ECTS CATALOGUE 2021-2022

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.

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MASTER Electromechanical Engineering

New Code	Title - Portuguese	Title - English	ECTS	Term
1.º ano / 1st Year				
60014058	Matemática Aplicada	Applied Mathematics	6	Fall
60014086	Medidas e Instrumentação	Instrumentation and Measurement Systems	6	Fall
60014069	Informática Aplicada	Applied Informatics	6	Fall
61000365	Instalações Elétricas e Luminotecnia	Eletrical Installation and Lighting Engineering	6	Fall
60014075	Transmissão de Calor e Combustão	Heat Transfer and Combustion	6	Fall
60014141	Instalações Técnicas Especiais I	Special Technical Installations I	6	Spring
60014113	Redes de Fluidos	Fluid Networks	6	Spring
60014102	Equipamentos Térmicos	Thermal Equipments	6	Spring
60014130	Transmissão de Informação e Redes	Information Transmission and Networks	6	Spring
60014124	Instalações de Climatização e Refrigeração	HVAC-R Plants	6	Fall
2.º ano / 2nd Year *				
60014165	Edifícios Inteligentes e Domótica	Home Automation and Intelligent Builgings	5	Fall
60014176	Instalações Técnicas Especiais II	Special Technical Installations II	5	Fall
60014159	Produção e Gestão de Energia	Production and Management of Energy	4	Fall
60014187	Segurança Contra Incêndios	Fire Safety Systems	4	Fall
60014234	Dissertação	Dissertation	12	Fall
60014240	Dissertação	Dissertation	30	Spring
60014212	Estágio	Internship	12	Fall
60014223	Estágio	Internship	30	Spring
60014198	Projeto	Project	12	Fall
60014201	Projeto	Project	30	Spring

*The second year of this master course is not available for 2021-2022.

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Signature of Teacher:_____

Mestrado em Engenharia Eletromecânica
Especialização em Instalações e Equipamentos em Edifícios
Master Course in Electromechanical Engineering
Specialization in Building Services Engineering

Academic Year: 18 / 19

Program Contents

Course Unit FLUID NETWORKS

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

Year 1º **Semester** 2º **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	40
Works / Group Works	58
Project	
Evaluation	2
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	João Carlos Antunes Ferreira Mendes	PhD	Prof. Coord.
	Avelino Virgílio Fernandes Monteiro de Oliveira	PhD	Prof. Adjunto
Theoretical-Practical Lectures	João Carlos Antunes Ferreira Mendes	PhD	Prof. Coord.
	Avelino Virgílio Fernandes Monteiro de Oliveira	PhD	Prof. Adjunto
Practical-Laboratoty Lectures	João Carlos Antunes Ferreira Mendes	PhD	Prof. Coord.
	Avelino Virgílio Fernandes Monteiro de Oliveira	PhD	Prof. Adjunto
Tutorial Orientation			

Responsible(s) Lecturer (s) João Carlos Antunes Ferreira Mendes

Goals / Skills

Transmit to students the general notions of the different fluid networks and develop the ability to elaborate fluid network projects. Encourage group work. Competencies to be acquired: Design fluid networks and direct their installation; Know how to plan and execute fluid network maintenance programs and activities.

Program Contents

1. Introduction
2. Sizing of fluid networks
3. Tubes
4. Piping connection modes
5. Pipe connection fittings
6. Valves
7. Expansion joints
8. Steam traps, separators and filters

9. Material recommendations for services - Piping material specifications
10. Pipe supports
11. Pipe designs
12. Mounting and testing of pipes
13. Standards, codes and specifications

Work Done

Realization of a fluid network project.

Teaching Methododoly

Theoretical instruction with computer support; Study visits to different fluid network installations; Seminars on specific topics; Group learning.

Bibliography

- Power point presentations of the lectures available at the Moodle platform.
- Mohinder Nayyar Piping Handbook - McGraw-Hill.
- CARRIER International Limited - Manual de Aire Condicionado, Marcombo Editores, 1992. ISBN: 84-267-0115-9
- Fluid Piping Systems & Insulation (@Moodle)

Evaluation Method

The evaluation of this curricular unit involves simultaneously a written test at the end of the semester, the report of the proposed work and the oral presentation of the work. The weighting is as follows: written test - 50%; Report - 30%; Presentation and discussion - 20%. In the written test of evaluation, it is required, as a minimum mark, 40% of the value of the test.

Conditions for Exam Admission

Final exam (10 points) for all enrolled students.

Access Conditions and Attendance Excuse

Not applicable.

Conditions for Results Improvement

It is only allowed to improve classification to the component evaluated in the examination.

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 Eletromecânica
Especialização em Instalações e Equipamentos em Edifícios
Master Course in Electromechanical Engineering
Specialization in Building Services Engineering

Academic Year: 2018/2019

Program Contents

Course Unit THERMAL EQUIPMENTS

Subject type Specialty Curricular Unit **Research Area** Mechanical Engineering

Year 1st **Semester** 2nd **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	97
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	António Manuel de Morais Grade	MSc	Adjunct Professor
Theoretical-Practical Lectures	António Manuel de Morais Grade	MSc	Adjunct Professor
Practical-Laboratoty Lectures	António Manuel de Morais Grade	MSc	Adjunct Professor
Tutorial Orientation			

Responsible(s) Lecturer (s) António Manuel de Morais Grade

Goals / Skills

This course unit aims to provide students with in-depth knowledge of thermal equipment and systems used in buildings.
This course unit contributes to the achievement of the following specific competences:
- Dimensioning and selection of thermal equipment;
- Conception, design, implementation and maintenance of heating, ventilation and air conditioning installations;
- Inspection of mechanical engineering installations.

Program Contents

1. **Combustion technology and equipment.**
   Common fuels and their properties. Fundamental concepts on combustion. Optimization of combustion efficiency. Analysis and monitoring of gaseous emissions. Gas analyzers. Energy losses and boiler efficiency. Burners. Gas installations in buildings. Maximum reference concentrations of pollutants inside buildings.
2. **Heat exchangers with phase change. Heat and mass transfer heat exchangers.**
   Heat pipes. Cooling towers. Evaporative condensers.
3. **Central heating installations and domestic water heating.**
   Water boilers and hot air generators. Thermal power output. Determination of the efficiency of a boiler. Calculation of fuel consumption. Gas boiler for the production of domestic hot water and central heating. Condensation boilers. Biomass furnaces and boilers. Central heating installation types. Domestic hot water systems with and without accumulation tank. Centralized and local temperature control. Heating terminal units: radiators, fan-coils and radiant panels.

Signature of Teacher:_____

4. **Solar thermal systems.**
   Thermal solar collectors. Types of solar collectors. Components of solar collectors. Flat collectors with and without glass cover. Compound parabolic collectors (CPC). Vacuum tube collectors. Energy study of the collector. Useful thermal power. Collector efficiency. Characteristic curve. Selection of the type of collector most suitable for a given application. Optimum orientation and tilt angle of solar collectors. Penalty curves. Shading. Natural circulation systems (thermosiphon) and forced circulation systems with pump. Accumulation deposit. Circulating pump. Expansion vessel. Air vents. Safety valves. Thermostatic mixing valve. Differential pressure relief valve. Pipes and insulation.

Work Done

N.A.

Teaching Methododoly

Presentation and discussion of the subjects taught in theoretical classes. Problem solving in theoretical-practical classes. In the practical classes is presented software related to the subjects taught and a visit is made to the Laboratory of Thermal Systems for contact with the equipment and thermal systems present in this laboratory.

