unibz
Fakultät für Ingenieurwesen
Facoltà di Ingegneria
Faculty of Engineering

COURSE DESCRIPTION – ACADEMIC YEAR 2023/2024

Course title	**Programmable Controllers for Industrial Automation**
Course code	42168
Scientific sector	ING-IND/32
Degree	Bachelor Industrial and Mechanical Engineering (L-9)
Semester	2
Year	3
Credits	6
Modular	No

Total lecturing hours	36
Total laboratory hours	24
Attendance	The attendance to the lecturing hours is not compulsory. The attendance to the laboratory hours is also not compulsory but very warmly recommended, as those hours are an extremely formative part of the course. Students failing to work out the 70% of the laboratory hours will have to prove their practical programming skill in the lab before taking the oral examination. Students intending to perform the exam in these conditions are required to inform the Lecturer at least 2 months in advance of the chosen exam session. This time is required to organize the practical part of the exam as special exam session.
Prerequisites	
Course page	Microsoft Teams

Specific educational objectives	The course belongs to the type "caratterizzanti – discipline informatiche". It discusses the principles and standard practices of the programmable logic controllers (PLC) used in industry for automation purposes. At first the principles of digital systems are covered. Programming aspects are introduced afterwards. Finally, practical activities will be carried out during the laboratory hours. The students will therefore learn the following scientific content: • The principles of Boolean logic; • Fundamental logic circuits and logic circuit design. And the following professional skills and knowledge: • What are PLCs, how they are built and how do they work; • How PLC can be programmed using the languages of the IEC 61131-3 standard; • What are the challenges of developing PLC software for a real application and how to solve them.

Lecturer	Anton Soppelsa
Contact	NOI A1.4.27B, anton.soppelsa@eurac.edu

Scientific sector of lecturer	ING-INF/04
Teaching language	English
Office hours	Just after the class or arranged beforehand by email.
Lecturing Assistant (if any)	none
Contact LA	-
Office hours LA	-
List of topics	The main topics of the course are: • Design of logic circuits. Canonical Normal Forms. Optimal synthesis: Karnaugh maps; • Fundamental combinatorial and sequential circuits: building blocks of a Programmable Logic Controller (PLC); • PLCs: structure, IO modules, applications. PLC programming using IDEs; • Moore and Mealy state machines and their implementation in the LD language; • Languages of the IEC 61131-3 standard: Ladder Diagram (LD), Functional Block Diagram (FBD), (Structured Text (ST)); • Hands-on development of supervisory controls using state-of-the-art toolchain and hardware (laboratory activity).
Teaching format	Frontal lessons, exercises and laboratory activities.

Learning outcomes	If followed successfully, this course will allow the student to acquire the following knowledge and skills. Knowledge and understanding: • The knowledge to master the most important concepts about programmable logic controller. • The understanding of how PLC programming IDE work. Applying knowledge and understanding: • Ability to recognise the design principles behind real automation systems; • Ability to describe the state of the art of the adopted technology; • Ability to design a programmatic solution for common automation tasks; • Ability to make use of professional-grade IDE for programming PLCs. Making judgments: • The ability to select the more adequate automation system and components for a particular application. Communication skills: • Acquisition of the technical terminology of the field; • Ability to prepare and deliver technical presentations. Learning skills:

	• Ability to autonomously extend the knowledge acquired during the study course by reading and understanding scientific and technical documentation.

Assessment	The final assessment will be oral and project-based: the students will hold a presentation about one of the projects developed during the laboratory activities, randomly selected at the end of the course. At the end of the presentation, students will be challenged with questions about their presentation, the results of their project and the frontal lectures. Students that will not be able to follow at least 70% of the laboratory hours, will need to prove their programming abilities in the lab before being admitted to the final assessment. The challenge will be carried out in the lab where the students (up to 4 at time) will have 4 hours to set-up the hardware and implement from scratch one randomly selected project among those performed during the lab activities.
Assessment language	English
Assessment Typology	Monocratic
Evaluation criteria and criteria for awarding marks	The final grade is assigned considering the following criteria, which are valid for both the students that followed at least 70% of the laboratory hours and those who don't: • correctness of the developed solution; • clarity and correctness of answers; • mastery of technical language; • ability to summarize, evaluate, and presenting the results; • ability to establish relationships between topics; The final mark is the weighted sum of the laboratory activities/practical exam score (60%) and the oral score (40%).

Required readings	There is no single textbook that covers the entire course. The course material is collected from various sources that will be released during the course. Subject Librarian: David Gebhardi, David.Gebhardi@unibz.it and Ilaria Miceli, Ilaria.Miceli@unibz.it
Supplementary readings	
Software used	*TwinCAT 3*

Commented [SA1]: Devo lasciare?