

Course guide

330452 - SR - Robotic Systems

Last modified: 04/05/2023

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.

Degree: **Academic year:** 2023 **ECTS Credits:** 6.0
Languages: Catalan

LECTURER

Coordinating lecturer: Leon Pardo, Miguel

Others: Escobet Canal, Teresa

REQUIREMENTS

It is necessary to have taken the subjects of: "Advanced Automation" and "Automatic Regulation".

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. (ENG) Coneixements bàsics de sistemes de producció i fabricació
2. Knowledge of principles and applications of robotic systems.

Transversal:

3. 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.

TEACHING METHODOLOGY

The methodology used in this course is problem-based learning.

The course consists of 4 hours a week. Of these four hours a week, one is dedicated to presenting the main content in an expository manner and the remaining three to solving proposed practical problems. The resolution of the problem will involve individual work and group work.

Let's discuss the work methodology.

The student will be indicated monthly the practical problem to be solved for which he will need to consult the bibliography and prepare a solution proposal.

-In groups of 3 or 4 people they will have to analyze the proposals presented and plan a proposal to solve the problem.

-In a group it will be necessary to solve the problem and evaluate its solution.

-At the end you will have to make a presentation of the proposed solution and the results achieved.

LEARNING OBJECTIVES OF THE SUBJECT

The main objective of the course is to familiarize students with the architectures and elements used in robotic industrial production systems. Two of these elements will be studied in depth: industrial robots and artificial vision systems.

At the end of the Robotized Systems course, the student:

1. You will know the structure and basic operation of industrial robot manipulators and mobile robots.
2. Learn about artificial vision systems as a quality control tool in robotic facilities.
3. You will know the main applications of industrial robots.
4. You will know the technology of the different elements that make up a robot.
5. Will be able to apply the physical principles necessary for the design and control of robots.
6. You will know the basic stages involved in image processing.
7. You will know how to program the basic tasks of a commercial industrial robot and vision applications.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	15,0	10.00
Hours small group	45,0	30.00

Total learning time: 150 h

CONTENTS

TOPIC 1: INTRODUCTION TO ROBOTIZED SYSTEMS AND QUALITY INSPECTION

Description:

The objective of this topic is to describe robotic systems and give an overview of their evolution.

- Definition
- History
- Current paradigm

Full-or-part-time: 5h

Theory classes: 4h

Self study : 1h

TOPIC 2: ROBOTIZED ARM

Description:

This topic describes the robotic arm. It is structured in four sections:

1. Morphology of a robotic arm
2. Kinematics of robots
3. Kinematic control
4. Programming

Related activities:

Practices

Written tests

Full-or-part-time: 49h

Theory classes: 4h

Laboratory classes: 15h

Self study : 30h

TOPIC 3: MOBILE ROBOTS

Description:

This topic describes mobile robots and their programming is structured in four sections:

1. Morphology of mobile robots
2. Kinematics
3. Control of trajectories
4. Programming

Related activities:

Practices

Written tests

Full-or-part-time: 46h

Theory classes: 3h

Laboratory classes: 15h

Self study : 28h

TOPIC 4: ARTIFICIAL VISION

Description:

This topic describes the use of computer vision in industry. It is structured in four sections:

1. Introduction to computer vision
2. Image processing
3. Vision application programming

Related activities:

Practices

Written tests

Full-or-part-time: 49h

Theory classes: 4h

Laboratory classes: 15h

Self study : 30h

ACTIVITIES

ACTIVITY 1: PRACTICES

Description:

During the course three or four problems are proposed to be solved to be done during the practical sessions. Both the previous development and the execution of the same will be valued.

Specific objectives:

Those corresponding to the contents of the subject

Material:

The support materials are:

- Laboratory equipment
- Simulators
- Recommended basic bibliography
- Published teaching material

Delivery:

Before carrying out a task, the students will deliver the previous individual study corresponding to the problem to be solved. The achievement of the objectives achieved in each problem will be assessed taking into account the degree of understanding of the work demonstrated by each student. At the end, each group will give the internship teacher a file explaining the work done and the knowledge acquired and, if it is the case, there will be a public presentation of the work. The qualification obtained in these activities configures the LAB variable.

Full-or-part-time: 85h

Laboratory classes: 40h

Self study: 45h

ACTIVITY 2: WRITTEN TESTS

Description:

During the course there will be an individual control test. At the end of the course there will be a final globalizing test of the knowledge acquired

Specific objectives:

Solve practically and individually the problem posed

Material:

Support statements
Course work

Delivery:

The control test qualification sets the variable CON
The final test grade sets the FIN variable

Full-or-part-time: 16h

Theory classes: 6h

Self study: 10h

GRADING SYSTEM

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

$$\text{Final mark} = 0.20 * \text{CON} + 0.40 * \text{LAB} + 0.40 * \text{END}$$

The evaluation will be continuous.

Note 1. The qualification in a part or in the whole of the final test will replace, if it is higher and there is a coincidence in the evaluated aspects, the results obtained in other evaluation acts carried out throughout the course.

Note 2. When the results of the evaluation acts corresponding to the individual activities are substantially lower than those obtained in group activities, the individual execution of activities similar to those carried out in groups may be required. The last qualification will replace the original ones.

EXAMINATION RULES.

The activities will be carried out following the uses and customs of academic work and, particularly, the following guidelines will be respected:

1. Those activities that are explicitly declared as individual, whether in person or not, will be carried out without any collaboration from other people.
2. The dates, formats and other delivery conditions that are set will be mandatory.
3. Carrying out laboratory activities is a necessary condition to pass the subject.
4. If any of the activities of the subject is not carried out, it was considered a grade with zero.

BIBLIOGRAPHY

Basic:

- Barrientos, Antonio. Fundamentos de robótica [on line]. 2ª ed. Madrid: McGraw-Hill, 2007 [Consultation: 03/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4101. ISBN 9788448156367.
- González, Rafael C.; Woods, Richard E.; Eddins, Steven L. Digital Image processing using MATLAB. 2nd ed. New Delhi: McGraw-Hill, 2010. ISBN 9780070702622.