effective lessons and those that implemented and defended with success the implemented projects.

Access Conditions and Attendance Excuse

For students with "worker-student" status, by virtue of law and other applicable regulation, and for components with compulsive attendance and distributed evaluation, should be agreed between the responsible lecturer for the course unit and the student, on his own initiative and at the beginning of the academic semester, a form of alternative operation of these components. The presentation of the employer's work schedule or other relevant information must be required.

Conditions for Results Improvement

Accordingly with the current law regulation.

Date	Signature from the lecturer responsible for the course
2019/01/21	Victor D. N. Santos

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Mestrado - MSc em Engenharia Eletrotécnica – 6778 (Português)

Mestrado - MSc in Electrical Engineering - 6778 (Ingês)

Academic Year: 2018 / 2019

Program Contents

Course Unit 677812 - DISTRIBUTED INDUSTRIAL SYSTEMS

Subject type Specialty Sciences **Research Area** Electrical Engineering

Year 1 **Semester** 2 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	-	-
Practical-Laboratory Lectures	2	28
Tutorial Orientation	-	-

Unaccompanied Working Hours

Activity Type	Total Hours
Study	38
Works / Group Works	60
Project	-
Evaluation	2
Additional	-

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures Theoretical-Practical Lectures	Inácio Fonseca / Fernanda Coutinho	PhD / PhD	Professor Adjunto
Practical-Laboratoty Lectures Tutorial Orientation	Inácio Fonseca / Fernanda Coutinho	PhD / PhD	Professor Adjunto

Responsible(s) Lecturer (s) Inácio Fonseca / Fernanda Coutinho

Goals / Skills

Design and execute distributed systems based on microprocessor networks
Design and implement distributed instrumentation systems
Design and project methodologies and programming techniques for integrated systems
Design and project networks of industrial automatons
Design and project the system management architecture of the embedded system.

Program Contents

First Module (Fernanda Coutinho)
- Overview of multi-tasking distributed industrial systems programming with time constraints.
- Multitasking systems with real-time nature specifications: hard and soft temporal constraints; requirements (functional, temporal and reliability specifications); tasks; scheduling policies; scalability criteria; communication (queues) and synchronization ^(semaphores) between tasks.
- Programming of embedded systems with a multitasking and real-time core.

Second Module (Inácio Fonseca) - Use of First Module for:
- Industrial networks
- Instrumentation Networks
- Communication between processes

Signature of Teacher:

- Industrial applications project

Work Done

First Module
Programming multitasking applications with real-time constraints with the FreeRTOS kernel.

Second Module - Use of Part 1 to:
Concepts on Local and Industrial Networks.
Programming with Industrial networks of different manufacturers, using for this the DeviceNet, CanOpen and ProfiBus, and Industrial Ethernet.
Industrial Instrumentation Data Acquisition Systems, IoT

Teaching Methododoly

The classes will be done in a mixed way, presenting the concepts, corresponding to the theoretical classes and then presenting the methodologies and equipment for practical experimentation and simulation.

Bibliography

- PLC manuals, Siemens, Omron and Schneider, Wonderware industrial process management software.
- Slides on industrial networks: Can, DeviceNet, CanOpen and ProfiBus, Ethernet.
- J. Pimentel. "Communication Networks for Manufacturing". Prentice-Hall, 1990
- W. Stevens, "UNIX Network Programming"
- A. Lugli, M. Santos, "Fieldbus Systems for Industrial Automation", ISEC - 1-6-324
- A. Silberschatz, P. Galvin, G. Gagne. Operating System Concepts. ISBN: 978-0-470-12872-5. ISEC 1A-3-137
- FreeRTOS multitasking real-time core documentation, available at www.freertos.org/
- H. Kopetz. Real-time systems: design principles for distributed embedded applications. Kluwer Academic Publishers. ISEC-1A-2-79.
- Slides to support classes, available on the moodle platform of ISEC.

Evaluation Method

First Module - Research topic with mandatory presentation (2 values) + Programming work with compulsory defense (2 values) + Written exam (6 points). The works must be presented and defended until the last week of April, inclusive.
Second Module - Practical work (4 points) + Written exam (6 points). The practical work must be delivered and defended until the last week of classes.
Students with a grade higher than 16 are subjected to an oral defense to maintain the classification. If they do not wish to make this defense the grade will be limited to 16 values.

Conditions for Exam Admission

To have obtained a minimum of 30% in practical work.
To attend at least 75% of laboratory classes

Access Conditions and Attendance Excuse

For students under the Worker-Student Statute, and for components with compulsory attendance and distributed assessment, it may be agreed upon by the teacher responsible for the curricular unit and the student, adjustments to the functioning of these components.
In this case, during the first two teaching weeks, the students must indicate their status as student worker, establishing immediately how to adjust the functioning of the referred components. The submission of the employer's work time or other relevant information may be required.

