University of Puerto Rico
Mayagüez Campus
College of Engineering
Department of Industrial Engineering
Program

COURSE SYLLABUS

COURSE TITLE:	**Automation and Process Control**
ALPHA-NUMERIC CODIFICATION:	ININ 4057
NUMBER OF CREDITS-CONTACT HOURS:	Three credits
PREREQUISITES, COREQUISITES AND OTHER REQUIREMENTS:	Prerequisites: (INEL 4078 or INEL 4076) and (CIIC 3011 or CIIC3015 or INGE 3016)

COURSE DESCRIPTION

Spanish: Uso de controladores basados en computadoras para controlar los procesos usando señales digitales y análogas.

English: Use of computer-based controllers to control processes using digital and analog signals.

COURSE OBJECTIVES:

This course is required for the bachelor of science degree in Industrial Engineering. The purpose of the course is to introduce students to the computer-based process automation. The course does not serve as a prerequisite for any other course, but the knowledge acquired can be used in the Senior Project, InIn 4079.

At the completion of the course the students will be able to:

- Identify and use industrial sensors and actuators as main components of a process
- Creatively integrate electric, pneumatic and mechanical systems to automate a process.
- Formulate and code the control logic to run a process in real time
- Use of software to build a Human Machine Interface

TEXT BOOK: Material is provided by the professor from multiple resources.

Course time frame and thematic outline: (Sample of Distribution)

	TIME DISTRIBUTION
Theme	**Face-to-Face**
Introduction to Programable Automation	2
Automation Justification and Productivity Concept	2
Laboratory 1: Basic circuits	2
Engineering design process	2
Laboratory 2: Engineering design process	2
Introduction to Programmable Logic Controllers (PLCs) • Definition and basic components • Numeric systems	4

• Discrete Input/Output Modules	
Industrial Sensors - Components used as input devices: • -Manual switches • -Automatic switches • -Limit switch • -Photoelectric sensors • -Proximity sensors: inductive and capacitive sensors • -Phototransistor • -Switch signal: Relays • -Other sensors	4
Laboratory 3: Sensors	2
Industrial Actuators - Components used as output devices • DC Motors • Lights • Valves and pistons • Relay	4
Laboratory 4: Actuators and Relays	2
Programming Basics • Sequential Function Chart	4
Fundamental PLC programming • PLC program execution • Ladder diagram programming • Relay logic instructions • Timer and counter instructions • Jump commands • Shift registers • PLC programming units	16
Laboratory 5: Programming with the Computer and Handheld	2
Pressure systems • Pressure laws, properties and measurement scales and instruments • Hydraulic, pneumatic and vacuum systems	4
Use computer software for Human Machine Interface (HMI) Laboratory: HMI	2
Industrial Networking	2
Work on projects	4
Total contact hours	**60 hours**

INSTRUCTIONAL STRATEGIES:

Face-to-Face
♦ Conferences ♦ Lectures ♦ Team work ♦ Individual tasks ♦ Assessment activities ♦ Practice activities ♦ Oral presentations

MINIMUM OR REQUIRED RESOURCES AVAILABLE:

RESOURCE	**FACE-TO-FACE**

Institutional learning management platform account (Ex. Moodle) (Cuenta en la plataforma institucional de gestión de aprendizaje) (Ej. Moodle)	Institution
Institutional email account	Institution
Computer with high-speed internet access or mobile device with data service	Student
Programs or applications: word processor, spreadsheets, presentation editor	Student
Built-in or external speakers	Not applicable
Webcam or mobile with camera and microphone	Not applicable

EVALUATION STRATEGIES: (Examples of evaluation techniques)

FACE to FACE

Assignments (0% - 10%)
Laboratories (10% - 20%)
Exams (20% - 70%)
Project (15% - 45%
Oral presentations (0%-10%)

REASONABLE ACCOMMODATIONS:

The University of Puerto Rico at Mayagüez (RUM) recognizes that each student has an inherited right to request reasonable accommodation according to Law 51: Law for Integral Educational Services for People with Disabilities. Every student has the right to receive reasonable accommodation if he/she presents the necessary evidence to be evaluated by the Office of Services to Students with Disabilities (OSEI-RUM), and the related information can be found at the following link: https://www.uprm.edu/cms/index.php/page/85. If your case is approved by OSEI-RUM, you will receive reasonable accommodation in your courses and evaluation, and you must contact each professor for course registered. For additional information contact OSEI-RUM at Sánchez Hidalgo 410 or via telephone 787-832-4040 extension 3107.

ACADEMIC INTEGRITY:

The University of Puerto Rico promotes the highest standards of academic and scientific integrity. Article 6.2 of the UPR Student General Bylaws (Board of Trustees Certification 13, 2009-2010) states that academic dishonesty includes, but is not limited to: fraudulent actions; obtaining grades or academic degrees by false or fraudulent simulations; copying the whole or part of the academic work of another person; plagiarizing totally or partially the work of another person; copying all or part of another person's answers to the questions of an oral or written exam by taking or having someone else take the exam on his/her behalf; as well as enabling and facilitating another person to perform the aforementioned behavior. Any of these behaviors will be subject to disciplinary action in accordance with the disciplinary procedure established by the UPR Student General Bylaws.─.

To ensure the integrity and security of user data, all hybrid, distance and online courses must be offered through the institutional learning management platform, which uses secure connection and authentication protocols. The system authenticates the identity of the user (student and professor) using the username and password assigned by the institution. The users are responsible for keeping their password safe, protected, and not to share it with other people.

POLICY AGAINST DISCRIMINATION BASED ON SEX, SEXUAL ORIENTATION, AND GENDER IDENTITY:

«The University of Puerto Rico prohibits discrimination based on sex, sexual orientation, and gender identity in any of its forms, including that of sexual harassment. According to the Institutional Policy Against Sexual Harassment at the University of Puerto Rico, Certification 130 (2014-2015) from the Board of Governors, any student subjected to acts constituting sexual harassment, may turn to the Office of the Student Ombudsperson, the Office of the Dean of Students, or the Coordinator of the Office of Compliance with Title IX for an orientation or formal complaint».

GRADING SYSTEM

☒ Quantifiable (letters, A, B, C, D, F) ☐ Not Quantifiable

CONTINGENCY PLAN IN CASE OF AN EMERGENCY

In case of an emergency or class interruption, the professor can apply Bylaw 19-85 of the UPRM. bylaw states that up to 25% of a class can be offered online.

BIBLIOGRAPHY

Malekar, A. (2021) Everything about PLC programming: Practical lessons on Allen-Bradley, Siemens, and Mitsubishi PLC with real world examples (Industrial automation). Avinash Prakash Malekar.

Sharma, K.L.S. (2017) Overview of Industrial Process Automation, Elsevier, Second Edition.

Keler, V. (2017) Everything Electrical How To Find Electrical Shorts. Vincent Keler.

Keler, V. (2017) Everything Electrical How To Use All The Functions On Your Multimeter. Vincent Keler.

Automationdirect. (2021) Productivity1000 User Manual. Automationdirect.com® Incorporated.