ECTS Information Package: Degree Programme

Master's degree in

ELECTRICAL ENGINEERING (SPECIALIZATION IN CONTROL AND INDUSTRIAL ELECTRONICS)

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Diploma Supplement Label
2013 — 2016
Awarded by the European Commission to


ECTS Label
2013 — 2016
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A - General Description

Programme Title - Mestrado em Engenharia Eletrotécnica - Especialização em Controlo e Eletrónica Industrial

Qualification awarded - Master's degree in Electrical Engineering (specialization in Control and Industrial Electronics)

Level of qualification - Second-cycle degree, EQF Level 7; ISCED Level 5

Specific admission requirements

General

According to the Portuguese Law, the following candidates are eligible for entry to the course of study leading to the *Mestre* degree:

- Holders of a *licenciado* degree or legally equivalent corresponding to the first cycle of higher education;
- Holders of a foreign higher degree awarded on completion of a first-cycle programme organised in the framework of the Bologna Process;
- Holders of a foreign higher degree which is deemed by the Technical-Scientific Committee of ESTT-IPT to meet the requirements of a *licenciado* degree.
- Holders of an academic, scientific or professional curriculum which is deemed by the Technical/Scientific Committee of ESTT-IPT as appropriate to access the programme.

Specific

Holders of a pre-Bologna degree (3-year Bacharelato or 5-year Licenciatura) or a Bologna Licenciatura in Electrical Engineering or related areas (Physical Engineering, Mechanical Engineering, Computer Engineering and others).

Holders of an academic, scientific or professional curriculum which is deemed by ESTT?s Scientific Committee to meet the necessary requirements to access this study program.

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

General
Granting of credits from prior learning is regulated by the Portuguese Law taking into account the level of credits and the field of study where they have been earned and is subject to the recognition of ESTT-IPT Technical/Scientific Committee.

- Training undertaken in the context of other higher education programmes of study from national or foreign HE establishments or organised in the framework of the Bologna Process or other prior learning can be credited towards the present programme of study;
- Credits earned from postgraduate studies can also be credited towards this programme of study;
- Professional experience or other training, different from the abovementioned ones, can also be credited towards this programme of study.

Specific

Allocation of credits to individuals holding a licenciado degree in Electrical Engineering or similar programs prior to Bologna with a duration equivalent to 300 ECTS credits (5 years of study) is formally analysed on a case-to-case basis.

Qualification requirements and regulations:

The master's degrees are regulated by Portuguese Law and applicable program regulations established by the School of Technology-IPT.

In order to complete the master's degree it is necessary to accumulate 120 ECTS credits distributed throughout 4 curricular semesters as according to the course curriculum.

Each ECTS credit corresponds to 27 hours of work.

Profile of the program:

This Mastercourse presents a new educational approach, where areas of Electrical Engineering (specialization in Industrial Electronics and Control), are transverse, and intend to provide the master?s student with a professional profile that can respond to the demands of the vast and diverse business/industries community, from the smallest to largest company / industry.

The Master course in Electrical Engineering aims to contribute to enhance quality, efficiency, flexibility, safety and competitiveness of industrial proceedings. Provides Training of professional and specialized nature that can respond to increasing demands of the labour market towards the training of technicians in a growing area of technical requirement. Provides abilities and skills in state-of-the-art and new developments in intelligent control systems, sensors and actuators, in industrial electronics and associated technologies and methodologies. It will also provide skills in the optimization and maintenance of these systems improving students? critical and analytical thinking on these issues. Following the 1st cycle course in Electrical Engineering, allowing the continuation of studies for the enhancement and enrichment in the area of professional specialized training and postgraduate

education.

Therefore, this master course qualify professionals with the skills to detect, analyze and resolve complex issues in new and emergent areas of expertise,and also with the ability to apply innovative methods and techniques in problem solving, as well as withentrepreneurshipskills enabling them to create technology-based companies.

This course of study includes:

- A set of course units corresponding to 66 ECTS credits;

- An original project or a professional internship including final report corresponding to 54 ECTS credits.