Conditions for Results Improvement

Improvement of classification is allowed to the component evaluated in the exam and the practical work.

Date

18-01-2019

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Mestrado - MsC Engenharia Eletrotécnica

Mestrado - MsC Electrical Engineering

Academic Year: 2018/2019

Program Contents

Course Unit ROBOTIC SYSTEMS

Subject type Sciences of Specialty **Research Area** Electrical Engineering

Year 1 **Semester** 2 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures		
Practical-Laboratoty Lectures	2	26
Tutorial Orientation		
Seminar		2
Total of Working Hours		156

Unaccompanied Working Hours

Activity Type	Total Hours
Study	40
Works / Group Works	28
Project	30
Evaluation	2
Additional	

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	João Paulo Morais Ferreira Fernanda Madureira Coutinho	PhD PhD	Prof. Adj. Prof. Adj.
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	João Paulo Morais Ferreira Fernanda Madureira Coutinho	PhD PhD	Prof. Adj. Prof. Adj..
Tutorial Orientation			
Seminar	To be defined		
Responsible(s) Lecturer (s)	João Paulo Morais Ferreira		

Goals / Skills

This course on Robotic Systems aims to provide students with an overview of issues and technologies involved in designing and implementing robots in industrial systems. Students examine and evolve on the understanding of these topics through the implementation of real systems.

Program Contents

Part I (João Paulo Morais Ferreira)
1. Introduction to Robotics
2. Main configurations of robots
3. Fundamentals of robotics
4. Sensors for industrial robots
5. Safety systems for the protection of robotic cells
6.Paths planning
7. Mobile robotic systems
8. Robots programming languages
9. Simulation tools for robotics systems.

Signature of Teacher: 

Part II (Fernanda Madureira Coutinho)
10. Teleoperation and telepresence

Work Done

Implementation of several jobs using the existing Motoman robot in the laboratory, as well as a mobile robot with manipulator, and a hyper-redundant robot. (TP1 - Robot Motoman, beginning 3rd week and ending 6th week; TP2 - Virtual manipulation, beginning 7th week and ending 9th week; TP3 - Virtual Robot and real control, beginning 10th week and ending 14th week..

Teaching Methodology

The elements necessary to understand the fundamentals of robotic systems are gradually presented. Direct and inverse kinematics are studied, direct and inverse Jacobian, static force and path planning, including application examples. It complements the use of a real robot (mobile robot with manipulator) as well as the development of its virtual model. In a second phase an introduction to the Motoman robot programming is made both at the level of the console and its own virtual system (Motosim). The study of the themes is accompanied by laboratory work done in the laboratory.
Finally, the sensors for industrial robots and safety systems for the protection of robotic cells are discussed..

Bibliography

1. Fu, K.-S., Gonzalez, R. C., and Lee, C. S. G. Robotics: Control, Sensing, Vision and Intelligence. McGraw-Hill series in CAD/CAM, robotics and computer vision. McGraw-Hill, 1987.
2 Robotics Industries Association. American national standard for industrial robots and robot systems—Safety requirements, ANSI/RIA R15.06, 1992.
3. John j. Craig, "Introduction to Robotics Mechanics and Control", Addison-Wesley Publishing Company, 1989.
4. L. Sciavicco. B. Siciliano, "Modelling and Control of Robot Manipulators", Springer, ISBN 1-85233-221-2, 2001.
5. Introduction to Robotics Mechanics & Control, John Craig, Addisson-Wesley.
6. Introduction to Robotics, Phillip John Mckerrow.
7. J. Ferreira, Notes of the lectures and practices.
8. Inform manual and Motoman guide.

Evaluation Method

The practical work carried out represents 8 values of the final grade. The other 12 values are the result of a written exam. In any of these evaluations a rating of 40% or more is required.
Each written exam will include theoretical and practical questions and will last 2 hours.

Conditions for Exam Admission

Have attended the laboratory classes (up two fouls) and have held and defended with approval the laboratory work.

Access Conditions and Attendance Excuse

For students under the Worker-Student Statute, and for components with compulsory attendance and distributed assessment, it may be agreed upon by the teacher responsible for the curricular unit and the student, adjustments to the functioning of these components.
In this case, during the first two teaching weeks, the students must indicate to their respective teacher their status as student worker, establishing immediately how to adjust the functioning of the referred components. The presentation of the employer's work schedule or other relevant information may be required.

Conditions for Results Improvement

The improvement of classification will be done through a global evaluation process, in order to allow the improvement of all evaluation components. Through a research work to improve the practical component and final exam in one of the allowed times.

