

## 69150 - Autonomous Robots

### Syllabus Information

**Academic year:** 2024/25

**Subject:** 69150 - Autonomous Robots

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura

**Degree:** 615 - Máster Universitario en Robótica, Gráficos y Visión por Computador / Robotics, Graphics and Computer Vision

**ECTS:** 6.0

**Year:** 1

**Semester:** First semester

**Subject type:** Compulsory

**Module:**

### 1. General information

The main objective of this course is to give an overview of the main components and algorithms that currently exist to provide autonomy to a mobile robot, including mathematical tools, planning and navigation methods and the main aspects related to their implementation.

### 2. Learning results

The student should be able to:

- Know and understand basic mathematical tools for autonomous robots: spatial transformations and probabilistic robotics.
- Know the basic handling of robotic development software platforms.
- Design and develop systems for trajectory generation, motion planning and robot navigation.
- Develop navigation systems that integrate information from different sensors.
- Apply the concepts and systems learned to the design of 2D and 3D robot navigation systems.
- Know the basic problems and techniques used in multi-robot systems.
- Know aspects and problems related to the operation of autonomous robots in different real applications.

### 3. Syllabus

1. Basic tools: spatial transformations, probabilistic robotics, robotic platforms
2. Autonomous robots: kinematics and dynamics
3. Motion planning and reactive navigation techniques
4. Multi-sensor perception for autonomous robots
5. Decision and learning methods for planning and navigation
6. Multi-robot systems
7. Field Robotics

### 4. Academic activities

The course consists of 6 ECTS credits that imply an estimated dedication by the student of 150 hours, divided into the following activities:

A01 - Lecture class: 30 hours

A02 - Problem solving and case studies: 4 hours

A03 - Laboratory practicals: 18 hours

A07 - Study: 92 hours

A08 - Evaluation tests: 6 hours

### 5. Assessment system

The student must demonstrate that he/she has achieved the expected learning outcomes through the following evaluation activities.

Continuous evaluation:

**Theoretical Evaluation (TE):** One or more written or oral tests that demonstrate that the student has acquired the theoretical knowledge of the subject.

**Practical Evaluation (PE):** Deliverables of laboratories and/or practical work (laboratory, special and research) related to the subject that demonstrate that the student has acquired the practical competences of the subject.

Each of the two evaluations will result in a grade from 0 to 10 points. The student's final grade will be calculated by weighting

40% TE and 60% PE, Final grade =  $0.4 \cdot TE + 0.6 \cdot PE$ .

To pass the course the student must obtain a grade greater than or equal to 5 points in the TE grade, 4 points in each deliverable of PE, and 5 points in the Final Grade. If one of these conditions is not met, the student's grade will be the minimum between Final grade and 4 points. Otherwise, the grade will be Final grade.

Global evaluation (official exams):

Theoretical Evaluation (TE): A written exam.

Practical Evaluation (PE): Written and/or oral exam about all the deliverables.

The final grade will be calculated in the same way as in the continuous evaluation.

## **6. Sustainable Development Goals**

3 - Good Health & Well-Being

9 - Industry, Innovation and Infrastructure

11 - Sustainable Cities and Communities