Course guide
220600 - 220600 - Optimization and Simulation

Last modified: 11/04/2025

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: MASTER'S DEGREE IN AUTOMATIC SYSTEMS AND INDUSTRIAL ELECTRONICS (Syllabus 2012). (Compulsory subject).

Academic year: 2025 **ECTS Credits:** 5.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: JAUME FIGUERAS JOVE

Others: JORDI ZARAGOZA BERTOMEU - ANTONI ARIAS PUJOL - ANTONI GUASCH PETIT

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Learn the concepts involved in decision taking quantitative and experimental methods.
4. Research, design, development and implementation of simulation methods for electronics, control and robotics systems.

Transversal:
6. ENTREPRENEURSHIP AND INNOVATION: Knowing about and understanding how businesses are run and the sciences that govern their activity. Having the ability to understand labor laws and how planning, industrial and marketing strategies, quality and profits relate to each other.
7. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
8. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.

Basic:
5. Improve technical communication of results.

TEACHING METHODOLOGY

In the theory sessions, the teacher will introduce the theoretical basis of the concepts motivating all its content and linking up with the themes of the earlier and later subjects.
The development of the different concepts and their should be made clearly and concisely all illustrated with examples to facilitate understanding.
Students will work and adapt examples of theory in order to cope with applications of simulation performed in the laboratory.

In the laboratory, must ensure that students review the concepts covered in the theory sessions. In depth analysis and critical thinking to problems and consistent results will be assured. Also demonstrative sessions with real applications will be carried on.

LEARNING OBJECTIVES OF THE SUBJECT

The course is divided into two parts.

In the first part we will study the discrete event oriented systems. At the end of the course students should have learnt to model, simulate and optimize such systems that are fundamental to the analysis and improvement of processes, logistics and transport.

These processes are modeled using Petri Nets, the use of statistical analysis tools and models for implementing a discrete event simulator. The student will use a industrial simulator for analysis and optimum decision making on resources of the systems studied.

In the second part, the student to pass the course, must know how to analyze, design and simulate control for applications where the actuators are electric machines.

It aims to give special emphasis to the conversion efficiency and therefore optimum mechanical energy to electricity (generators) and electrical mechanics (engines), pointing to the cutting-edge applications such as renewable energy (wind power) and electric vehicles (motors).

STUDY LOAD

Type	Hours	Percentage
Hours large group	31,0	24.80
Self study	80,0	64.00
Hours small group	14,0	11.20

Total learning time: 125 h

CONTENTS

(ENG) Modelat de sistemes orientats a esdeveniments discrets

Description:
Descripció de la part de Teoria

Els continguts d'aquest mòdul pretenen formar a l'estudiant en la metodologia de modelat de sistemes d'esdeveniments discrets amb l'objectiu de disposar d'una eina de representació independent del paquet de simulació per ordinador amb la que es pugui treballar, facilitant el diàleg entre les diferents parts que integren un estudi de simulació. Es mostraran els conceptes:

Formalització de models conceptuals
Xarxes de Petri
Xarxes de Petri Acolorides

Descripció de la part de Laboratori

Model de Simulació d'un sistema Job-Shop

Full-or-part-time: 21h
Theory classes: 6h
Laboratory classes: 3h
Self study : 12h

(ENG) Models estadístics en simulació

Full-or-part-time: 14h
Theory classes: 4h
Laboratory classes: 2h
Self study : 8h

(ENG) Disseny d'experiments i anàlisi de resultats

Description:
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Full-or-part-time: 27h 30m
Theory classes: 5h 30m
Laboratory classes: 2h
Self study : 20h

(ENG) EINES PEL MODELAT I SIMULACIÓ DE MÀQUINES ELÈCTRIQUES

Full-or-part-time: 12h
Theory classes: 2h
Laboratory classes: 2h
Self study : 8h

(ENG) APLICACIONS DE CONTROL AMB MÀQUINES ELÈCTRIQUES

Full-or-part-time: 30h
Theory classes: 8h
Laboratory classes: 2h
Self study : 20h

(ENG) ENERGIA EÒLICA

Description:
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Full-or-part-time: 20h 30m
Theory classes: 5h 30m
Laboratory classes: 3h
Self study : 12h

GRADING SYSTEM

By performing two exams and lab sessions.
Exam of Part 1 (Activity 2): 33%
Laboratory ED (Activity 3): 17%
Exam of Part 2 (Activity 4): 33%
Laboratory SOCE (Activity 5): 17%

The unsatisfactory results of the 1st Partial can be redone through a written test to be done on the day set for the final exam. This test can be accessed by all enrolled students. The mark obtained by the application of the conversion will replace the initial qualification as long as it is superior.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.
If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

EXAMINATION RULES.

No unusual normative in exams

BIBLIOGRAPHY

Basic:
- Kazmierkowski, M. P.; Krishnan, R.; Blaabjerg, F. Control in power electronics: selected problems [on line]. Amsterdam: Academic Press, 2002 [Consultation: 15/06/2022]. Available on: https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780124027725/control-in-power-electronics. ISBN 0124027725.
- Dorf, R.C.; Bishop R.H. Modern control systems. 12th ed. Boston: Pearson, 2011. ISBN 978-0-13-138310-4.
- Guasch, A. ... [et al.]. Modelado y simulación: aplicación a procesos logísticos de fabricación y servicios [on line]. 2ª ed. Barcelona: Edicions UPC, 2003 [Consultation: 23/06/2020]. Available on: http://hdl.handle.net/2099.3/36767. ISBN 8483017040.
- Law, Averill M. Simulation modeling and analysis. 4th ed. Boston: McGraw-Hill, 2007. ISBN 9780071255196.
- Banks J. ... [et al.]. Discrete-event system simulation. 5th ed. Upper Saddle River: Prentice Hall, 2010. ISBN 9780138150372.

Complementary:
- Ogata, Katsuhiko. Modern control engineering. 5th ed. Boston: Pearson, 2010. ISBN 9780137133376.
- Vas, P. Sensorless vector and direct torque control. Oxford: Oxford University Press, 1998. ISBN 0198564651.
- Blaabjerg, F.; Chen, Z. Power electronics for modern wind turbines. [S.l.]: Morgan & Claypool, 2006. ISBN 1598290320.
- Scheaffer, R.L.; McClave, J.T. Probability and statistics for engineers. 4th ed. Belmont: Duxbury Press, 1995. ISBN 0534209645.
- Barceló, J. Simulación de sistemas discretos. Madrid: Isdefe, 1996. ISBN 8489338124.