Date

21/01/2019

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher: _____

Mestrado em Engenharia Eletrotécnica

MsC in Electrical Engineering

Academic Year: ***2018/2019***

Program Contents

Course Unit SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL MANAGEMENT

Subject type Engineering Sciences **Research Area** Electrical Engineering + Chemical and Biological Engineering

Year 1st **Semester** 2nd **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures		
Practical-Laboratoty Lectures	2	24
Seminar		4
Total of Working Hours		156

Unaccompanied Working Hours

Activity Type	Total Hours
Study	60
Works / Group Works	37
Project	
Evaluation	3
Additional	

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Dulce Helena de Carvalho Coelho	PhD	Prof. Adjunta
	Luís Miguel Moura Neves de Castro	PhD	Prof. Adjunto
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	Dulce Helena de Carvalho Coelho	PhD	Prof. Adjunta
	Luís Miguel Moura Neves de Castro	PhD	Prof. Adjunto
Tutorial Orientation			

Responsible(s) Lecturer (s) Dulce Helena de Carvalho Coelho
Luís Miguel Moura Neves de Castro

Goals / Skills

To provide deeper knowledge of sustainable development;
To understand the relationship between energy systems and sustainable development;
To learn of sustainable energy options;
To learn about technologies and systems for improving energy efficiency;
To understand the basic concepts of Environmental Management Systems (EMS);
To learn how to implement an EMS;
To understand the basic concepts of EMS auditing

Program Contents

Part I – Sustainable Development
The concept of sustainability and sustainable development. Principles of Sustainable Development: economic development, social development and environmental protection. International activities.
The local context. Local Agenda 21. The use of indicators.
Energy and Sustainable Development. Principles of sustainable energy. Energy Efficiency: The role of energy efficiency in achieving sustainable development; End-use efficiency. Renewable energy: The role of technological development.

Signature of Teacher:

Part II - Environmental Management
1 - Introduction to Environmental Management Systems
Motivation for the implementation of an Environmental Management System.
Cycle of implementation of Environmental Management Systems.
The NP EN ISO 14001: 2015 standard and the European Eco-Management and Audit Scheme – EMAS. Main features.
Legal support: Regulamento (CE) nº 1221/2009 do Parlamento Europeu e do Conselho, de 25 de Novembro alterado pelo Regulamento (UE) 2017/1505 de 28 de agosto de 2017. EMAS versus ISO 14001.
2. Design, development and implementation of Environmental Management Systems
The NP EN ISO 14001: 2015 standard. Scope of application. The requirements of the standard: General Requirements. Environmental Policy. Planning. Brief reference to the most relevant Portuguese environmental legislation. Implementation and Operation. Verification.
3. Environmental Certification Process
Motivation for Environmental Certification.
Process of certification of an Environmental Management Systems.

Work Done

Laboratory case studies. Simulation of a process of implementation of an Environmental Management System in a manufacturing unit.

Teaching Methododoly

Theoretical: theoretical exposition of various matters; Case-studies presentation.
Practical: Problem solving; Case-studies analysis

Bibliography

- EU and Portuguese Legislation (Energy).
- NP EN ISO 14001:2015 standard.
- Guimarães Sá, J., Santos, João; de Sousa, Teresa Carvalho e de Sousa, Rita Ribeiro. Guia do Utilizador ISO 14001:2015. APCER 2016.
- Regulamento (CE) n.º 1221/2009 de 25 de Novembro de 2009.
- Regulamento (UE) 2017/1505 de 28 de agosto de 2017.
- Decreto-Lei n.º 95/2012 de 20 de abril.
- Decisão da Comissão 2011/832/UE de 7 de Dezembro.
- Decisão da Comissão 2013/131/UE de 19 de Março.
- Decisão (UE) 2017/2285 de 6 de dezembro de 2017.

Evaluation Method

Sustainable Development Module - Final exam, without consultation (10 points).
Environmental Management Modules (10 points):
Students should choose one of two alternative assessment systems:

- Traditional assessment: by means of a final examination, without consultation, in which the students can present themselves to the examination on both exams (normal and recource).
- Distributed evaluation: evaluation by means of a test on the date of the normal exam (50% final quotation, minimum score of 7.5 / 20 values) and performance and resolution and presentation of the grupo work in the practical classes (50%).

In case of failure or if student wish to improve the classification, they may only resort to the appeal period. In this regime, students have compulsory attendance (of theoretical and practical classes) and have to be present at least in 80% of the classes. At the recourse exam the component obtained in the performance in the classes can be considered with a weight of 40% in the final grade, if it favors the student, maintaining the need to take the minimum grade of 7.5 / 20 values on the exam. "

For students under the Statute of the Student Worker, and for the components with compulsory attendance and distributed assessment, adjustments to the functioning of these components may be agreed with the student.

Conditions for Exam Admission

All students enrolled in the course have access to the exam, although those applying for continuous assessment may only have access to the appeal period - see "Evaluation Method

Access Conditions and Attendance Excuse

In the case of worker students the conditions of participation in the classes will be combined between the teachers and students, in the first week of school, and according to the current legislation

Conditions for Results Improvement

According to the legislation

Date	Signature from the lecturer responsible for the course
21/01/2019	