COMPUTER ENGINEERING (LM55)

(Lecce - Università degli Studi)

Teaching ROBOTICS AND INDUSTRIAL AUTOMATION

GenCod A006452

Owner professor DANIELA DE PALMA

Reference professors for teaching DANIELA DE PALMA, Antonio MASCIULLO

Teaching in italian ROBOTICS AND INDUSTRIAL AUTOMATION

Teaching ROBOTICS AND INDUSTRIAL AUTOMATION

SSD code ING-INF/04

Reference course COMPUTER ENGINEERING

Course type Laurea Magistrale

Credits 9.0

Teaching hours Front activity hours: 81.0

For enrolled in 2021/2022

Taught in 2022/2023

Course year 2

Language ENGLISH

Curriculum AUTOMATION FOR INDUSTRIAL & HEALTH-CARE

Location Lecce

Semester First Semester

Exam type Oral

Assessment Final grade

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION	This course offers a broad overview of fundamental topics in the area of robotics, mobile robotics and industrial automation systems. It is aimed at providing principles and tools to state and solve the design problems for industrial robots and mobile devices, and the solution is numerically sought with the aid of suitable softwares (Matlab and/or ROS, etc.).
REQUIREMENTS	Sufficiency in calculus, mechanics, control theory and linear algebra
COURSE AIMS	Ability to apply knowledge and understanding) Describe and explain the main peculiarities (both advantages and disadvantages) of each facet of the design of a robotic, mobile robotic and industrial automation systems. (Ability to apply knowledge and understanding) + (Communication skills) + (Autonomy of judgment) Be aware, describe and explain the practical problems of controlling complex systems and how to overcome these drawbacks using modern approaches. (Ability to apply knowledge and understanding) + (Learning ability) + (Autonomy of judgment) Starting from a practical problem, the student must be able to formalize an adequate theoretical formulation, and also should be able to build a framework of simulation to find a computer solution of the mathematical problem with the use of a suitable software. (Communication skills) + (Learning skills) Students can develop a project on an application of interest in which to apply the methodologies developed along the course.
TEACHING METHODOLOGY	Lectures and exercises including numerical simulation sessions.

ASSESSMENT TYPE	Final assessment consists in a written exam and an oral discussion on the main topics of the course. The written exam is based on theory questions, exercises, and coding problems. In case some practical work has been assigned during the course, it will be verified during the exam. In both the oral or written exam, the students will be asked to define the kinematic model of simple robotic mechanism, and to show proper knowledge of dynamic and control elements for robotics and industrial automation systems.
FULL SYLLABUS	Introduction to Robotics: Robot Mechanical Structures, Robot Manipulators, Mobile Robots, Industrial robotics, Advanced Robotics, Field Robots, Service Robots, Robot Modelling, Planning and Control. Kinematics. Euler Angles. Denavit–Hartenberg Convention. Kinematics of Typical Manipulator Structures. The Inverse Kinematics Problem. Dierential Kinematics and Statics. Geometric Jacobian. Kinematic Singularities. Analysis of Redundancy. Statics. Kineto-Statics Duality. Trajectory Planning. Joint Space Trajectories. Dynamics. Motion Control. Mobile Robots: Nonholonomic Constraints, Kinematic Model, Planning, Motion Control. Laboratory activities on the control of robots. Architecture for Computer-Integrated Manufacturing, Hardware architecture for adaptive control system, real-time systems, PLC - Hardware and Software architecture, PLC Programming Languages, PLC laboratory for industrial automation with examples and exercises.
REFERENCE TEXT BOOKS	1) Siciliano, B., Sciavicco, L., Villani, L. and Oriolo, G., Robotics Modelling, Planning and Control, Springer 2009, ISBN 978-1-84628-641-4 2) Siciliano & Khatib eds., *Handbook of Robotics*, Springer, New York, 2008