

Course guide

330111 - AA - Advanced Automation

Last modified: 04/05/2023

Unit in charge:	Manresa School of Engineering	
Teaching unit:	750 - EMIT - Department of Mining, Industrial and ICT Engineering.	
Degree:	BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject). BACHELOR'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Optional subject).	
Academic year: 2023	ECTS Credits: 6.0	Languages: Catalan

LECTURER

Coordinating lecturer: TERESA ESCOBET CANAL

Others: SERGI GRAU TORRENT

REQUIREMENTS

Students are expected to have passed "Control industrial y Automatización" and "Regulación Automática"

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

- 2. Ability to design control and automation systems.
- 6. Ability to design and implement web user interfaces through HTML, CSS and JS languages.
- CE21. Knowledge of automatic regulation, control techniques and its application to industrial automation.
- 1. Knowledge of discrete event-oriented systems.

Transversal:

- 3. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.
- 4. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

In face-to-face lecture sessions, teachers will introduce the theoretical basis of the concepts.

In face-to-face practical work sessions, teachers guide students in applying theoretical concepts to solve problems, always using critical reasoning

Some autonomous activities outside the classrooms are proposed.

Students can access all the support material via ATENEA.

Methods and results and illustrate them with examples appropriate to facilitate their understanding.

LEARNING OBJECTIVES OF THE SUBJECT

The learning objectives are:

- Understanding and handling correctly the theoretical and technological disciplines involved in the design, construction and use of automatic systems.
- Training students for designing and programming industrial automation systems.
- Providing students with the skills and the needed knowledge to use supervision systems.
- Training students in safety automation systems

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	20.00
Self study	90,0	60.00
Hours small group	30,0	20.00

Total learning time: 150 h

CONTENTS

1. Introduction to automation control systems

Description:

The main aim of this chapter is to provide a brief overview of the evolution of industrial control system.

- Introduction
- Control systems evolution
- Structure of industrial automation system

Full-or-part-time: 4h

Theory classes: 2h

Self study : 2h

2. Discrete event systems and PLC

Description:

The aim of this chapter is to introduce the industrial automation control, describing the machine logic control, systems, hardware, and associated software.

- Modelling discrete-event systems with GRAFCET and implementation in PLCs
- GEMMA guide as general methodology for the design of automated systems.
- Characteristics of an industrial programmable logic controller (PLC)

Related activities:

Laboratory practice

Examinations

Full-or-part-time: 58h

Theory classes: 11h

Laboratory classes: 13h

Self study : 34h

3. Industrial Applications of PID Controllers

Description:

The chapter explores PID challenges and solutions including practical and ultimate limits to PID performance, then explores the advanced classical methods and techniques that are popular in the current industrial practice.

- PID control
- PID modifications
- Industrial PIDs
- Tuning a PID controller
- Advanced control structures

Related activities:

Laboratory practice
Examinations

Full-or-part-time: 25h

Theory classes: 5h

Laboratory classes: 5h

Self study : 15h

4. Supervision

Description:

This chapter deals with the implementation of one monitoring system:

- Introduction to monitoring systems
- SCADA Monitoring Software and human machine interface (HMI)

Related activities:

Laboratory practice
Examinations

Full-or-part-time: 32h

Theory classes: 6h

Laboratory classes: 6h

Self study : 20h

5. Safety in Automation

Description:

The main objectives are:

- Introduction
- Machinery directive
- Risk assessment and risk reduction methodologies
- Maintenance in industrial automation

Related activities:

Laboratory practice
Examinations

Full-or-part-time: 32h

Theory classes: 6h

Laboratory classes: 6h

Self study : 20h

ACTIVITIES

1. Laboratory classes

Description:

Practical classes are oriented to problem solving.
Practical application will be made in the Industrial Automation Laboratory.

Specific objectives:

Those corresponding to the contents of the subject.

Material:

Statements delivered by the teacher.

Delivery:

A preliminary study must be submitted in the pre- application phase.
The experimentation and achievement of the objectives achieved in each of the planned activities will be evaluated.

Full-or-part-time: 60h

Laboratory classes: 30h

Self study: 30h

2. EVALUATION

Description:

An individual control test will be performed during the course. At the end of the course there will be a final test globalizing the acquired knowledge.

Specific objectives:

Evaluate the achieved goals

Material:

Test statements.
Problems collection.

Delivery:

CON: mark of control test .
FIN: mark of final test

Full-or-part-time: 26h

Theory classes: 6h

Self study: 20h

3. PRACTICAL TEST

Description:

At the end of the course there will be an individual practical test in which one of the solved problems must be presented.

Specific objectives:

Evaluate the achievement of the objectives of the subject.

Material:

Statement of the test.

Documentation of the resolved issue.

Delivery:

The control test score sets the PRAC variable.

Full-or-part-time: 13h

Theory classes: 3h

Self study: 10h

GRADING SYSTEM

The final grade of the course will be obtained as follows:

$$\text{Final grade} = 0.25 * \text{CON} + 0.30 * \text{LAB} + 0.10 * \text{PRAC} + 0.35 * \text{FIN}$$

CON: mid-term exam, FIN: final exam, LAB: laboratory, PRAC: other deliveries

EXAMINATION RULES.

All activities are mandatory.

If one of the activities of the subject is not carried out, it will be considered qualified with zero.

Carrying out laboratory activities is a necessary condition to pass the subject.

The dates, formats and other delivery conditions that are established will be mandatory.

BIBLIOGRAPHY

Basic:

- Sanchis, Robert; Ariel Romero, Julio; Vicente Ariño, Carlos. Automatización industrial [on line]. Castelló de la Plana: Publicacions de la Universitat Jaume I, 2010 [Consultation: 06/11/2020]. Available on: <http://hdl.handle.net/10234/24182>. ISBN 9788469309940.

- Piedrafita Moreno, Ramón. Ingeniería de la automatización industrial. 2a ed. Paracuellos de Jarama: Ra-Ma, 2004. ISBN 8478976043.

RESOURCES

Other resources:

Manual for Programmable Logic Controllers
safety machinery standards