Bibliography

- GLASSMAN, I.; YETTER, R.; GLUMAC, N. - *Combustion*, Academic Press, 5ª Ed., 2014. ISBN: 012407913X
- CORNFORTH, J. R. (British Gas) - *Combustion Engineering and Gas Utilisation*, Routledge, 3ª Ed., 2014. ISBN: 9781136737930
- TURNS, S. R. - *An Introduction to Combustion: Concepts and Applications*, McGraw-Hill Education, 3ª Ed., 2011. ISBN: 9780073380193
- RASMUSSEN E. - *Combustion Analysis and Fuel Efficiency*, Esco Press, 2007. ISBN: 1930044259
- SILVERSTEIN, C. - *Design And Technology Of Heat Pipes For Cooling And Heat Exchange*, CRC Press, 1992. ISBN: 0891168591
- HILL, G.; PRING, E.; OSBORN, P. - *Cooling Towers: Principles and Practice*, 3ª Ed., Butterworth-Heinemann, 2013. ISBN: 1483162745
- KROGER, D. - *Air-Cooled Heat Exchangers and Cooling Towers: Thermal-Flow Performance Evaluation and Design*, Vol. 1 e Vol. 2, PennWell Corp., 2004. ISBN: 0878148965 e 1593700199
- JUGLAR, L.; MIRANDA, A.; VILLARRUBIA M., *Manual de Calefacción*, Ed. Técnicas Marcombo, 2011. ISBN: 8426717381
- RECKNAGEL; SPRENGER; HONMANN - *Manual Técnico de Calefacción y Aire Acondicionado – 1. Calefacción*, Bds Librería Editorial, 1993. ISBN: 8485198603
- ASHRAE - *HVAC Systems and Equipment, S.I. Edition*, Amer Society of Heating, 2016. ISBN: 193920027X
- DUFFIE, John A.; BECKMAN, William A. - *Solar Engineering of Thermal Processes*, 4ª Ed., John Wiley, 2013. ISBN: 0470873663
- BANYERAS, L. - *Energia solar*, Ceac, 2007. ISBN: 8432910635
- EN 12975-1 - *Thermal Solar Systems and Components - Solar Collector : Part 1 - General Requirements*, CEN, 2000
- RAZNJEVIC, Kuzman - Handbook of Thermodynamic Tables, Begell House, Inc., 2ª Rev. Ed., 1995. ISBN: 1567000460

Evaluation Method

Final exam, consisting of a written test with theoretical and theoretical-practical questions, on the subjects taught in the respective classes.

Conditions for Exam Admission

All students enrolled in the course unit are admitted to the exam.

Access Conditions and Attendance Excuse

N.A.

Conditions for Results Improvement

The improvement of the classification can be obtained through a new written exam.

Date	Signature from the lecturer responsible for the course
22.01.2019	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Mestrado em Engenharia Eletromecânica
Especialização em Instalações e Equipamentos em Edifícios
Master Course in Electromechanical Engineering
Specialization in Building Services Engineering

Academic Year: 2018/2019

Program Contents

Course Unit ELETRICAL INSTALLATIONS AND LIGHTING ENGINEERING

Subject type Engineering Sciences **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	2	28
Practical-Laboratoty Lectures		
Tutorial Orientation		
Seminar		
Total of Working Hours		156

Unaccompanied Working Hours

Activity Type	Total Hours
Study	14
Works / Group Works	54
Project	28
Evaluation	4
Additional	

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Cristina Isabel Ferreira Figueiras Faustino Agreira	PhD	Professor
	Manuel Maria Abranches Travassos Valdez	PhD	Professor
Theoretical-Practical Lectures	Cristina Isabel Ferreira Figueiras Faustino Agreira	PhD	Professor
	Manuel Maria Abranches Travassos Valdez	PhD	Professor
Practical-Laboratoty Lectures			
Practical-Laboratoty Lectures			
Tutorial Orientation			

Responsible(s) Lecturer (s) Cristina Isabel Ferreira Faustino Agreira
Manuel Maria Abranches Travassos Valdez

Goals / Skills

Design, implement and maintenance of the Electrical Installations Buildings
Design and perform projects of interior and exterior lighting techniques

Program Contents

1st Part – Electrical Installations

Overview of electrical installation
The security of the electrical installations
Land systems
Stations Transformations
The protection of people in electrical installations
Protection against overvoltage´s of atmospheric origin
Protection of electrical motors

Signature of Teacher: Cristina Ag.

Special electrical installations

2nd Part – Lighting Technique

Definitions of magnitudes used in lighting techniques
General Laws
Switchgear and control lighting circuits
Lamp types and theirs applications
Interior Lighting Installations
Exterior Lighting Installations

Work Done

Elaboration of Practical Work related to the two parts of the Course. The first Practical Work is a Project of Electrical Installations and the second a Project of Lighting of Interiors and Exteriors. These works will be carry out in a group by the students and guided by the teachers in the theoretical - practical classes.
The presentation and defense of these works will be realize in the theoretical - practical classes.

Teaching Methododoly

Group work, companion study and oral presentation.

Bibliography

Electrical Installations

- Instalações Elétricas de Baixa Tensão: Projeto, Execução e Exploração, Constantino Soares.
- Regras Técnicas das Instalações Elétricas de Baixa Tensão, Imprensa Nacional Casa da Moeda
- Regulamento de Segurança de Subestações, Postos de Transformação e Seccionamento.

Lighting Tecniques

- Luminotecnia Fundamental, Rogério P. Cardoso, Dinalivro
- Desenho de Esquemas Elétricos, F. Silva, A. Roseira, Porto Editora
- Lighting Manual, Fifth edition, Philips Lighting
- Green Lighting, Brian Howard, Seth Leitman, William Brinsky first edition.

Evaluation Method

The evaluation in normal time and recourse will focus on both parts of the Course. The part of the written exam will have a classification of 10 values and there are minimum ones, being necessary to obtain a classification equal or superior to 5 values. The Project part will have a total classification, in the set of the two works, of 10 Values. The Project note will be divide into 5 values for each project to be carried out, with minimums being necessary, obtaining a rating of 2.5 or more in each Project. All values given, relative to the classification, correspond to a scale of 0 to 20 values.

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. However, the final classification will be dependent on the delivery of the works proposed in the two modules.

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**
16-October-2018	Cristina Tavsim Ag.

Instituto Superior de Engenharia de Coimbra
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Lecturer's signature:_____

Mestrado - MsC em Engenharia Electromecânica – Especialização em Instalações e Equipamentos em Edifícios
(Português)

Mestrado - MsC in Electromechanical Engineering - Specialization in Facilities and Equipment in Buildings (Ingês)
Academic Year: 2018 / 2019

Program Contents

Course Unit INSTRUMENTATION AND MEASUREMENT SYSTEMS

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

Year 1º **Semester** 1º **ECTS** 6

Working Hours

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

Unaccompanied Working Hours

Activity Type	Total Hours
Study	52
Works / Group Works	44
Project	
Evaluation	4
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Carlos José de Oliveira Pereira e Jorge Alcobia Helena Jorge da Silva Marto	PhD Master	Prof. Adjunct Prof. Adjunct
Theoretical-Practical Lectures	Carlos José de Oliveira Pereira e Jorge Alcobia Helena Jorge da Silva Marto	PhD Master	Prof. Adjunct Prof. Adjunct
Practical-Laboratoty Lectures	Carlos José de Oliveira Pereira e Jorge Alcobia Helena Jorge da Silva Marto	PhD Master	Prof. Adjunct Prof. Adjunct
Tutorial Orientation			

Responsible(s) Lecturer (s) Carlos José de Oliveira Pereira e Jorge Alcobia
Helena Jorge da Silva Marto

Goals / Skills

Complement the preparation acquired in previous disciplines, in particular with regard to measurement techniques applicable to the quantities focused on them. To make students aware of the importance that experimental methods can have in solving engineering problems and to provide training that allows them to operate, configure and select measurement systems. To foster the development of new skills associated with experimental work, namely problem identification, assembly planning, analysis and synthesis of information.

Signature of Teacher:_____

Program Contents

MODULE OF MEASUREMENT SYSTEMS, SENSORS AND TRANSDUCERS

Applications of measurement systems
Introduction. Monitoring, control of operations and processes.
Functional description of measurement systems and general definitions
Introduction. Modes of operation. Relationship between input and output signals in measurement systems.
Static characteristics of measurement systems
Calibration. Minimum squares method. Static features. Causes and types of experimental errors.
Uncertainty analysis. Chauvenet laws. Combination of errors in a measurement system.
Dynamic characteristics of measurement systems
Characterization of zero-order systems. Response to input signals. Characterization of first order systems. Response to input signals. Characterization of the systems of Second. Response to input signals. Characteristic times in the dynamic response of measurement systems.
Kinematic quantities
Introduction. Measurement of displacements: potentiometers, extensometers, sensors, LVDTs, encoders. Speed measurement. Measurement of acceleration.
Strength, torque and power
Standards and units. Basic methods of force measurement. Transducers. Load cells. Measurement of torque in rotational shafts. Measurement of mechanical power.
Flow measurements and visualizations
Drainage views: surface views; Space views. Flow velocity:
Pressure probes; Wire anemometry / hot film. Flowmeters.
Temperature
Methods of measurement. Thermometers. Thermoresistances. Thermistors. Radiative methods.