Key learning outcomes:

Graduates from this program are expected to be able to apply relevant concepts and techniques of intelligent control systems, sensors and actuators and industrial electronics.

They should also have skills in optimization and maintenance of these systems which will allow them to increase analysis and critical abilities in these domains.

Occupational profiles of graduates with examples:

Holders of the master's degree in Electrical Engineering are prepared to perform in:

- Renowned national public bodies and enterprises engaged in activity sectors such as Energy, mobile communications and telecommunications, industrial production.

- Enterprises needing specialised technicians in areas such as control, automation and robotics; electrical vehicles; monitoring and remote control; power electronics and electrical engines; medical electronics and consumption electronics among others.

Access to further studies:
The master's degree in Electrical Engineering gives access to third-cycle programs in areas of Electrical Engineering and other related areas according to applicable admission regulations.

Course structure diagram with credits

Course Title	Year	Semester	Credits
Digital Control	1	S1	6
Distributed Control Systems	1	S1	6
Intelligent Sensors and Actuators	1	S1	6
Power Electronics	1	S1	6
Power Generation and Storage	1	S1	6
Digital Electronics	1	S2	6
Industrial Management Systems	1	S2	6
Mathematical Modelling and Simulation	1	S2	6
Optimal and Adaptive Control	1	S2	6
Signal Processing and Analysis	1	S2	6
	2	A	54
op: Internship/Training Period	2	A	54
op: Project	2	A	54
Entrepreneurship and Business Strategy	2	A	6

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

Examination regulations, assessment and grading

General
Assessment of course units complies with the Academic Regulations in force at ESTT-IPT, except for the Dissertation, Project and Internship, to which apply the provisions set out in the regulations for the master's degrees offered by the ESTT-IPT.

- Dissertation, Project and Internship have only two assessment seasons and the students are free to choose only one.
- The assessment calendar for the Dissertation, Project and Internship is proposed by the Programme Coordinating Committee to the Technical/Scientific Committee at the beginning of each academic year.
- The general grade improvement scheme does not apply to the Dissertation, Project and Internship.

The overall grade of the master's programme is the arithmetic weighted average rounded off to the ones of the number of ECTS credits and the grades of the course units that form part of the programme of study.
The 10-20 mark expressed on a 0-20 scale is converted into its equivalent in the European grading scale with the awards Satisfactory, Good, Very Good or Excellent.

Specific
The students should develop an original project or undertake professional internship and associated report. Both the project and the internship report must be submitted for appreciation to an examination panel appointed for that purpose.

Graduation requirements:

Completion of this course of studies requires a pass in all its constituent modules, including the public defence of project work or internship report so as to gain a total of 120 accumulated ECTS credits in accordance with general and specific assessment regulations.

Mode of study:
Full- or part-time. Evening program.

Program director or equivalente

Director: Paulo Manuel Machado Coelho
Erasmus coordinator: Jorge Manuel Correia Guilherme
ECTS coordinator: Jorge Manuel Correia Guilherme

