



A) COURSE

Course Id:	Course
5671	Programmable Logic Control

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
3	2	3	8	48

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:	VII				VIII
Course Type (Required/Elective)	Required				Required
Prerequisite Course:	Industrial Instrumentation				Electropneumatics, Industrial Instrumentation
CACEI Classification:	IA				IA

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:
Analyze and Design automatic systems using PLC, and sensors and actuators

D) TOPICS (CONTENTS AND METHODOLOGY)

1. General concepts of automation systems	6 Hours
Specific Objective:	The student will identify the elements of a automation system and learn about different types of automation
<ul style="list-style-type: none"> 1.1 Automation concepts 1.2 Elements in an automation system 1.3 Control systems 1.4 Control strategies 1.5 Analog and digital automatisms 1.6 Wired logic 1.7 Programmed logic 1.8 The programmable logic control (PLC) applied to automation 	



Readings and other resources	GARCÍA MORENO EMILIO, “Automatización de Procesos Industriales”, Alfaomega 2000. PIEDRAFITA MORENO RAMÓN, “Ingeniería de la Automatización Industrial”, Ra-Ma 2001. PALLAS ARENY RAMÓN, “Sensores y Acondicionadores de Señal”, Alfaomega 2007. 3ª Ed. ROCA ALFRED, “Control de Procesos”, Theory exposition Alfaomega, 2002, 2ª Ed
Teaching Methodologies	Theory exposition
Learning Activities	Analysis of concepts. Problems resolutions and discussion about possible solutions. Laboratory practices

2. Architecture of PLCs		10 Hours
Specific Objective:	The student will identify the architecture of a PLC, the more representative modules composing the PLC and their individual functionality.	
	<p>2.1 Preliminary concepts and definition of PLC</p> <p>2.2 Application and advantages of using a PLC</p> <p>2.3 Elements of a system based on PLC</p> <p>2.4 External structure</p> <p>2.4.1 Compact structure</p> <p>2.4.2 Modular structure</p> <p>2.5 Internal structure</p> <p>2.5.1 Central processing unit (CPU)</p> <p>2.5.2 Data addressing</p> <p>2.5.3 Power source</p> <p>2.6 Electrical and physical features of a PLC</p> <p>2.7 Operation modes of a PLC</p> <p>2.8 Service functions of a PLC</p> <p>2.9 I/O interphases</p> <p>2.10 PC-to-PLC interphase</p> <p>2.11 Memory and redundant processor</p>	
Readings and other resources	BALCELLS JOSEPH, ROMERAL JOSÉ LUIS, “Autómatas Programables”, Alfaomega 1999 PORRAS CRIADO ALEJANDRO, “Autómatas Programables, Fundamentos, Manejo, Instalación y Prácticas”, Mc Graw-Hill, 2002 WEBB JOHN W., REIS RONALD A, “Programmable Logic Controllers, Principles and Applications”, Prentice Hall 1995	
Teaching Methodologies	Theory exposition	
Learning Activities	Analysis of concepts. Problems resolutions and discussion about possible solutions. Laboratory practices	

3. Programming languages of PLC		10 Hours
Specific Objective:	The student will design a program for PLC using different programming languages	



<p>3.1 Logic of a ladder diagram</p> <p>3.2 KOP language</p> <p>3.3 AWL language</p> <p>3.4 FUP lenguaje</p> <p>3.5 GRAFCET, SFC programming</p> <p>3.6 Examples of all languages</p> <p>3.7 Basic functions</p> <p>3.8 Logic operation using bits</p> <p>3.9 Ladder diagram to PLC program</p> <p>3.10 View online</p> <p>3.11 Execute application online</p>	
Readings and other resources	BALCELLS JOSEPH, ROMERAL JOSÉ LUIS, "Autómatas Programables", Alfaomega 1999 PORRAS CRIADO ALEJANDRO," Autómatas Programables, Fundamentos, Manejo, Instalación y Prácticas", Mc Graw-Hill, 2002 WEBB JOHN W., REIS RONALD A, "Programmable Logic Controllers, Principles and Applications", Prentice Hall 1995
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4. Special functions		16 Hours
Specific Objective:	The student will apply the special functions in PLC programming	
<p>4.1 Use of Timers</p> <p>4.1.1 Delay of connection</p> <p>4.1.2 Delay of disconnection</p> <p>4.2 Operations using comparators, counters (incremental and decremental).</p> <p>4.3 Edge detection</p> <p>4.4 Memory and erase functions (Set/reset, latch/unlatch)</p> <p>4.5 Subroutines</p> <p>4.6 Interrupts</p> <p>4.7 Arithmetic operation using fixed and floating point.</p> <p>4.8 Transfer operations</p> <p>4.9 Analog signals management</p> <p>4.10 Programming of PID</p> <p>4.11 Programming of Real-Time timers</p> <p>4.12 Projects and presentations</p>		



Readings and other resources	BALCELLS JOSEPH, ROMERAL JOSÉ LUIS, “Autómatas Programables”, Alfaomega 1999 PORRAS CRIADO ALEJANDRO, “Autómatas Programables, Fundamentos, Manejo, Instalación y Prácticas”, Mc Graw-Hill, 2002 WEBB JOHN W., REIS RONALD A, “Programmable Logic Controllers, Principles and Applications”, Prentice Hall 1995
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E) TEACHING AND LEARNING METHODOLOGIES

- a) Topics Explanations.
- b) Programming exercises.
- c) Team work.
- d) Problems solving
- e) Making of a final project

F) EVALUATION CRITERIA:

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
1st Term	Session 16	Exam 85%, Homework 15%,	Units 1 and 2
2nd Term	Session 32	Exam 85%, Homework 15%,	Unit 3
3rd Term	Session 48	Exam 85%, Homework 15%,	Unit 4
Final evaluation		100% (Average of the partial evaluations)	
Other activity:			
Extraordinary Exam	According to schedule	100% Exam	100% of topics
Title Exam	According to schedule	100% Exam	100% of topics
Regularization Exam	According to schedule	100% Exam	100% of topics

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main Books

BALCELLS JOSEPH, ROMERAL JOSÉ LUIS, “Autómatas Programables”, Alfaomega 1999
 GARCÍA MORENO EMILIO, “Automatización de Procesos Industriales”, Alfaomega 2000
 PALLAS ARENY RAMÓN, “Sensores y Acondicionadores de Señal”, Alfaomega 2007. 3ª Ed. PIEDRAFITA

MORENO RAMÓN, “Ingeniería de la Automatización Industrial”, Ra-Ma 2001.
 ROCA ALFRED, “Control de Procesos”, Alfaomega, 2002, 2ª Ed.



PORRAS CRIADO ALEJANDRO, "Autómatas Programables, Fundamentos, Manejo, Instalación y

Prácticas", Mc Graw-Hill, 2002

WEBB JOHN W., REIS RONALD A, "Programmable
Logic Controllers, Principles and Applications" Prentice Hall 1995

Complementary Books

Internet Links

<http://www.autotecmex.com/> <http://www.siemens.com.mx> <http://www.schneider-electric.com.mx/>
<http://www.abb.com.mx/> http://www.festo.com/cms/es-mx_mx/ <http://www.smc.com.mx/>
<http://www.parker.com/> <http://www.millerfluidpower.com/> <http://www.rockwellautomation.com/>
<http://www.gefanuc.com/> <http://www.pepperl-fuchs.com/> <http://www.diell.com/>
<http://www.keyence.com/>