AUTOMATIC DATA ACQUISITION AND VIRTUAL INSTRUMENTATION MODULE

Introduction to Automatic Data Acquisition
Signal conditioning: instrumentation amplifiers; separation of the noise from the main signal; isolation; filters; linearization.
Data acquisition boards: number of input channels, signal bandwidth, digital inputs and outputs, resolution, dynamic range, number of channels, determination of sampling rate.
Applications.
Virtual instrumentation
Introduction to LabVIEW and its common functions.
LabVIEW vocabulary.
Components of a virtual instrument. Programming tools in LabVIEW.
Cycles of repetition, creation of subroutines in LabVIEW.
Graphics.
LabVIEW data structures (strings, arrays, clusters, and structures).
Error handling techniques.
Development of modular applications.
Use of variables in LabVIEW.
LabVIEW project techniques.
Synchronization techniques: notifiers and queues.
Event programming. User interface.
Input and output files (low and high level).

Work Done

Calibration of transducers. Development of a LabVIEW program.

Teaching Methododoly

Theoretical-practical teaching with computer support; Theoretical-practical teaching with discussion; Laboratory teaching with computer support; Group learning; Brainstorming.

Bibliography

- Presentations of classes made available on the Moodle platform
- Gustavo da Silva, Instrumentação Industrial, Vol. I, Escola Sup. de Tecnologia de Setúbal, 2004, ISBN 972-8431-22-8
- Gustavo da Silva, Instrumentação Industrial, Vol. II, Escola Sup. de Tecnologia de Setúbal, 2004, ISBN 972-8431-23-6
- Pedro Guedes, Metrologia Industrial, 2011, ISBN: 978-972-8480-27-1
- E. O. Doebelin, Measurement Systems: application and design, McGraw Hill, fourth edition, ISBN 0-07-017338-9, 1990
- J. P. Holman, Experimental Methods for Engineers, McGraw Hill, sixth edition, ISBN 0-07-029666-9, 1994
- J. G. Webster, The Measurement, Instrumentation and Sensors Handbook, ISBN 0-84-938347-1, 1999

Signature of Teacher:_____

- S. Wolf, R. Smith, Student Reference Manual for electronic Instrumentation laboratories, Prentice-Hall International., ISBN 0-13-117605-6, 2004
- John Essik, Hands-on introduction to Labview for scientists end engineers, Oxford University Press,ISBN978-019-537395-0, 2009
- Robert H. Bishop, LabVIEW 2009 student edition, Pearson - Prentice Hall, ISBN 978-0-13-214129-1, 2010

Evaluation Method

Evaluations tests, delivery and discussion of a report from a laboratory calibration and development of a program in the LabVIEW environment for all students enrolled.
Weighting: - Formal evaluation tests (50%);
- Report of a laboratory calibration (20%);
- Program in LabVIEW (30%).
Approval conditional on obtaining a positive classification in the formal evaluation test.
The assignment of classification to the laboratory component is conditioned to the minimum frequency of 70% of the respective classes actually given. (In the case of student-workers, the criterion of minimum attendance is not applicable, with a discussion of the laboratory test report as well as the program developed in the LabVIEW environment).

Conditions for Exam Admission

Students have access to examination with a minimum frequency of 70% of the laboratory classes.

Access Conditions and Attendance Excuse

Not applicable.

Conditions for Results Improvement

It is only allowed to improve classification to the component evaluated in the examination.

Date	**Signature from the lecturer responsible for the course**
10-10-2018	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher: _____

Mestrado em Engenharia Eletromecânica – Especialização em Instalações e Equipamentos em Edifícios

MSc in Eletromechanical Engineering - Specialization in Building Services Engineering

Academic Year: 2018/2019

Program Contents

Course Unit HEAT TRANSFER AND COMBUSTION

Subject type Engineering Sciences **Research Area** Mechanical Engineering

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

Working Hours

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

Unaccompanied Working Hours

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

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Gilberto Cordeiro Vaz	PhD	Coordinator Prof.
Theoretical-Practical Lectures	Gilberto Cordeiro Vaz	PhD	Coordinator Prof.
Practical-Laboratoty Lectures			
Tutorial Orientation			

Responsible(s) Lecturer (s) Gilberto Cordeiro Vaz

Goals / Skills

The aim of this course is to convey to students the concepts of Heat Transfer and Combustion relevant to the MSc in Eletromechanical Engineering - Specialization in Building Services Engineering so that they can acquire the skills required. This course contributes mainly to the acquisition by the students of the following specific skills: To conceive, design, implement and do the maintenance of heating, ventilation and air conditioning installations; To conceive, design, and implement fluid networks; To supervise the implementation of Mechanical Engineering Installations.

Program Contents

Heat Transfer

1. Introduction
   Heat transfer modes. Rate equations. Principle of conservation of energy. Methodology of analysis of heat transfer problems. Relevance of heat transfer.
2. .Introduction to Heat Conduction
   The conduction rate equation. Thermal properties of matter. Heat diffusion equation. Boundary and initial conditions.
3. One-Dimensional Steady State Conduction
   Plane wall: temperature distribution, thermal resistances, composite wall, contact resistance. Analogy between the diffusion of heat and electrical charge. Cylindrical systems.

4. Heat transfer in Extended Surfaces.
   Introduction. Types of fins. Materials.
5. Thermal Convection
   Physical mechanisms of convection. Boundary layers. Convection heat transfer coefficient-empirical correlations.
6. Heat Exchangers
   Types and modes of operation. Analysis and selection of heat exchangers (DMLT and ε-NUT Methods).
7. Thermal Radiation
   Fundamental concepts. Planck distribution. Stefan-Boltzmann and Wien laws. Surface emission, absorption, reflection and transmission. Kirchhoff's law. Gray surfaces. Radiation exchange between surfaces: View factor. View factor relations.

Combustion

1. Gas Mixtures
   Mass and molar fractions. Behavior of gas mixtures: Equation of state of ideal gases; Dalton and Amagat laws. Ideal gas mixtures.
2. Basic Notions of Combustion
   Fuels types and characteristics. Oxidant types and characteristics. Chemical reaction of combustion. Ignition temperature. Flammability limits. Principle of mass conservation. Air-fuel ratio.
3. Theoretical and Actual Combustion Processes
   Complete combustion. Incomplete combustion. Stoichiometric combustion. Equations of combustion. Stoichiometric air. Excess air. Equivalence ratio. Gas analysis.
4. Enthalpy of Formation and Enthalpy of Combustion
   Standard reference state. Enthalpy of reaction. Enthalpy of combustion. Enthalpy of formation. Higher heating value. Lower heating value.
5. Adiabatic Flame Temperature
   Adiabatic flame temperature. Energy balance equation. Calculation of adiabatic flame temperature.
6. Combustion Systems
   Types of burners for gaseous, liquid and solid fuels.

Work Done

Teaching Methododoly

During the semester visits to the ISEC Laboratories relevant to this course are carried out, in order to motivate students to the contents. At the theoretical classes, content is usually exposed and developed using audiovisual equipment. At the theoretical-practical classes, a theoretical introduction is initially made and then typical problems are solved.

Bibliography

- INCROPERA, F.P.; DEWITT, D.P. - FUNDAMENTOS DE TRANSFERÊNCIA DE CALOR E DE MASSA, LTC EDITORA, 5ª ED., 2003. ISBN: 85-216-1378-4.
- INCROPERA, F.P.; DEWITT, D.P. - FUNDAMENTALS OF HEAT AND MASS TRANSFER, JOHN WILEY & SONS, 5TH ED., 2001. ISBN: 0471386502.
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- CENGEL, Y.A., BOLES, M. A. – TERMODINÂMICA, MCGRAW-HILL, 3ª EDIÇÃO, 2001. ISBN: 972-773-097-3.
- CENGEL, Y.A., BOLES, M. A. - •*Thermodynamics : an engineering approach*, McGraw-Hill, 2nd Edi., 1994. ISBN 0-07-114104-9.
- VAZ, G.C. – TRANSMISSÃO DE CALOR E COMBUSTÃO – 2018.

Evaluation Method

The assessment of this course is done through a written test at the end of the semester, which includes two components. A theoretical component and a theoretical-practical component, each corresponding to 50% of the final mark. In each of the components, a minimum of 30% of the value of the component is required.

Conditions for Exam Admission

Access Conditions and Attendance Excuse

Conditions for Results Improvement

Date

15.10.2018

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
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Signature of Teacher:

Mestrado em Engenharia Eletromecânica
Especialização em Instalações e Equipamentos em Edifícios
Master Course in Electromechanical Engineering
Specialization in Building Services Engineering

Academic Year: 2018 / 2019

Program Contents

Course Unit 678602 - APPLIED INFORMATICS

Subject type Engineering 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 de Sousa Adelino da Fonseca	PhD	Prof. Adjunto
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	Inácio de Sousa Adelino da Fonseca	PhD	Prof. Adjunto
Tutorial Orientation			

Responsible(s) Lecturer (s) Inácio de Sousa Adelino da 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.

