Course guide
205109 - 205109 - Information Technologies & Data Analysis

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Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: MASTER'S DEGREE IN TECHNOLOGY AND ENGINEERING MANAGEMENT (Syllabus 2016). (Optional subject).

Academic year: 2024 **ECTS Credits:** 7.5 **Languages:** English

LECTURER

Coordinating lecturer: Ramon Pérez Magraé

Others: Bernardo Morcego Seix

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE02-MEM. The ability to analyse data for pattern recognition.
CE03-MEM. The ability to optimise problems and systems using mathematical models and make decisions in conditions of uncertainty.
CE07-MEM. The ability to manage processes and projects in technological settings subject to levels of uncertainty.
CE09-MEM. The ability to include aspects of internationalisation in decision making.

Transversal:
CT1a. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding how companies are organised and the principles that govern their activity, and being able to understand employment regulations and the relationships between planning, industrial and commercial strategies, quality and profit.

CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

TEACHING METHODOLOGY

Lecture: Lecturers present concepts, principles and techniques, with the active participation of students.
Problem Based Learning: Lecturers and students resolve exercises and standard problems through specific techniques related to the theoretical contents and principles of the course.
Project Based learning: Students resolve complex problems through specific techniques related to the theoretical contents and principles of the course.
Self-study: Students diagnose their learning needs, in collaboration with the lecturers, and plan their own learning process.

LEARNING OBJECTIVES OF THE SUBJECT

The Information Technologies & Data Analysis course introduces the students into the concepts, principles and technologies associated with the Information and Communication Technologies to manage corporative data and the Data Analytics techniques to analyze sets of Big Data. The course is planned to follow the natural flow of data beginning with the data source, data modelling, information system design and management, data retrieval, big data analysis and decision support techniques with predictive models.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	30,0	16.00
Hours large group	30,0	16.00
Self study	127,5	68.00

Total learning time: 187.5 h

CONTENTS

Module 1: Information Systems and Databases

Description:
This module focuses on the main concepts of an information system and its organization, storage and retrieval in a database. Nowadays the role of data analytics is taking more importance in an organization, that means than an engineering manager will take decisions based on data analysis. Which sets of data are important in an organization, how are this sets modelled and which is the best way to store and retrieve the needed information are key concepts to perform in big data analytics. This module will focus on the information system, provide knowledge of data access languages and technologies, and most important database management system selection and database design.

The main objectives are outlined in the next list:
- Information Systems theory and concepts
- Data modelling
- SQL language and relational databases
- NoSQL databases and Big Data

A set of problems, presented as exercises, will guide in the design of an information system to end in a running environment that will be used in the Big Data module

Related activities:
Distance and in-class activities
Group project (First part)
Final exam

Full-or-part-time: 87h 30m
Theory classes: 10h
Practical classes: 10h
Self study : 67h 30m

Module 2: Big Data

Description:
The goal of this module is to obtain the knowledge from the information available in the great amount of data available both within the company and coming from the environment. The first step is to validate the data and prepare them for the analysis. These data are used for the training of predictive models that will give the insight necessary to take decisions based on the information nowadays available. Finally, data and predictions are presented in a dashboard that monitor industrial processes and companies.

The outline of this module is:
- Introduction to Data Mining
- Validation and reconstruction of data
- Predictive Models (linear and Logistic regression, CART)
- Dashboard elaboration

Problems and project will be developed using R that will connect with the data bases studied in module 1.

Related activities:
Distance and in-class activities
Group project (Second part)
Final exam

Full-or-part-time: 60h
Theory classes: 10h
Practical classes: 10h
Self study : 40h

GRADING SYSTEM

The final grade depends on the following three elements:

* 30%, Distance and in-class activities
* 40%, Group project (report and dissertation)
* 30%, Final exam

BIBLIOGRAPHY

Basic:
- Van der Heijden, Hans. Designing management information systems. New York: Oxford University Press, 2009. ISBN 9780199546336.
- Baumer, Benjamin; Kaplan, Daniel T.; Horton, Nicholas J. Modern data science with R. Boca Raton: Taylor & Francis CRC Press, 2017. ISBN 9781498724487.