POLI ESCOLA SUPERIOR TECNOLOGIA GESTÃO TÉCNICO GUARDA	**SUBJECT DESCRIPTION**	**MODELO** PED.013.03

Course	**Mechanics and Industrial Informatics**					
Subject	**Robotic Systems**					
Academic year	2023/2024	*Curricular year*	2nd	*Study period*	2nd semester	
Type of subject	Compulsory	*Student workload (H)*	Total: 175,5	Contact: 60	*ECTS*	6,5
Professor(s)	Prof. Doutor Carlos Carreto					
☒ *Area/Group Coordinator* ☐ *Head of Department* *(select)*	Prof. Fernando Melo Rodrigues					

PLANNED SUBJECT DESCRIPTION

1. LEARNING OBJECTIVES

Upon completion of the course unit, students should be able to:

1. Understand the fundamentals of Mobile Robotics, including the components, operating principle, history, types and applications of robots. Describe the different types of industrial robots and their basic functioning.
2. Analyse robotic systems with 3 degrees of freedom commonly found in industry, including components and types of manipulators, direct and inverse kinematics, coordinate transformation, singularities and trajectory generation.
3. Select appropriate sensors and use digital and analog sensors (including visible light cameras) to obtain and use information in robotic systems. Distinguish and implement open-loop and closed-loop controllers for control of a single joint.
4. Describe the main technologies and navigation methods of automated guided vehicles.
5. Describe and apply robot programming methods.
6. Design simple robotic manipulators.

2. PROGRAMME

1. **Fundamentals of Robotics**
   - Basic concepts about robots
   - History
   - Applications of industrial robots
   - Topology, components and basic functioning of industrial robots
2. **Kinematic modeling of manipulative robots**
   - Reference systems and coordinate transformation
   - Direct and inverse kinematics

- Singularities
- Trajectory generation

3. **Sensors and Actuators of Manipulating Robots**
   - Types of sensors and interfaces
   - Object localization with computer vision and coordinate transformation
   - Types of motors
   - Control of the movement of motors in open loop and closed loop
4. **Automatic Guided Vehicles**
   - Technologies and navigation methods
5. **Robot Programming**
   - Programming methods
   - Practical examples
6. **Project**

3. COHERENCE BETWEEN PROGRAMME AND OBJECTIVES

The program contents are consistent with the objectives, as each point of the content addresses the essential topics for students to acquire the skills defined in the respective objectives.

4. MAIN BIBLIOGRAPHY

Mandatory

- Notes provided by the teacher.

Recommended

- J. Norberto Pires (2018), ROBÓTICA INDUSTRIAL – Indústria 4.0, Editora LIDEL, ISBN: 978-989-752-226-0.
- Fabrizio Frigeni (2023), Industrial Robotics Control – Mathematical Models, Software Architecture, and Electronics Design, Apress Berkeley, ISBN: 978-1-4842-8988-4
- Kevin M. Lynch e Frank C. Park (2017), Modern Robotics: Mechanics, Planning, and Control, Cambridge University Press, ISBN: 978-110-715-630-2.
- Hamed Fazlollahtabar e Mohammad Saidi-Mehrabad (2015), Autonomous Guided Vehicles: Methods and Models for Optimal Path Planning, Springer, ISBN-13: 978-331-914-746-8.
- Peter Corke (2017), Robotics, Vision and Control: Fundamental Algorithms In MATLAB, Second Edition, Springer, ISBN: 978-331-954-412-0.

5. TEACHING METHODOLOGIES (INCLUDING EVALUATION)

Teaching Methodologies

6

- Lecture Lesson
- Interactive Lesson
- Problem Solving
- Project Work

Evaluation Rules

- Continuous assessment: Tests (70%) + Project (30%). The continuous assessment does not have a frequency test.
- Assessment by exam (Normal and Appeal): Exam test (70%) + Project Grade (30%)

6. COHERENCE BETWEEN TEACHING METHODOLOGIES AND OBJECTIVES

- The Expositive Lecture is consistent with the objectives due to the need to present the theoretical content to students, so that they acquire a comprehensive and solid knowledge about robotic systems.
- The Interactive Lesson is consistent with the objectives as it is expected that student participation in practical demonstrations of technology solutions and case studies will help in understanding the contents studied, with emphasis on “how it is done”.
- Problem Solving is consistent with the objectives as it is intended that solving practical exercises, based on the application of the studied contents, will help to consolidate the acquired skills, with emphasis on knowing “how to do”.
- Project work is consistent with the objectives as it provides the context for students to consolidate the knowledge and skills they have acquired through the design and implementation of technological solutions to realistic professional life problems.

7. ATTENDANCE

Not applicable.

8. CONTACTS AND OFFICE HOURS

Prof. Dr. Carlos Carreto

E-mail: ccarreto@ipg.pt

Office Nº 12

Office hours:

- Tuesday 15:00 - 18:00

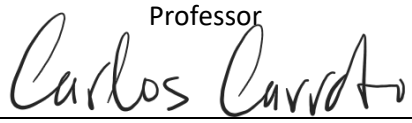
9. OTHERS

DATE

19 de fevereiro de 2024

SIGNATURES

Professor



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Area/Group Coordinator

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