Program Contents

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

Signature of Teacher: Tfonseca

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 web-based data management system for a brainstorming management system. Statement made available on 2018/10/15 at moodle platform, deadline for submission 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.
Practical work for 8 values.

Conditions for Exam Admission

Have obtained a minimum of 30% on the written exam.
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	Inês Sousa Adelino da Fonseca

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:__ _____

Mestrado em Engenharia Eletromecânica
Especialização em Instalações e Equipamentos em Edifícios
Master Course in Electromechanical Engineering
Specialization in Building Services Engineering

Academic Year: 2018/2019

Program Contents

Course Unit APPLIED MATHEMATICS

Subject type Basic Science **Research Area** Mathematics

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

Working Hours **Unaccompanied Working Hours**

Activity Type	Working Hours Per Week	Total Hours	Activity Type	Total Hours
Theoretical Lectures	2	28	Study	87
Theoretical-Practical Lectures	2	28	Works / Group Works	10
Practical-Laboratoty Lectures			Project	
Tutorial Orientation			Evaluation	3
			Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	João António Ribeiro Cardoso	PhD	Prof. Coord.
Theoretical-Practical Lectures	João António Ribeiro Cardoso		
Practical-Laboratoty Lectures			
Tutorial Orientation			

Responsible(s) Lecturer (s) João António Ribeiro Cardoso

Goals / Skills

Student should be able to:
interpret analytically and geometrically functions of several variables, preferably using computational tools; understand the basic concepts of vector fields and use them in the description of physical phenomena; know examples of ODEs applications in various engineering areas; implement the main numerical methods to solve ODEs; compute Laplace transform of functions, including functions used in engineering; apply Laplace transforms to solve initial value problems; calculate Fourier series and Fourier transforms; realize the importance of Fourier analysis in engineering; solve boundary value problems involving the heat equation or the Laplace equation; use Matlab in the treatment of the subjects taught; use mathematical techniques to solve practical problems of his vocational area; develop skills of abstraction, demonstration and logical structuring; show interest and autonomy in the performance of practical work.

Program Contents

1. Vector Analysis

Review of functions of several variables and their derivatives;Vector fields; Handling functions of several variables and vector fields with Matlab.

2. Ordinary Differential Equations. Numerical Resolution Methods

Introduction to differential equations; Importance of differential equations in Engineering; Numerical methods for first

order initial value problems (Taylor and Runge-Kutta methods); Implementation in Matlab; Runge-Kutta method for systems of ordinary differential equations.

3. Laplace Transforms

Brief review of integration; Laplace transform and inverse Laplace transform: definition and properties; Heaviside function; Convolution; Application of Laplace transforms in the resolution of initial value problems.

4. Fourier Analysis

Periodic functions; Fourier series of 2L-periodic functions; Convergence of Fourier series; Fourier series of even or odd functions; Fourier transform.

5. Partial differential equations

Basic concepts; Heat and diffusion equation and applications; Solving the diffusion PDE by separation of variables; Laplace equation; applications; Two-dimensional Laplace equation in Cartesian coordinates; Resolution by the method of separation of variables.

Work Done

One teamwork using Matlab, with written report and oral presentation – 15% weighting (3 values).

Teaching Methododoly

The teaching methodologies are the followings: Lectures by the teacher; Practical exercises by students. Some classes will take place in computer lab in order to solve problems using Matlab.

Bibliography

- R. Burden e J. Faires, *Numerical Methods*, 2ª Ed., Brooks/Cole, 1998.
- J. R. Cardoso, *Apontamentos de apoio às aulas teóricas e teórico-práticas de Mat. Aplicada,* DFM, ISEC, 2018
- J. R. Cardoso, *Actividades de apoio às aulas de laboratório de Matemática Aplicada,* DFM, ISEC, 2018
- T. Harman, J. Dabney, N. Richert, *Advanced Engineering Mathematics with Matlab*, 2ª Ed., Brooks/Cole, 2000.
- E. Kreyszig, *Advanced Engineering Mathematics*, 8ª Ed., John Wiley & Sons, 1999
- Larson, Hostetler, Edwards, *Cálculo*, Volume 2, McGraw-Hill, 8ªEd, 2006
- C. Moler, *Numerical computing with Matlab*, SIAM, Philadelphia, 2004
- P. O'Neil, *Advanced engineering mathematics*, 5ªEd, Thomson Brooks/Cole, 2003

Evaluation Method

- Theoretical + Practical Components - 85% weighting (17 values):

Evaluation can be either continuous (two written tests) or by a final written exam.

- One teamwork using Matlab, with written report and oral presentation – 15% weighting (3 values).

Conditions for Exam Admission

The student must be officially enrolled in the course unit (Secretaria Virtual).

Access Conditions and Attendance Excuse

Not applicable

Conditions for Results Improvement

According to the rules of ISEC.

Date	**Signature from the lecturer responsible for the course**
18/10/2018	José António Ribeiro Cardoso

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:_____

Mestrado em Engenharia Eletromecânica
Especialização em Instalações e Equipamentos em Edifícios
Master Course in Electromechanical Engineering
Specialization in Building Services Engineering

Academic Year: 2018/2019

Program Contents

Course Unit DISSERTATION / PROJECT / INTERNSHIP

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

Year 2nd **Semester** 1st + 2nd **ECTS** 42
3

Working Hours **Unaccompanied Working Hours**

Activity Type	Working Hours Per Week	Total Hours	Activity Type	Total Hours
Theoretical Lectures			Study	165
Theoretical-Practical Lectures			Works / Group Works	
Practical-Laboratory Lectures			Project	840
Tutorial Orientation	3	94	Evaluation	3
			Additional	

Total of Working Hours 1092

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures			
Theoretical-Practical Lectures			
Practical-Laboratory Lectures			
Tutorial Orientation	According to the work's topic		

Responsible(s) Lecturer (s) Coordinating Committee of the Master:
Paulo Pereirinha, Gilberto Vaz, Avelino Virgílio, Dulce Coelho

Goals / Skills

Project:
Give the student the opportunity to demonstrate autonomy and originality;
Develop the capacity to plan and organize a project of appropriate size over an extended period;
Put in practice the knowledge and techniques acquired and developed during the master course.

At the end of the Project the student should demonstrate the ability to:
- Participate in a project, select components, supervise the installation and ensure efficient operation and maintenance of equipment and systems;
- Apply critical analysis and demonstrate ability to investigate;
- Use and integrate knowledge to solve complex problems.

Internship:
Acquire relevant professional experience that allows the student a first integration in the job market;

Acquire the necessary knowledge to transfer skills to the professional environment and set goals for professional careers;
Put in practice the knowledge and techniques acquired and developed during the master course.

Signature of Teacher:_____

At the end of the Internship, the student must demonstrate the ability to:
- Work in a team, communicate ideas and be able to take on leadership tasks;
- Apply scientific and technical knowledge in the solution of problems in a professional environment;
- Develop an inter-disciplinary perspective of problems.

Dissertation:
Develop research skills for students who demonstrate an interest in pursuing academic or research careers;
Develop local know-how that will serve as the basis for future dissertations, projects or internships;
Contribute to the development of innovative technologies in the area of Building Services Engineering.

At the end of the Dissertation the student should demonstrate:
- To have an overall view of the state of the art in the area of study;
- Ability to conduct research in a structured manner, leading to the presentation of scientific results and to compare them critically with other works in the area;
- To understand in detail the main techniques in the subject of study.

Program Contents

Project:
Development of an original individual project, privileging themes that aggregates several areas of Electrical Engineering and / or Mechanical Engineering, and associated with real cases. The theme of the project can be proposed by a teacher or by the student. Each project is assigned to one or more supervisors, according to the areas involved, who will support the student through tutorial guidance throughout the school period. The student and the supervisors will agree on a Work Plan for the project that is subject to approval by the Scientific Committee. The Work Plan includes the objectives and scope of the project as well as a schedule of activities to be developed. Students should develop the various phases of the Work Plan, namely: definition of the problem and definition of an approach strategy, the conceptual design phase, the detailed design phase and the elaboration phase of the project support documentation. The use of software tools is valued, especially if developed by the student for calculations, scaling or simulation. The construction and testing of a prototype will also be valued.