B - Description of individual course units

Course unit title	Digital Control
Course unit code	30192
Type of course unit	Compulsory
Level of Course unit	Second Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Paulo Manuel Machado Coelho
Learning outcomes of the course unit	The objectives are to provide knowledge on several digital control systems structures; and to be able to design and analyse digital control designs. Be able to discretize a continuous-time plant to design a digital control system.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	Discrete systems analysis; Z-transform; Discrete systems analysis using Z-transform; Sampling; digital controller design; state-space models; controllability, attainability and observability; state-space design; estimators.
Recommended or required Reading	- Wittenmark, B. e Astrom, K. (1997). *Computer-controlled systems: theory and design*. USA: Prentice-Hall - Ogata, K.(1994). *Discrete-time Control Systems*. USA: Prentice-Hall - Franklin, G. e Workman, M. e Powell, J. (1998). *Digital Control of Dynamic Systems*. USA: Addison-Wesley
Planned learning activities and teaching methods	Lectures incorporating illustrative cases. Theoretical-practical lessons focused on concept application and problem-solving.Practical exercises.
Assessment Methods and criteria	Exam (50%) and practical assignments (50%). The student must obtain a minimum grade of 8 marks (on a scale of 0 to 20) in the exam and a minimum grade of 9.5 marks (on a scale of 0 to 20) in the practical assignments. The average of the two components must be greater than or equal to 9.5 marks (on a scale of 0 to 20).
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Distributed Control Systems
Course unit code	30193
Type of course unit	Compulsory
Level of Course unit	Second Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Manuel Fernando Martins de Barros
Learning outcomes of the course unit	The aim of this unit is to provide the fundamental concepts of distributed control systems (DCS) with special focus to modern devices as well as the architectures, the communication models and protocols, the main industry fieldbus and SCADA systems. Introduction to Realtime Systems & Industrial IOT.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1) Introduction 2) Architecture of Embedded Systems (ES) 3) Distributed Control Systems (DCS) and SCADA Systems for Industrial Environments 4) Networks and Communication Models for DCS & SCADA Systems & FieldBus 5) Wireless Sensor Networks (WSN) and Internet of Thing (IoT) for industrial environments. 6) Real-time systems (STR)
Recommended or required Reading	- Technologies, I.(2004). *Practical Distributed Control Systems (DCS) for Engineers and Technicians*. (Vol. 1). (pp. 1-623). www.idc-online.com: IDC Technologies - Mahalik, N.(2003). *Fieldbus Technology, Industrial network Standards for realtime distributed control*. (Vol. 1). Springer online: Springer - Margolis, M.(2011). *Arduino Cookbook*. (Vol. 1). OReilly Media online: OReilly Media - Barros, M.(0). *Sebenta e Slides de - Sistemas Distribuídos de Controlo (in PT)*.Acedido em24 de setembro de 2015 em http://www.e-learning.ipt.pt/course/view.php?id=1020
Planned learning activities and teaching methods	Lectures, Problem solving classes and Laboratory classes;
Assessment Methods and criteria	Lab work (40%); Final project Demo(30%); Final project report (30%)
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Intelligent Sensors and Actuators
Course unit code	30194
Type of course unit	Compulsory
Level of Course unit	Second Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Jorge Manuel Correia Guilherme Carlos Alberto Farinha Ferreira
Learning outcomes of the course unit	Get familiar with the different types and technologies of intelligent sensors and actuators available in the market as well as its modes of operation and uses; Be able to select, apply and maintain intelligent sensors and actuators and to incorporate sensors into distributed systems.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	General characteristics of sensors: potentiometric, extensometric, photoresistive, thermoresistive, magnetoresistive, capacitive, inductive (LVDT and RVDT), hall-effect sensors; thermocouples and pyrometers; auto-resonant sensors; CCD and ultrasonic sensors; linear and angular encoders; optical fibre and optical sensors; microsensors and multisensors; micro and nanoelectronics.
Recommended or required Reading	- Wilson, J.(2005). *Sensor Technology Handbook*. (Vol. 1). US: Elsevier Inc - Bouwens, A.(1996). *Digital Instrumentation*. (Vol. 1). US: McGraw-Hill - Morris, A.(1993). *Principles of Measurement and Instrumentation*. (Vol. 1). US: Prentice Hall - Bell, D.(1994). *Electronic Instrumentation and Measurements*. (Vol. 1). US: Prentice Hall
Planned learning activities and teaching methods	Lectures supported by illustrative cases. Theoretical-practical classes focused on concept application and problem-solving.
