

## **EMJMD - STEPS**

### **Sustainable Transportation and Electrical Power Systems**

The EMJMD STEPS is promoted by a partnership led by the University of Oviedo (ES), together with the University of Nottingham (UK), the University of Rome (IT) and the Polytechnic Institute of Coimbra (PT).

The Erasmus Mundus Joint Master Degree in Sustainable Transportation (Rome-IT) and Electrical Power Systems (Coimbra-PT) will provide advanced education to prepare highly qualified electrical and electronic engineers in two areas of the highest technological content and professional requirements in the energy sector: Electrical Transportation and Power Systems, with a strong focus on energy efficiency and on sustainability issues. The two proposed minors in the Electrical Power Systems strand will allow for accommodating the large academic demand on that sector, one of the minors is oriented towards power electronics and their use in power systems applications while the other strand is focused in design analysis and operation of power systems. The first one is more focused in the technologies while the second one provides a vision of the power systems as a whole. There is also a Sustainable transportation minor in focused in power electronics and energy management in electric vehicles and other mobility applications.

At ISEC, the course is focused on Electrical Power Systems. Subjects are focused in the needed background on generation and distribution but also with subjects leading to the integration of power electronics in power systems, including digital implementation and communications competences later needed for the development of FACTS, HVDC, microgrids and smartgrids technologies.

This Course is offer at ISEC just in English Language.

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## Erasmus Mundus Joint Master Degree

### Sustainable Transportation and Electrical Power Systems (EMJMD - STEPS)

Code	Title	ECTS	Term
<b>1<sup>st</sup> Year</b>			
61000203	Electric Power Systems Control and Operation	3	Fall
60013112	Digital Control	3	Fall
60013065	Distribution Systems	6	Fall
60013123	DSP and Communications	3	Fall
60013076	Electrical Machines	6	Fall
60013155	Introduction to Programming	1	Fall
60013041	Microcontrollers	3	Fall
61000185	Power Electronics	6	Fall
60013101	Power Plants	6	Fall
61000196	Electric Power Systems	6	Fall
<b>2<sup>nd</sup> Year</b>			
61000214	Master Thesis Project	30	Spring

## Master syllabus

### POWER ELECTRONICS

In this course, the student should be able to identify different power converter topologies and to understand and apply the specific and particular design and control techniques involved in the operation of power converters.

### ELECTRIC POWER SYSTEMS CONTROL AND OPERATION

The contents of this course include the basics for the dynamic modelling and control of industrial motor-driven electromechanical systems. Control algorithms are explained in order to allow students to make digital implementation. Motor efficiency maximization centered control methods are discussed in the scope of industrial applications. The control of electrical generators is briefly discussed.

#### DIGITAL CONTROL

The contents of this course include an introduction to control system design. Implementation of digital control algorithms using different approach to control a integrated System.

#### POWER SYSTEMS

The contents of this course include the modelling of the major types of components used in electrical power systems, the analysis of fault conditions including both balanced and unbalanced faults, the evaluation of the electric power systems dynamics and its stability, the study of the power network security and the main protection systems.

#### POWER PLANTS

In this subject the main types of power stations used to generate electrical energy are explained, considering the basic components and its main operation principles. The main aims of this course unit include the concepts of electric energy generation; developing of analytical skills needed for economic analysis of electric energy generation projects and understanding the modern energy paradigm.

#### DISTRIBUTION SYSTEMS

This course provides students with an understanding of the technologies used in electrical distribution systems. The students will be able to recognize the problems which may occur during the operation of distribution systems and propose solutions to correct those problems in order to improved electricity service with better continuity and quality of supply.

#### ELECTRICAL MACHINES

The content of this course includes the study of the most used of electrical machines, focusing on power transformers, industrial motors and generators used in conventional and emerging power plants.

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## DSP AND COMMUNICATIONS

In this course, the fundamental concepts and mathematical tools for signal processing and digital signal processing are introduced. Building on this fundamental concepts and tools, simple specific communications applications are presented, demonstrating the full relevance of these topics for the development and implementation of communication technologies.

## MICROCONTROLLERS

This module covers the design, development and maintenance of microcontroller based systems. It includes: (a) Understanding the operation of a microprocessor and a microcontroller; (b) Using design and development tools for creating control applications based on the i8051 and Texas Instruments F28X microcontrollers.