Internship:
Alternatively to the Project, students have the possibility of attending an internship of a professional nature. Internship can be proposed by teachers, by a company or institution or by the student. At each internship, one or more academic advisors are assigned, according to the areas involved, who will support the student through tutorial guidance throughout the school year, and a supervisor of the company or institution that will support the student in the integration into the work environment. The student, the academic advisor(s) and the supervisor will agree on a Work Plan for the Internship. The Work Plan includes the objectives and scope of the internship as well as a schedule of activities to be developed. The internship should lead to the production of an Internship Report that meets the requirements for obtaining the master's degree.

Dissertation:
For students with a more established academic profile, and with a high degree of autonomy in terms of theoretical concepts, a dissertation on a specific topic can be proposed. The specific theme selected should be included in the area of Building Services Engineering, and have the potential for future integration in field technologies. The recommended structure for the dissertation is the following: motivation for the study of the specific theme; bibliographic summary of the state of the art; description of research; results presentation; analysis and critical discussion of results in the face of bibliographic summary; conclusions.

Work Done

Specific to each work.

Teaching Methododoly

Specific to each work.

Bibliography

Specific to each work.

Evaluation Method

Evaluation of Progress Report;
Public defense of the Dissertation, Project Work or Internship Report before a jury appointed by the Scientific Committee and in accordance with the Master's Normative Rules.

Conditions for Exam Admission

According to the Master's Normative Rules.

Signature of Teacher: _____

Access Conditions and Attendance Excuse

According to the Master's Normative Rules.

Conditions for Results Improvement

According to the law.

Date	Signature from the lecturer responsible for the course
15/10/2019	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher: _____

Mestrado em Engenharia Eletromecânica
Especialização em Instalações e Equipamentos em Edifícios
Master Course in Electromechanical Engineering
Specialization in Building Services Engineering

Academic Year: 2018/2019

Program Contents

Course Unit FIRE SAFETY SYSTEMS

Subject type Engineering Sciences **Research Area** Mechanical Engineering

Year 2 **Semester** 1 **ECTS** 4

Working Hours

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

Unaccompanied Working Hours

Activity Type	Total Hours
Study	45
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 104

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Avelino Virgílio Fernandes Monteiro de Oliveira	PhD	Adjunct Professor
Theoretical-Practical Lectures	Avelino Virgílio Fernandes Monteiro de Oliveira	PhD	Adjunct Professor
Practical-Laboratoty Lectures			
Tutorial Orientation			

Responsible(s) Lecturer (s) Avelino Virgílio Fernandes Monteiro de Oliveira

Goals / Skills

Knowledge of the legislation.
Acquisition of knowledge on generation and propagation of fires.
Know how to identify and to distinguish types and classes of fires.
Know how to design manual and automatic fire extinguishing systems.
Definition and selection of fire detection systems.
Define evacuation plans.
Design of firefighting systems.

Program Contents

1. Fundamentals of fire generation and propagation.
2. Types and classes of fires.
3. Manual and automatic fire-extinguishing systems.
4. Fire detection systems.
5. Natural and mechanical smoke systems.
6. Design of fire-fighting systems.
7. Standards and Regulations

Signature of Teacher:_____

Work Done

Research work regarding a topic related to Fire Safety

Teaching Methodology

Lectures;
Diverse learning situations, including seminars and study visits;
Research work regarding a topic related to Fire Safety;
Situations of debate, leading the student to think / reflect.

Bibliography

- Regulation on Fire Safety.
- European standards.
- "Cepreven" Standard.
- Manufacturers Technical Sheets.
- Manual de Segurança Contra Incêndio em Edifícios, Escola Nacional de Bombeiros, 2ª Edição
- Sistemas de Prevenção Contra Incêndios, Ary Gonçalves Gomes, Editora Interciência
- Manual de Extintores, António Matos Guerra, Escola Nacional de Bombeiros
- Segurança Contra Incêndio em Edifícios de Habitação, António Leça Coelho, Edições Orion

Evaluation Method

The UC evaluation will have 2 components: - practical work and final written exam.
The work has to be framed in the "Program Contents" of the CU and will consist of a report oriented to the decision making on technical equipment of the area to be studied. It has a quotation of 5 points and students will have to obtain a minimum of 30%, that is, 1.5 points. The work will presented and discussed in the last lectures of the semester.
The final exam will have a quotation of 15 points; a minimum of 5 points is required.
The approval is dependent on an aggregate classification (final exam and work) equal or superior to 9.5 values.

Conditions for Exam Admission

Those provided in the legislation and regulations.

Access Conditions and Attendance Excuse

Not applicable.

Conditions for Results Improvement

The classification improvement is only possible in the written exam component.

Date

18/10/2018

Signature from the lecturer responsible for the course

A. Virgílio Mendeiro de Oliveira

Program Contents

Course Unit SPECIAL TECHNICAL INSTALLATIONS II

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

Year 2 **Semester** 1 **ECTS** 5

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	44
Works / Group Works	28
Project	
Evaluation	2
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	João Carlos Antunes Ferreira Mendes	Doutoramento	Prof. Coordenador
	Avelino Virgílio Fernandes Monteiro de Oliveira	Doutoramento	Prof. Adjunto
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	João Carlos Antunes Ferreira Mendes	Doutoramento	Prof. Coordenador
	Avelino Virgílio Fernandes Monteiro de Oliveira	Doutoramento	Prof. Adjunto
Tutorial Orientation			

Responsible(s) Lecturer (s) João Carlos Antunes Ferreira Mendes

Goals / Skills

Design and selection of technical equipment / installations in buildings and developments.

Program Contents

Part I
1. Industrial Kitchens
2. Elevators

Part II
1. Central Vacuum Systems
2. Gas Installations
3. Hospital Laundry

Work Done

Ventilation project of an industrial kitchen. Elaboration of a report oriented to the decision making on technical equipment of

the area to be studied.

Teaching Methododoly

Theoretical teaching with computer support; Study visits to different operating facilities; Seminars on specific topics; Group learning.

Bibliography

Catálogos de fabricantes de Sistemas de Aspiração Central

Manual de Lavanderia, Fundação CASA, Superintendência de Saúde, Brasil, 2008

Manual de Lavanderia Hospitalar – Ministério da Saúde, Brasil

Gás Natural: Manual Técnico – Instalações de Utilização de Gás Natural para Clientes Domésticos, GALP

Instalações de Gás na Restauração, Hotelaria e Catering, Victor Monteiro, Editora LIDL, ISBN: 9789727578030, 2012

Ventilação na Restauração e Hotelaria, Victor Monteiro, ETEP, 2016

Evaluation Method

The evaluation of the first part of the unit will have three components: a project (5 values), performance during classes (1,5 values) and final written exam (3.5 values).
The evaluation of the second part of the uc will have 2 components: practical work and final written exam.
The work will have to be framed in the programmatic content of the CU and will consist of a report oriented to the decision making on technical equipment of the area to be studied. You will have a price of 2.5 and the students will have to obtain a minimum price of 30%. The work will be the subject of public presentation and discussion, in the last class of the semester.
The final exam will have a price of 7.5, requiring a minimum grade of 2.5 points.
The aggregate classification (final exam and work) of part II must be equal to or greater than 4.0 values.

Conditions for Exam Admission

Final exam part I (3.5 points) and part II (7.5 points) for all enrolled students.

Access Conditions and Attendance Excuse

Not applicable.

Conditions for Results Improvement

It is only allowed to improve classification to the component evaluated in the examination.

Date

18/10/2018

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:_____

Mestrado em Engenharia Eletromecânica
Especialização em Instalações e Equipamentos em Edifícios
Master Course in Electromechanical Engineering
Specialization in Building Services Engineering

Academic Year: 2018/2019

Program Contents

Course Unit SPECIAL TECHNICAL INSTALLATIONS II

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

Year 2 **Semester** 1 **ECTS** 5

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	44
Works / Group Works	28
Project	
Evaluation	2
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	João Carlos Antunes Ferreira Mendes	Doutoramento	Prof. Coordenador
	Avelino Virgílio Fernandes Monteiro de Oliveira	Doutoramento	Prof. Adjunto
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	João Carlos Antunes Ferreira Mendes	Doutoramento	Prof. Coordenador
	Avelino Virgílio Fernandes Monteiro de Oliveira	Doutoramento	Prof. Adjunto
Tutorial Orientation			

Responsible(s) Lecturer (s) João Carlos Antunes Ferreira Mendes

Goals / Skills

Design and selection of technical equipment / installations in buildings and developments.

Program Contents

Part I
1. Industrial Kitchens
2. Elevators

Part II
1. Central Vacuum Systems
2. Gas Installations
3. Hospital Laundry

Work Done

Ventilation project of an industrial kitchen. Elaboration of a report oriented to the decision making on technical equipment of

the area to be studied.

