

## Course Specification Document

<b>Title</b>	Industrial Automation and Communication Networks
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<b>Credits</b>	5 ECTS
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<b>Aims</b>	<p>This course aims to provide the student with knowledge related to industrial automation systems and to prepare him for the use of Programmable Logic Controllers (PLCs) in automating industrial machinery and production lines. In addition, it aims to provides him with knowledge related to industrial communication <b>networks, their various uses and communication protocols</b>, with application to the two most important industrial protocols: the first is time-triggered and the second is eve.nt-triggered: Profibus, CAN.</p>
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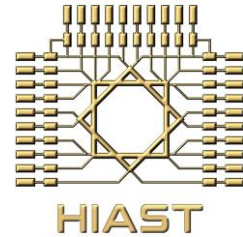
### Intended learning outcomes

On successful completion of this course, the student will be able to:

- Understand the Hardware of the PLC.
- Know how to program a PLC, using LADDER language.
- Understand PLC programming using the Grafcet language and understand how to apply it.
- Understand communication types and hierarchical structures of communication protocols.
- Identify important protocols at the layers level, with a focus on the first two layers: the physical layer and the data link layer.
- Comprehend the two most important industrial protocols: Profibus as a time- triggered protocol, and CAN as an event- triggered protocol. Also, recognize a general third protocol for communication within a local LAN network: Ethernet/IP.
- **Apply theoretical concepts in the field of specialization to industrial practices.**
- Practically program PLCs and explore gaps in theoretical analysis.
- Use the Gemma methodology in PLC programming.
- **Apply theoretical networking concepts to real industrial practices.**
- Apply mathematical models using the computer to obtain operational models.
- Utilize the appropriate networks for communication, data exchange, control, automation, and monitoring.

### Syllabus

- **General Introduction:** Overview of the environment surrounding of PLCs, including actuators and sensors, etc.



- **Hardware of PLC:** Introduction to the components of PLCs, including the central processing unit and various input and output modules, and how PLCs work.
- **Programming PLC using the Ladder language:** Introducing the general structure of the program and the basic instructions of the language, with practical examples.
- **Programming PLC using the Grafcet language:** Presenting the general structure of the program and the basic instructions of the language, with practical examples.
- **The Gemma methodology:** Explaining the general structure of the methodology and its basic stages, with a practical example.
- **Introduction to industrial networks:** The components of a data transmission system, the difference between circuit switching and packet switching, transmission modes, network switching modes.
- **Standards models:** The importance of standards, the OSI model, the TCP/IP model, packaging.
- **Addressing:** Physical addressing, Ethernet protocol, logical addressing, Internet protocol (IP).
- **Transport layer protocols:** Introduction, UDP protocol, TCP protocol.
- **Profibus Protocol for Industrial Communication:** A detailed explanation of the data link layer of this time- triggered protocol.
- **CAN Industrial Communication Protocol:** A detailed explanation of the data link layer of this event-driven protocol.