Assessment Methods and criteria	Practical assignments and presentations throughout the semester. In the practical classes students make a project for an application involving sensors and actuators with a final grade weight of 60%. In the theoretical lectures students make 4 presentations about sensors and actuators with a final grade weight of 40%. Final grade = 60% Practical + 40% Theoretical
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Power Electronics
Course unit code	30191
Type of course unit	Compulsory
Level of Course unit	Second Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Francisco José Alexandre Nunes Raul Manuel Domingos Monteiro
Learning outcomes of the course unit	Provide students with solid fundations of power electronic circuits, its control, and the components used; ability to design and assembly, using simulation, build and study a power electronic converter with control.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	Introduction. Power semiconductor devices. Switch-mode power converters. Reference to resonant converters. Rectifiers with sinusoidal input current (power factor corrected). Voltage mode control and current mode control. Drives for power semiconductor devices. Fundamentals of Electromagnetic Compatibility. Magnetic components project.
Recommended or required Reading	- Mohan, N. e Undeland, T. e Robbins, W. (2002). *Power Electronics: Converters, Applications and Design*. Wiley: John Wiley & Sons - Maksimov, D. e Erickson, R. (2012). *Fundamentals of Power Electronics*. Springer: Springer - Monteiro, R.(0). *Sebenta de Eletrónica de Energia (circuitos de potência)*.Acedido em12 de setembro de 2015 em http://www.e-learning.ipt.pt/mod/resource/view.php?id=48271 - Nunes, F.(0). *Diapositivos de Eletrónica de Energia (controlo)*.Acedido em12 de setembro de 2015 em http://www.e-learning.ipt.pt/mod/resource/view.php?id=54332
Planned learning activities and teaching methods	Lectures and practical sessions focused on problem solving, demonstrations and laboratory experiments. Individual tutorial guidance.
Assessment Methods and criteria	Design, simulation, construction and implementation of control in a power electronic converter; detailed written report and oral discussion of the Project. Minimum pass grade: 9.5/20.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Power Generation and Storage
Course unit code	30195
Type of course unit	Compulsory
Level of Course unit	Second Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Mário Helder Rodrigues Gomes José Filipe Correia Fernandes
Learning outcomes of the course unit	Students will learn about the generation of power through renewable sources, especially: mini-hydro, photovoltaic and wind systems as well as power storage systems.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	PV systems: characteristics, operation, assembly, sizing calculations, design and operation. Wind Energy: conversion limits, performance, power regulation, conversion systems and their characteristics. Wind farms, sizing and production control of active and reactive power. Energy storage systems: batteries, supercapacitors, flywheels, pumping, etc.
Recommended or required Reading	- Ter-Gazarian, A.(1994). *Energy Storage for Power Systems*. .: Peter Peregrinus - Castro, R.(2011). *Uma Introdução às Energias Renováveis: Eólica, Fotovoltaica e mini-hídrica*. Lisboa: IST Press - Europeia, C.(0). *Manual de Análise de Custos e Benefícios dos Projectos de Investimento*.Acedido em22 de setembro de 2017 em ec.europa.eu/regional_policy/sources/docgener/guides/.../guide02_pt.pdf - Fernandes, J. e Gomes, M. (0). *Material de apoio fornecido pelos docentes*.Acedido em25 de setembro de 2019 em http://www.e-learning.ipt.pt
Planned learning activities and teaching methods	Lectures supported by class debates. Practical sessions focused on problem solving and laboratory demonstrations.
Assessment Methods and criteria	Written test: theoretical (40%) Practical (60%).
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Digital Electronics
Course unit code	30196
Type of course unit	Compulsory
Level of Course unit	Second Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Jorge Manuel Correia Guilherme Pedro Daniel Frazão Correia
Learning outcomes of the course unit	Students will familiarise themselves with the technologies used in the manufacturing of integrated circuits; design methodologies and tools used in microelectronics, hardware technical jargon and design of integrated circuits using CMOS technology.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	An introduction to integrated circuits; technology concepts; digital CMOS circuits; Programmable devices; Digital CMOS systems; Introduction to the design of digital systems using programmable logic devices; an introduction to VERILOG and VHDL technical jargon.
Recommended or required Reading	- Silva, M.(1999). *Circuitos com Transístores Bipolares e MOS*. (Vol. 1). Lisboa: Gulbenkian - Baker, J.(2005). *CMOS Circuit Design, Layout and Simulation*. (Vol. 1). US: IEEE Press - Razavi, B.(2001). *Design of Analog CMOS Integrated Circuits*. (Vol. 1). US: McGraw-Hill - Martin, K.(2000). *Digital Integrated Circuit Design*. (Vol. 1). US: Oxford University Press