Teaching Methododoly

Theoretical teaching with computer support; Study visits to different operating facilities; Seminars on specific topics; Group learning.

Bibliography

Catálogos de fabricantes de Sistemas de Aspiração Central

Manual de Lavanderia, Fundação CASA, Superintendência de Saúde, Brasil, 2008

Manual de Lavanderia Hospitalar – Ministério da Saúde, Brasil

Gás Natural: Manual Técnico – Instalações de Utilização de Gás Natural para Clientes Domésticos, GALP

Instalações de Gás na Restauração, Hotelaria e Catering, Victor Monteiro, Editora LIDL, ISBN: 9789727578030, 2012

Ventilação na Restauração e Hotelaria, Victor Monteiro, ETEP, 2016

Evaluation Method

The evaluation of the first part of the unit will have three components: a project (5 values), performance during classes (1,5 values) and final written exam (3.5 values).
The evaluation of the second part of the uc will have 2 components: practical work and final written exam.
The work will have to be framed in the programmatic content of the CU and will consist of a report oriented to the decision making on technical equipment of the area to be studied. You will have a price of 2.5 and the students will have to obtain a minimum price of 30%. The work will be the subject of public presentation and discussion, in the last class of the semester.
The final exam will have a price of 7.5, requiring a minimum grade of 2.5 points.
The aggregate classification (final exam and work) of part II must be equal to or greater than 4.0 values.

Conditions for Exam Admission

Final exam part I (3.5 points) and part II (7.5 points) for all enrolled students.

Access Conditions and Attendance Excuse

Not applicable.

Conditions for Results Improvement

It is only allowed to improve classification to the component evaluated in the examination.

Date	Signature from the lecturer responsible for the course
18/10/2018	

Signature of Teacher:____
_____

Instituto Superior de Engenharia de Coimbra
www.isec.pt

MSc em Engenharia Eletromecânica – Especialização em Instalações e Equipamentos em Edifícios - 6786 (Português)

MSc in Electromechanical Engineering - Specialization in Building Services Engineering - 6786 (Ingês)

Academic Year: _2018_/_2019__

Program Contents

Course Unit HOME AUTOMATION AND INTELLIGENT BUILDINGS - 678612

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

Year 2nd **Semester** 1st **ECTS** 5

Working Hours **Unaccompanied Working Hours**

Activity Type	Working Hours Per Week	Total Hours	Activity Type	Total Hours
Theoretical Lectures	2	28	Study	30
Theoretical-Practical Lectures			Works / Group Works	42
Practical-Laboratoty Lectures	2	28	Project	
Tutorial Orientation			Evaluation	2
			Additional	

Total of Working Hours 130

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.

Signature of Teacher:____
_____

Integrated Project of Buildings.
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

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

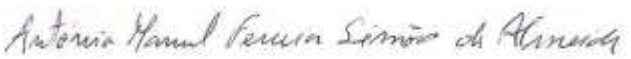
Participation in at least 75% of the practical classes and delivery of the final report for the practical work until the end of the last theoretical class week.

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	**Signature from the lecturer responsible for the course**
2018-10-12	

Signature of Teacher:_____

Instituto Superior de Engenharia de Coimbra
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MSc em Engenharia Eletromecânica – Especialização em Instalações e Equipamentos em Edifícios - 6786 (Português)

MSc in Electromechanical Engineering - Specialization in Building Services Engineering - 6786 (Ingês)

Academic Year: _2018_/_2019__

Program Contents

Course Unit HOME AUTOMATION AND INTELLIGENT BUILDINGS - 678612

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

Year 2nd **Semester** 1st **ECTS** 5

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	30
Works / Group Works	42
Project	
Evaluation	2
Additional	

Total of Working Hours 130

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.
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

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.

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	Signature from the lecturer responsible for the course
2018-10-12	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Mestrado em Engenharia Electromecânica – Especialização em Instalações e equipamentos em Edifícios

MSc in Electromechanical Engineering- Specialization in Building Services

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

Program Contents

Course Unit PRODUCTION AND MANAGEMENT OF ENERGY

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

Year 2nd **Semester** 1st **ECTS** 4

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	2	28
Practical-Laboratoty Lectures		
Tutorial Orientation		
Total of Working Hours		104

Unaccompanied Working Hours

Activity Type	Total Hours
Study	24
Works / Group Works	20
Project	
Evaluation	4
Additional	

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Anabela Duarte de Carvalho Dulce Helena de Carvalho Coelho	PhD. PhD	Prof. Adjunto Prof. Adjunto
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	Anabela Duarte de Carvalho Dulce Helena de Carvalho Coelho	PhD. PhD	Prof. Adjunto Prof. Adjunto
Tutorial Orientation			

Responsible(s) Lecturer (s) Dulce Helena de Carvalho Coelho

Goals / Skills

To familiarize students with different technologies of local energy generation in buildings such as combined heat power and renewable energy systems.
To become familiar with the concepts related to energy use and efficient energy use in buildings and equipment.
To learn about technologies and systems for improving energy efficiency.
To learn the methodology, phases and expected outputs of energy audits in buildings.
To become familiar with actions needed to achieve implementation of energy certification of buildings.

Program Contents

Energy Production. Production of thermal energy and conventional power. Decentralized energy production: combined heat power (CHP), fuel cells and renewable energies (solar energy; solar photovoltaics; geothermal energy; wind energy). Laws and regulations for local energy production.
Energy Management in Buildings. Energy consumption in buildings. Bioclimatic strategies. The rational use of energy in

buildings and equipments: Lighting; HVAC equipment; Driving force; Other equipment. Building energy audits: Methodology and equipment. Methods for estimating energy savings. Economic analysis. European and Portuguese regulations. The SCE, RECS and REH regulation. Integration of renewable energies in buildings.

Work Done

Laboratory case studies, written report and oral presentation

Teaching Methododoly

Lectures, Lectures by experts in specific areas, case-studies presentation, group work, case-studies analysis, visits of energy production systems installed in local laboratories, software tools.

Bibliography

- Class presentations and other documents supplied by teachers.
- GASQUET HL, Manual Teórico y Prático sobre los Sistemas Solares Fotovoltaicos, 2004
- HODGE, B. K. – Alternative Energy Systems and Applications, 2010. John Wiley & Sons. ISBN: 978-0-470-14250-9, COTA: 1-2-573 (ISEC).
- MORAIS, J. L. – Sistemas Fotovoltaicos da Teoria à Prática, 2009. ISBN: 978-989-96101-0-1
- Scott A. Spiewak, Larry Weiss, Cogeneration & small power production manual.
- IEA (International Energy Agency) - Technology Roadmap. Energy-efficient Buildings: Heating and Cooling Equipment, 2011.
- IEA (International Energy Agency) – Renewables for Heating and Cooling, 2007
- ETP-RHC (European Technology Platform on Renewable Heating and Cooling) - Strategic Research Priorities for Geothermal Technology; 2012.
- EURELECTRIC (Union of the Electricity Industry)- Power Statistics & Trends, 2013
- Energias Renováveis em Meio Urbano, ADENE/AREAC, Março 2005
- PNAPRI – Guia Técnico do Sector da Produção, Transporte e Distribuição de Energia - Sector da Produção de Energia, INETI, Julho 2003
- European and National Legislation and Regulation.
- www.cogenportugal.com
- HKEIA. Guidebook for ISO 50001 Energy Management System (2013).
- AIDA. Sistema de Gestão Energética Guia Prático (2014).
- Websites related with energy generation and management subjects (http://www.edp.pt ; http://www.dgeg.pt ; http://www.erse.pt; http://www.iea.org; http://www.ewea.org (European Wind Energy Association); http://www.fuelcells.org; http://www.ises.org (International Solar Energy Society); http://www.spes.pt ; www.cogenportugal.com

Evaluation Method

Final written exam (50%); laboratory case studies, written report and oral presentation (50%). Minimum attendance is required in the laboratory part.
To obtain approval in the course unit a grade higher than 9.5/20 values and a minimum grade of 8/20 values in each assessment component is required.

Conditions for Exam Admission

Access Conditions and Attendance Excuse

Conditions for Results Improvement

Only allowed to the written component assessed in the exam.

