Course guide
320040 - FARI - Automated Manufacture and Industrial Robotics

Last modified: 19/04/2023

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

Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: RITA MARIA PLANAS DANGLA

Others: MARC FLOR SÀNCHEZ
MANUEL MEIXIDE VÁZQUEZ
RITA MARIA PLANAS DANGLA
LAUREANO TINOCO GOMEZ

PRIOR SKILLS

Students will be expected to have passed the following subjects: Electronic Systems. Electrical Systems. Mechanical Systems. Programming. Industrial automation.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
5. ELO: Ability to design and control automation systems.

6. ELO: Understanding of the principles and applications of robotic systems.

Transversal:
1. 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.
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
3. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
4. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

TEACHING METHODOLOGY

Face-to-face lecture sessions.
- Face-to-face practical work sessions.
- Independent learning and exercises.
- Preparation and completion of group activities subject to assessment.

In the face-to-face lecture sessions, the lecturer will introduce the basic theory, concepts, methods and results for the subject and use examples to facilitate students' understanding.

Students will be expected to study in their own time so that they are familiar with concepts and are able to solve the exercises set.

LEARNING OBJECTIVES OF THE SUBJECT

Specific learning objectives
· Mastery of the basics of automated production and manufacturing systems.
· Applied knowledge of automated production and manufacturing systems.
· Mastery of the principles and applications of robotic systems.
· The ability to design and automate machines, processes and systems.
· The ability to analyse and solve problems in the field of automated manufacturing.
· The ability to select elements for a robotic process.
· Design and programme automated industrial processes
· The ability to analyse and solve problems within a distributed environment for automated manufacturing that involves industrial communication and process monitoring.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

Automated manufacturing

TOPIC 1: VERTICAL COMMUNICATIONS: LEVELS 1, 2 AND 3 OF THE CIM PYRAMID

Description:
1.1. Fundamental concepts of automated manufacturing systems.
1.2. The CIM pyramid.

Specific objectives:
Familiarity with automated manufacturing systems featuring industrial communications and information flows.
Mastery of the communication and information elements that make up an automated manufacturing process.

Full-or-part-time: 6h
Theory classes: 2h
Self study : 4h

TOPIC 2: MONITORING SYSTEM ARCHITECTURE

Description:
2.1. Logical redundancy.
2.2. Functional redundancy.

Specific objectives:
The ability to select and connect monitoring systems.
The ability to analyse and solve monitoring problems in automated manufacturing systems.

Related activities:
Configuration and development of systems for monitoring automated manufacturing processes.

Full-or-part-time: 32h
Theory classes: 4h
Laboratory classes: 10h
Self study : 18h

TOPIC 3: DATA LOGGING AND STORAGE SYSTEMS

Description:
3.1. Concept of data logger.
3.2. Data logging methods.
3.3. Data storage design.
3.4. Compression and distribution of data.

Specific objectives:
The ability to select and connect data-logging systems in an automated process.
The ability to analyse and solve problems in data-logging systems.

Related activities:
Setup and configuration of data-logging systems in an automated manufacturing process.

Full-or-part-time: 22h
Theory classes: 4h
Laboratory classes: 5h
Self study : 13h

TOPIC 4: TRACKING, TRACEABILITY AND GENEALOGY

Description:
4.1. Tracking.
4.2. Traceability.
4.3. Genealogy.

Specific objectives:
Mastery of the basic concepts of production monitoring.
The ability to outline and solve problems in the field of industrial automation and control.

Full-or-part-time: 6h
Theory classes: 2h
Self study : 4h

TOPIC 5: REPORTING

Description:
5.1. Introduction to reporting.
5.2. Reporting systems.
5.3. Automatic reporting systems.

Specific objectives:
Mastery of the basic concepts of reporting.
The ability to analyse and solve problems related to automatic reporting.

Full-or-part-time: 6h
Theory classes: 2h
Self study : 4h

Industrial robotics

TOPIC 7: BASIC CONCEPTS

Description:
1.1. Background and evolution of robotic automation.
1.2. Fields of application.

Specific objectives:
An understanding and command of the basic concepts of automation.

Full-or-part-time: 6h
Theory classes: 2h
Self study : 4h

TOPIC 8: MANIPULATORS AND ROBOTS

Description:
2.1. Manipulators and robots: basic concepts
2.2. Types of robots: basic characteristics.
2.3. Proprioceptive and exteroceptive sensors.
2.4. Actuators.

Specific objectives:
An understanding of the basic principles of robotic systems.
The ability to analyse and select robotic systems for a robotic process.

Full-or-part-time: 12h
Theory classes: 4h
Self study : 8h

TOPIC 9: TERMINAL ELEMENTS

Description:
3.1. Basic characteristics of terminal elements.
3.2. Types of terminal elements.
3.3. Specific design of terminal elements.

Specific objectives:
The ability to select or design and connect the appropriate terminal elements according to the tasks to be carried out.

Full-or-part-time: 6h
Theory classes: 2h
Self study : 4h

TOPIC 10: ROBOT PROGRAMMING

Description:
4.1. Introduction to robot programming.
4.2. Types of programming: teach-in and textual.
4.3. Programming languages.
4.4. Basic and advanced features.

Specific objectives:
Mastery of the basic concepts of robot programming.
The ability to program integrated industrial robots that form part of manufacturing processes.

Related activities:
Programming robots to carry out specific tasks as part of an automated manufacturing system.

Full-or-part-time: 29h
Theory classes: 3h
Laboratory classes: 10h
Self study : 16h

TOPIC 11: TASK ROBOTISATION

Description:
5.1. Introduction to task robotisation.
5.2. Adapting the environment to a robot.
5.3. Adapting a robot to its environment: sensory control.

Specific objectives:
The ability to analyse robotic tasks.
The ability to analyse and solve problems in industrial robotics.

Related activities:
Integration of robots to carry out specific tasks as part of an automated manufacturing system.

Full-or-part-time: 16h
Theory classes: 2h
Laboratory classes: 5h
Self study : 9h

TOPIC 12: SECURITY

Description:
6.1. Protection and safety elements.
6.2. Safety rules in robotic environments.

Specific objectives:
Mastery of safety-related concepts in industrial robotics.
A basic understanding of safety systems and rules in robotic systems.

Full-or-part-time: 4h
Theory classes: 1h
Self study : 3h

TOPIC 13: INDUSTRIAL APPLICATION

Description:
7.1. Presentation of a case study.

Specific objectives:
An understanding of automated manufacturing systems by examining a case study.

Full-or-part-time: 6h
Theory classes: 2h
Self study : 4h

GRADING SYSTEM

- Automation examination: 30%
- Robotics examination: 30%
- Laboratory: 40%

All those students who fail, want to improve their mark or cannot attend the partial exam, they will have the opportunity to be examined the same day of the final exam. If due to the circumstances it is not viable to do it the same day of the final exam, the teacher responsible for the subject will propose, via the platform Atenea, that the mentioned recovery exam will be carried out another day, in class schedule.
The new mark of the recovery exam will substitute the previous one, unless it is lower.

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.

BIBLIOGRAPHY

Basic:
- Fu, K. S. [et al.]. Robótica: control, detección, visión e inteligencia. Madrid: McGraw-Hill, 1988. ISBN 8476152140.
- Angulo Usategui, José María. Introducción a la robótica: principios teóricos, construcción y programación de un robot educativo. Madrid: Thomson, 2005. ISBN 8497323866.
- Piedrafita Moreno, Ramón. Ingeniería de la automatización industrial. Paracuellos de Jarama: Ra-ma, 2004. ISBN 8478976043.