Planned learning activities and teaching methods	Lectures supported by illustrative cases. Theoretical-practical classes focused on concept application and problem-solving.
Assessment Methods and criteria	Practical project on FPGA board: Theoretical VLSI project from verilog to layout and extraction. Practical note 60% and theoretical note 40% of total.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Industrial Management Systems
Course unit code	301910
Type of course unit	Compulsory
Level of Course unit	Second Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Henrique Joaquim de Oliveira Pinho Pedro Manuel Granchinho de Matos
Learning outcomes of the course unit	Students will be able to associate the production function with other functional areas of an enterprise, apply models, techniques and fundamental methods developed in the production management context, implement SPC systems and use production management computer tools.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1. The evolution of production systems and the production function. 2. Competitiveness factors. 3. Methods engineering and process design. 4. Quality Management. 5. Forecasting 6. Aggregate Planning 7. Inventory Control 8. Material Requirements Planning - MRP 9. Operations Programming 10. Simulation
Recommended or required Reading	- Rold, V. e Ribeiro, J. (2014). *Gestão das Operações - Uma Abordagem Integrada*. Lisboa: Monitor - Martin-Bonnefous, C. e Pillet, M. e Courtois, A. (2007). *Gestão da Produção*. Lisboa: Lidel - Winston, W.(2003). *Operations Research - Applications and Algorithms*. USA: Duxbury Press - Chase, R. e Aquilano, N. e Jacobs, F. (2006). *Operations Management for Competitive Advantage*.. Irwin: McGraw-Hill
Planned learning activities and teaching methods	Lectures and theoretical-practical classes focused on the analysis and solving of practical cases with the aid of microsoft excel tools.
Assessment Methods and criteria	Written test with two parts: theorical and theoretical-practical. Each component is worth 50% of the overall mark. The final grade is the average mark of two parts. Minimum pass mark: 10/20.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mathematical Modelling and Simulation
Course unit code	30198
Type of course unit	Compulsory
Level of Course unit	Second Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Cristina Maria Mendes Andrade
Learning outcomes of the course unit	The students will acquire knowledge about mathematical models, calculation techniques and methods: -analysis of a real situation, its interpretation and simplification -design and mathematical modelling of real models -analysis, interpretation and evaluation through simulation.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1. Mathematical Modelation Principles 2. Introduction to Matlab Programming 3. Numerical Methods Topics 4. Simulation: Case studies
Recommended or required Reading	- Han, W. e Atkinson, K. (2003). *Elementary numerical analysis*. USA: John Wiley - Faires, J. e Burden, R. (2011). *Numerical analysis.*. Boston, USA: Brooks/Cole, Cengage Learning - Heath, M.(2002). *Scientific Computing: an Introductory survey*. New York, USA: McGraw-Hill - Heinz, S.(2011). *Mathematical modelling*. New York, USA: Springer
Planned learning activities and teaching methods	Theoretical-practical lessons focused on the use of Matlab and supported by interactive class debates.
Assessment Methods and criteria	Assessment: - 1 mandatory group project (75%) - 1 individual work (25%) oral defense of both works (mandatory)
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Optimal and Adaptive Control
Course unit code	30197
Type of course unit	Compulsory
Level of Course unit	Second Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Paulo Manuel Machado Coelho Ana Cristina Barata Pires Lopes
Learning outcomes of the course unit	General knowledge of control, including most common techniques and methods in MIMO control (multivariable) and state-space approaches; analysis and design skills through practical applications of the different techniques such as state estimate using Kalman Filter; design optimal and adaptive systems
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	State estimate; Kalman filter; optimal control; optimal estimate; adaptive control systems; optimising control systems; parameter estimate; system identification techniques.
Recommended or required Reading	- Ogata, K.(1994). *Discrete-time Control Systems*. USA: Prentice-Hall - Workman, M. e Powell, D. e Franklin, G. (1998). *Digital Control of Dynamic Systems*. USA: Addison-Wesley - Wittenmark, H. e Astrom, K. (1997). *Computer-controlled systems: theory and design*. USA: Prentice-Hall
Planned learning activities and teaching methods	Lectures supported by illustrative cases. Theoretical-practical lessons focused on concept application and problem-solving. Practical works proposed to the students.