Date	Signature from the lecturer responsible for the course
15/10/2018	Dulce Helena Coelho

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher: Cristina Ag

Mestrado - MSc Engenharia Eletromecânica
Especialização em Instalações e Equipamentos em Edifícios

MSc in Electromechanical Engineering
Specialization in Building Services Engineering
Academic Year: 2018/2019

Program Contents

Course Unit SPECIAL TECHNICAL INSTALLATIONS I

Subject type **Research Area** Electrical and Electronics Engineering

Year 1 **Semester** 2 **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		
Seminar		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	40
Works / Group Works	20
Project	38
Evaluation	2
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Cristina Isabel Ferreira Faustino Agreira	PhD	Professor
Theoretical Lectures	João Carlos Ramos Perdigoto	MSc	Invited Professor
Theoretical-Practical Lectures	Cristina Isabel Ferreira Faustino Agreira	PhD	Professor
Theoretical-Practical Lectures	João Carlos Ramos Perdigoto	MSc	Invited Professor
Practical-Laboratoty Lectures	Cristina Isabel Ferreira Faustino Agreira	PhD	Professor
Practical-Laboratoty Lectures	João Carlos Ramos Perdigoto	MSc	Invited Professor
Tutorial Orientation			

Responsible(s) Lecturer (s) Cristina Isabel Ferreira Faustino Agreira; João Carlos Ramos Perdigoto

Goals / Skills

1st Part

To know and understand the communication and information technologies available in the market.
To understand the requirements of telecommunications services.
To choose equipment available in the market for reception of satellite television: parabolic reflector, LNB, etc.
To know and understand the main characteristics of antennas.
To choose antennas available in the market for reception of broadcast services and implementation of WLANs.
To know and understand the network technologies available in the market.
To know and understand the industrial communication technologies, using equipment available in the market.

Signature of Teacher: _____

To choose, run and maintain local area networks using commercially available equipment.
To install and maintain local area networks and industrial communication systems.
To understand and execute diagnosis of communication problems in local and industrial networks.
To know, execute and maintain the communication part of automation and robotics systems.

2nd Part

Students who attend this part of the curricular unit should learn about the applicable legislation in the area of telecommunications infrastructures, applied to buildings.

They must acquire competences in the design, execution and maintenance of telecommunications installations in buildings (national regulation ANACOM/ITED).

Program Contents

1st Part

Introduction to telephone networks, audio and video systems
Audio and video technologies
Conversational services: telephone service; video telephony, video conferencing and tele-surveillance, etc.
Interactive services: voice messages; web browsing and email (server access)
Streaming services: audio streaming; video streaming, still images, etc.
Requirements for telecommunications services
Modes of information transfer
CATV and SMATV television distribution systems
Satellite television reception: basics
Introduction to Local and Wireless Networks:
Architectures and Topologies: Bus (bus); Ring; Star; Mesh.
Ethernet (IEEE 802.3); Token-Ring (IEEE 802.5); FDDI; Token-Bus
Wireless Local Area Networks: IEEE 802.11; Bluetooth; ZigBee;
Network Equipment: HUB, Switch, Router.
Structured wiring: cable types; applicable standards
TCP / IP protocols
Introduction to Industrial Networks:
The Productive Process
Use of Networks in the Industrial Environment
Industrial Network Requirements
Sensor networks and actuators
Transmission Media
Architectures and protocols:
Fieldbus
CAN and DeviceNet
Modbus
Profibus
Industrial Ethernet
CCTV and video surveillance systems
Equipments,Transmission Systems,Image acquisition.

2nd Part

Telecommunications Infrastructure in Buildings (ITED)
General information on telecommunications Infrastructure in buildings
Systems of sound and television broadcasting
Basic Concepts of Coaxial Cable TV Networks
Fiber Optics Basics
XTP Cabling Basics
3th edition ITED Manual

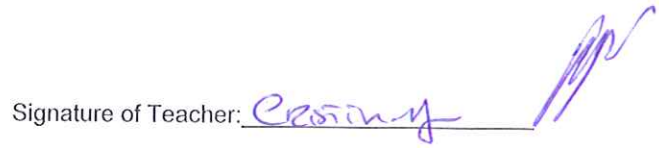
Work Done

Module 1

Practical Work Nº 1 - Structured Cabling - Physical Media (copper and fiber)

Practical Work Nº 2 - Structured cabling measurements - UTP cable parameters

Practical Work Nº 3 - Building and Testing an Ethernet Local Area Network

Signature of Teacher: 

Practical Work Nº 4 - TCP / IP Parameters

Practical Work Nº5 - Wi-Fi Networks (802.11x) - Authentication and use

Module 2

The students present an ITED project that will be discussed later in the last class of module 2, with the teachers of the curricular unit.

Teaching Methododoly

Oral presentation of the subjects in theoretical and theoretical-practical classes, including small practical examples and detailed application exercises.
A practical component through the execution of laboratory work.
Seminar presentations by external entities (companies or guests) for specific topics.
It is intended that students gain competencies at the level of ITED projects with the execution of projects close to what would be required in concrete situations

Bibliography

1st Part

ITU-T Re " Transmission systems and media, digital systems and networks" http://www.itu.int/ITU-T/index.html

Antenna Theory: Analysis and Design, 3rd Edition. Constantine A. Balanis

Satellite internet: broadband service providers and dish pointing – worldwide http://www.satsig.net/

São disponibilizadas aos alunos as cópias das apresentações das aulas teóricas e os manuais dos equipamentos utilizados nas aulas laboratoriais.

ISEC, "Cablagem Estruturada CCNA1", DEIS ISEC, Outubro 2007,

Monteiro, E., Boavida, F. "Engenharia de Redes Informáticas", FCA,

Spurgeon, C., "Ethernet: the definitive guide", O´Reilly,

Lammle, Todd, "CCNA Cisco certified network associate: study guide", Sybex,

Geier, Jim, "Wireless Lans: implementing interoperable networks", MacMillan,

São também disponibilizadas aos alunos as cópias das Apresentações efectuadas nas aulas teóricas
São também disponibilzados os manuais dos equipamentos utilizados nas aulas laboratoriais.

2nd Part

Manual 3th edition ITED http://www.anacom.pt/

Evaluation Method

1st PART:
Final exam (up to 14 values in 20 maximum) and Laboratory Work and / or Bibliographic Summary (6 values). For global approval, must have a mark of 40% or more in the final exam.

2nd PART:
Project with final discussion (20 values)

The final grade is calculated according to the following expression:

N = (0.5 * M1 + 0.5 * M2)
where
M1 - Final mark of Part 1 (in 20 values)
M2 - Final mark of Part 2 (in 20 values)

Signature of Teacher: Cristina Ag

Conditions for Exam Admission

Regular attendance of laboratory classes with a maximum of 2 classes missed.

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 Ag

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Mestrado em Engenharia Eletromecânica - 6786
Especialização em Instalações e Equipamentos em Edifícios
Master Course in Electromechanical Engineering - 6786
Specialization in Building Services Engineering
Academic Year: 2018 / 2019

Program Contents

Course Unit INFORMATION TRANSMISSION AND NETWORKS - 678609

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	1	14
Practical-Laboratoty Lectures	1	14
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	Frederico Miguel do Céu Marques dos Santos	PhD	Prof. Adjunto
Practical-Laboratoty Lectures	Frederico Miguel do Céu Marques dos Santos	PhD	Prof. Adjunto
Tutorial Orientation			

Responsible Lecturer Fernando José Pimentel Lopes

Goals / Skills

The purpose of the Information and Networking Curricular Unit is to provide students with theoretical and practical knowledge that will allow them to understand and apply the fundamental concepts associated with communication systems in the context of telecommunications installations in buildings.
Theoretical concepts, technologies and applications include local interfaces and connections, long-distance telecommunication systems as well as IP network basics. Special attention is given to concepts, technologies and applications associated with twisted pair, fiber and coaxial networks within the scope of the ITED Project.

To understand the representation of information by electrical signals.
To understand the representation and implications of noise and interference in communication systems.
To know and understand the transmission of baseband signals in physical media.
To understand the principles and the need to use modulation techniques.
To know and understand the main techniques of analog and digital modulation.
To understand the application of propagation phenomena to radio and fiber optic communications.
To understand and calculate the limitations of physical channels to the transmission of information signals.
Ability to calculate and analyze simple analog and digital communications with and without noise.
Ability to analyze, in the time and frequency domains, signals in telecommunications systems.

Signature of Teacher:

To know the main types of electrical interfaces.
To understand the advantages and principles of communication networks.
Understand the principles of information theory and the objectives of source and channel coding.

Program Contents

Signals and noise; Signals and systems.
Physical transmission media – twisted pair, coaxial cable, optical fibers, radio propagation.
Limitations of physical channels.
Bandwidth and capacity.
Baseband transmission.
Analog modulation techniques.
Digital modulation techniques.
Fundamentals of propagation.
Power balances and applications.
Coaxial ITED - SMATV systems.
Applications of power balances to telecommunications installations in buildings (ITED).
Understanding Interfaces and Modems - ADSL Modems and Cable Modems.
Notions of networks.
Notions of information theory - source and channel coding.

