

# Course guide 220073 - MRM - Mechanics of Robotic Manipulation

Last modified: 02/04/2024

Unit in charge:	Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit:	712 - EM - Department of Mechanical Engineering.
Degree:	BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject). BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Optional subject). BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).
Academic year: 2024	ECTS Credits: 3.0 Languages: English

LECTURER	
Coordinating lecturer:	Francisco Javier Freire Venegas
Others:	Shadi Karimi

### **TEACHING METHODOLOGY**

This course is self-study oriented. Every week will be proposed on ATENEA net:

a) a theoretical matter to self-study using easily reached multimedia documentation.

b) some questions to be answered before the practical classes.

c) some problems to be done at practical classes using MAPLE software at ESEIAAT premises.

At the end of the course a 6 d.o.f. robot model project, using MAPLE, will be delivered.

In the practical classes (in the classroom with PCs), teachers will guide the students in applying theoretical concepts to solve problems, always using critical reasoning. We propose that students solve exercises in and outside the classroom, to promote contact and use the basic tools needed to solve problems.

Students, independently, need to work on the materials provided by teachers and the outcomes of the sessions of exercises/problems, in order to fix and assimilate the concepts.

The teachers provide the syllabus and monitoring of activities (by ATENEA).

# LEARNING OBJECTIVES OF THE SUBJECT

This course provides an overview of robot mechanisms, kinematics and dynamics. Topics include spatial kinematics and multi-rigidbody dynamics. Students will simulate robotic systems in a group-based term project.

## **STUDY LOAD**

Туре	Hours	Percentage
Hours large group	30,0	40.00
Self study	45,0	60.00

Total learning time: 75 h



## CONTENTS

#### **Module 1: Spatial Descriptions and Transformations**

**Description:** Transformation matrices

**Full-or-part-time:** 15h Theory classes: 6h Self study : 9h

#### Module 2: Kinematics. Inverse Kinematics

**Description:** Robot Kinematics

Full-or-part-time: 20h Theory classes: 8h Self study : 12h

#### Module 3: Jacobians. Singularities. Static Forces

**Description:** Jacobian utility and computation.

**Full-or-part-time:** 20h Theory classes: 8h Self study : 12h

#### Module 4: Introduction to Robot Dynamic

**Description:** Introduction to Robot Dynamic

**Full-or-part-time:** 20h Theory classes: 8h Self study : 12h

# **GRADING SYSTEM**

theoretical questions 10% practical work at practical classes 50% (every work will have the same weight) robot model project 50%

If the project grade is better than other grade (or grades) will replace the lower grades. Every student that will want to improve his grade may try it at the exam planned at the end of the course. The best note will be conserved.



# **BIBLIOGRAPHY**

#### **Basic:**

- Craig, John J. Introduction to robotics: mechanics and control [on line]. 3rd ed. Upper Saddle Hall: Pearson Education, cop. 2014 [Consultation: 18/04/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5174 674. ISBN 9781292040042.

## RESOURCES

Hyperlink:

- Introduction to Robotics. http://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/