UNIVERSITÀ degli STUDI di CATANIA

DEPARTMENT OF ELECTRICAL, ELECTRONIC AND COMPUTER ENGINEERING
Master's Degree in Electrical Engineering
Academic Year 2021/2022 - 1° Year

INDUSTRIAL AUTOMATION

ING-INF/04 - 6 CFU - 2° Semester

Teaching Staff

GIUSEPPE NUNNARI
Email: giuseppe.nunnari@dieei.unict.it
Office: Edificio Polifunzionale
Phone: 0957382306
Office Hours: Martedi 10-13 – Giovedì 11-13

LEARNING OBJECTIVES

1. Knowledge and understanding. Students will learn to:

- Represent Discrete Event Systems (DES) by means of Petri nets.
- Analyze the structural properties of a model represented by Petri nets and its control through the approach of monitor places.
- Know the architecture of Programmable Logic Controllers (PLC).
- Know the programming languages of programmable logic controllers (PLCs) as described in the IEC 61131-3 standard.
- Know the structure of computer networks for industrial automation and systems for supervision and data acquisition (SCADA).

Applying knowledge and understanding. Students will be able to:

- represent, analyze and simulate the properties of discrete event systems (DES).
- code the software for PLC and debugging, both through the use of simulators and by operating in the laboratory directly on the HW devices.

3. Autonomy of judgment. Students will be able to judge the strengths and weaknesses of techniques in use in the field of Industrial Automation.

4. Communication skills. Students will be able to illustrate the techniques learned in the course, interact in teams and collaborate with industry experts..

5. Learning skills. Students will be able to autonomously extend their knowledge of the techniques used in the field of industrial automation, drawing on the vast literature available in the field.

COURSE STRUCTURE

- The course takes place through lectures and experiences in the laboratory. To each course topic is

devoted an adequate amount of time in the laboratory experiences which reinforce the learning. In the laboratory, students will use both software tool and hardware devices to learn the analysis of discrete event systems and PLC programming.
- Should teaching be carried out in mixed mode or remotely, it may be necessary to introduce changes with respect to previous statements, in line with the programme planned and outlined in the syllabus.

DETAILED COURSE CONTENT

Discrete event systems (DES). DES representation by using Petri Nets. Analysis of Petri Nets. DES control using the Monitor approach. Continuous versus logic control. PID: Architecture and tuning approaches. Programmable logic controllers (PLC): architecture of a PLC, input-output modules special function modules PLC programming languages modules, special function modules. PLC programming languages. Graphic Graphic languages: Ladder Diagram, Function Block language (FBD), sequential function chart (SFC). Basic elements, instructions for timing and counting. Evolution rules Structures to control the program flow Examples of Evolution rules. Structures to control the program flow. Examples of programming using ladder diagram, FBD and SFC. Computer networks. The OSI model, network topologies, transmission media bus access methods: traditional standards: Ethernet token bus media, bus access methods: traditional standards: Ethernet, token bus, token ring. Computer networks for automation. Supervisory systems and data acquisition (SCADA). Modules of a SCADA system: database processing module, communication module, operator interface module, processing module, communication module, operator interface module, alarm management , recipe management module, maintenance support module, expert system module.

TEXTBOOK INFORMATION

1. Handbook of Industrial Automation, Ed. Marcel Dekker, 2000.
2. Hassen D.H., Programmable Logic Controllers - A practical approach to IEC 61131-3 Using Codesys, Wiley, 2015.
3. Bolton, Programmable Logic Controllers, 5th edition, Elsevier, 2009
4. Slides delle lezioni