Work Done

Laboratory work is carried out with evaluation:
- Decomposition and synthesis of periodic signals in Fourier Series using Matlab;
- Experimental determination of the bandwidth of an ADSL filter (optional);
- Power balance calculations to support the ITED Project;
- Simulation and experimental measurement of AM and FM modulation. ASK, FSK, PSK, PCM and OFDM-TDT.

Practical exercises and preparation for laboratory work are also carried out:
- Classification of signals;
- Phasor representation, power signals and Fourier Series;
- Energy signals and Fourier Transform;
- Power balances and noise-free analog communication;
- Thermal noise and analogue communication with noise (including ITED project).

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

Main:

Copies of lecture slides
Carlson, B.A. - Communication Systems: An introduction to Signals and Noise in Electrical Communication
Forouzan, B.A. - Data Communications and Networking

Secondary:

Simon Haykin, An Introduction to Digital and Analog Communications,
Henry Ott, Noise Reduction Techniques in Electronic Systems
K. Shanmugam, Digital and Analog Communication Systems.
Pierre-Gerard Fontolliet - Telecommunication Systems
Ulrich Reimers, Digital Video Broadcasting (DVB)
ETSI EN 300 473: "Digital Video Broadcasting (DVB): Satellite Master Antenna Television (SMATV) distribution Systems"
EUTELSAT, Information for installers of Hot Bird HOT BIRD™ DVB-S Systems, v 1.0 (http://www.eutelsat.com)
EUTELSAT, Digital Satellite Equipment Control (DiSEqC™), Bus Functional Specification, v 4.2 (http://www.eutelsat.com)
Fracarro Catalog (http://www.fracarro.com)
Televés Catalog (http://www.televes.es)
Teka Catalog (ITED) (http://www.televes.es)
ITED Manual (http://www.anacom.pt)

Evaluation Method

Exam - 14 points (in 20), minimum of 6 (in 14).
Execution and reports of laboratory work - 4 points, minimum 2 points (6 points, minimum 3 points if no synthesis work).
Thematic synthesis work (optional): 2 points, minimum 1 point.

Signature of Teacher: 

Conditions for Exam Admission

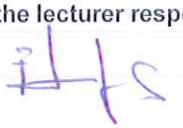
Have attended laboratory classes (up to 2 absences) and have performed and defended with approval the laboratory projects.

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: João Malça

Master Course in Electromechanical Engineering
Specialization in Building Services Engineering

Academic Year: 2018/2019

Program Contents

Course Unit HVAC-R PLANTS

Subject type Specialty curricular unit **Research Area** Mechanical Engineering

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

Working Hours

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

Unaccompanied Working Hours

Activity Type	Total Hours
Study	27
Works / Group Works	70
Project	
Evaluation	3
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	João Manuel Nogueira Malça de Matos Ferreira	PhD	Adjunct Professor
Theoretical-Practical Lectures	João Manuel Nogueira Malça de Matos Ferreira	PhD	Adjunct Professor
Practical-Laboratory Lectures	João Manuel Nogueira Malça de Matos Ferreira	PhD	Adjunct Professor
Tutorial Orientation			

Responsible(s) Lecturer (s) João Manuel Nogueira Malça de Matos Ferreira (jmalca@isec.pt)

Goals / Skills

The main aims of this course unit are: to understand the thermodynamics of air/water vapor mixtures and basic processes of air conditioning; to characterize HVAC systems and their field of application; to be able to select HVAC equipment; to understand the thermodynamic mechanisms that govern refrigeration applications; to distinguish the main components of refrigeration systems and how they interact to perform refrigeration; to select main components and accessories for a refrigeration system.
At the end of this course unit the student is expected to: understand HVAC fundamentals; describe main HVAC systems and their components; be aware of HVAC design guidelines, including installation, commissioning and maintenance requirements; integrate refrigeration fundamentals with refrigeration systems design; describe and size the main components of a refrigeration system.

Program Contents

PART I – HVAC SYSTEMS
1. Introduction
2. Thermal comfort and indoor air quality
3. Psychometrics and air conditioning processes
4. Main HVAC systems
5. Installation and maintenance of HVAC systems
6. Legislation, standards and regulations

PART II - REFRIGERATION SYSTEMS
7. Refrigeration cycles
8. Refrigerants
9. Refrigeration compressors
10. Condensers and evaporators
11. Control in HVAC-R plants
12. Calculation of refrigeration plants

Signature of Teacher: João Malça

Work Done

• Presentation and discussion in class of three relevant topics to the program contents of the curricular unit (HVAC);
• Presentation and discussion in class of three relevant topics to the program contents of the curricular unit (Refrigeration);
• Two technical visits to industrial and/or commercial facilities, including a final written report;
• Written report of one invited lecture held within the scope of the curricular unit.

Teaching Methodology

Topics at theoretical classes are presented through an application-driven approach, which tries to trigger discussion within the audience. “What-if” questions are extensively raised to engage students in the discussion. Students are also urged to deepen the study, using the recommended bibliography, books and other documents, and self-conducted research on the internet. Throughout the semester, each student presents four topics, followed by a discussion period. In theoretical-practical classes, problem solving is promoted to verify the knowledge level already acquired. Lab classes are grounded on software and technical catalogs of HVAC-R manufacturers. Additionally, one or more field visits to industrial and/or commercial units are provided for students to take contact with the technical facilities. Following these visits, students prepare summary reports, individually or in groups of two.

Bibliography

- MALÇA J. Apontamentos de apoio da unidade curricular, 2018
- CARRIER AIR CONDITIONING CO. Manual de Aire Acondicionado, Marcombo SA, 2009. ISBN: 9788426714992
- MIRANDA AL. Aire Acondicionado: Nueva Enciclopédia de la Climatización, 5ª ed., Ediciones CEAC, 2005. ISBN: 9788432910791
- CARPINTEIRO J. Aquecimento, Ventilação e Ar Condicionado, 3ed., Verlag-Dashöfer, 2011. ISBN: 978-989-642-152-6
- MIRANDA AL. Técnicas de Climatización, Marcombo SA, 2007. ISBN: 9788426714176
- JUTGLAR L, MIRANDA AL. Técnicas de Calefacción, Marcombo SA, 2009. ISBN: 9788426715296
- STOECKER WF. Industrial Refrigeration Handbook, McGraw-Hill, 1998. ISBN: 0-070-61623-X
- WHITMAN B, JOHNSON B, TOMCZYK J, SILBERSTEIN E. , 6th ed, Delmar Cengage Learning, 2009. ISBN: 978-1-4283-1937-0
- MONTGOMERY R, McDOWALL R. Fundamentals of HVAC control systems, SI edition, Elsevier, 2009. ISBN : 978-0-08-055234-7 (1)
- CREUS J. Tratado Prático de Refrigeração Automática, Dinalivro, Lisboa, 1978. ISBN: 972-576
- HUNDY GF, TROTT AR, WELCH TC. Refrigeration and Air-Conditioning, 4th edition, Elsevier, 2008. ISBN: 978-0-7506-8519-1
- Directives, standards and regulations
- Catalogues of HVAC-R equipment and accessories
- Software documentation

Evaluation Method

The evaluation of the course unit comprises:
1) Final written exam (22,5%);
2) Oral presentation of three HVAC topics (30%);
3) Oral presentation of three Refrigeration topics (30%);
4) Written report of two field visits (5%+5%);
5) Summary report of invited lecture (7,5%).
• The document supporting the presentations referred in 2) and 3) must be delivered to the head of the curricular unit in digital format (in PDF format, email jmalca@isec.pt) up to 2 weeks after the respective presentation and discussion in class . The filename must obey the following rule: "Surname short title of the work date" (example: "Mathews air filters 12may2018.pdf")
• Reports referred to in 4) and 5) must be delivered to the head of the curricular unit in digital support (email jmalca@isec.pt) until the last day of classes according to the available school calendar
• If there are no lectures and / or technical visits, the respective weight in the final grade is transferred to the final exam
• Failure to appear in the lecture(s) or technical visit(s), if duly justified, implies that the respective weight in the final grade is transferred to the final exam.

Conditions for Exam Admission

N/A

Access Conditions and Attendance Excuse

N/A

Conditions for Results Improvement

Improvement is only available through the written exam.

Date	Signature from the lecturer responsible for the course
24 January 2019	João Malça