Assessment Methods and criteria	Exam (50%) and practical assignments (50%). The student must obtain a minimum grade of 8 marks (on a scale of 0 to 20) in the exam and a minimum grade of 9.5 marks (on a scale of 0 to 20) in the practical assignments. The average of the two components must be greater than or equal to 9.5 marks (on a scale of 0 to 20).
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Signal Processing and Analysis
Course unit code	30199
Type of course unit	Compulsory
Level of Course unit	Second Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Manuel Fernando Martins de Barros Gabriel Pereira Pires
Learning outcomes of the course unit	The main objective of this course is to provide students with the concepts and fundamental techniques of processing and analysis of digital signals (DSP). In the end, students should be able to simulate, design and implement DSP system. The main focus will be the implementation of digital filters.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1- Introduction 2- Discrete signals and systems 3- Sampling of continuous and discrete signals 4- Discrete Fourier transform and spectral estimation methods 5- Digital Filters 6- Design and implementation of FIR and IIR filters 7- Introduction to the digital signal microprocessors.
Recommended or required Reading	- Smith, S.*The Scientist & Engineer's Guide to Digital Signal Processing*. USA: California: Technical Publishing - online - Lathi, B.(2000). *Signal Processing and Linear Systems*. USA: Oxford University Press
Planned learning activities and teaching methods	Lectures, Problem solving and laboratory sessions.
Assessment Methods and criteria	Written exam (40%), homework (10%), research work (10%), lab projects (40%).
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Internship/Training Period
Course unit code	301914
Type of course unit	Optional
Level of Course unit	Second Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Anual
Number of ECTS credits allocated	54
Name of Lecturer(s)	
Learning outcomes of the course unit	Be able to apply the knowledge, skills and tools acquired during the programme in the professional environment.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	Carry out an internship in an organisation or company in an area that falls within the scope of the master's degree.
Recommended or required Reading	
Planned learning activities and teaching methods	Work supervised by an academic.
Assessment Methods and criteria	Assessment of training work. The internship report is subject to public discussion and consideration. For this purpose the ESTT's Master's degree regulations shall apply.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Project
Course unit code	301913
Type of course unit	Optional
Level of Course unit	Second Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Anual
Number of ECTS credits allocated	54
Name of Lecturer(s)	
Learning outcomes of the course unit	The students will be able to apply the knowledge, tools and skills acquired during the degree to develop an applied research project.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	Develop a practical project in an area that falls within the scope of the master's degree.
Recommended or required Reading	
Planned learning activities and teaching methods	Work supervised by an academic.
Assessment Methods and criteria	Assessment of project work. The Project assignment is subject to public discussion and consideration. For this purpose the ESTT's Master's degree regulations shall apply.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Entrepreneurship and Business Strategy
Course unit code	301911
Type of course unit	Compulsory
Level of Course unit	Second Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Anual
Number of ECTS credits allocated	6
Name of Lecturer(s)	José Manuel Barros Pinheiro Nogueira
Learning outcomes of the course unit	Students are expected to develop strategic management skills, understand the role of entrepreneurship as a value generation process, be aware of the importance of innovation within organisations and be able to draw up, analyse and implement projects.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1. Strategic management 2. Entrepreneurship and business creation 3. Financial plans 4. Creating a business plan.
Recommended or required Reading	- Neves, C.(2007). *Análise financeira: técnicas fundamentais*. Lisboa: Texto Editores - Mariotti, S.(2007). *Entrepreneurship - Starting and operating a small business*. New Jersey: Pearson Prentice Hall - Kaplan, .. e Norton, R. (2006). *Balanced Scorecard: Translating Strategy into Action*. Boston: Harvard Business School Press - Freire, A.(2008). *Estratégia - Sucesso em Portugal*. Lisboa: Editorial Verbo
Planned learning activities and teaching methods	Theoretical and practical lessons focused on practical cases.
Assessment Methods and criteria	Presentation of a real enterprise (20%) Project consisting of a business plan for a company (40% of overall grade). Discussion (40% of overall grade).
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.