



**A) COURSE**

Course Id:	Course
5718	INDUSTRIAL NETWORKS

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
5	2	5	12	80

**B) GENERAL COURSE INFORMATION:**

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
<b>Level:</b>	IX				IX
<b>Course Type (Required/Elective)</b>	Elective				Required
<b>Prerequisite Course:</b>					Programmable Logic Control
<b>CACEI Classification:</b>	IA				IA

**C) COURSE OBJECTIVE**

**At the end of the course, the student will be capable of:**

To apply various field networks used in industrial environments and apply intelligent devices designed to work with these networks, including sensors and actuators.

**D) TOPICS (CONTENTS AND METHODOLOGY)**

1. INTRODUCTION TO COMMUNICATION SYSTEMS		<b>24 Hours</b>
Specific Objective:	<b>Students will learn the fundamentals of communications, data transmission and types, topologies and network protocols</b>	



1.1 Data communication 1.2 Coding characteristics 1.3 Transmission modes 1.4 Communication protocols 1.5 Transmission means 1.6 Communication systems regulations 1.7 Network topologies 1.8 Network types 1.9 Network working fundamentals with OSI model 1.10 Characteristics and importance of OSI model and its application in networks field 1.11 OSI model concepts for standards and communication protocols 1.12 Synchronous and asynchronous communication 1.13 Network architecture based in OSI model 1.14 Ethernet fundamentals 1.15 TCP/IP 1.16 Error detection and correction 1.17 Case of study	
<b>Readings and other resources</b>	Basic book for the subject
<b>Teaching Methodologies</b>	attendance and exposure
<b>Learning Activities</b>	attendance and exposure, development practices

<b>2. DIFFERENT FIELD NETWORKS AND ITS INTERACTION WITH OTHER NETWORKS</b>		<b>23 Hours</b>
Specific Objective:	<b>The student will be able to propose efficient solutions associated with installing of industrial networks, knowing the different existing networks, their characteristics, advantages and disadvantages</b>	
2.1 LAN, MAN, WAN networks 2.2 Data flow basic concepts 2.3 Cabling technologies 2.4 Cabling regulations and standards 2.5 Wireless technology and its protocols 2.6 CAN protocols 2.7 Modbus protocol (RTU, TCP, Modbus+) 2.8 ASI Protocols 2.9 DeviceNet 2.10 Profibus 2.11 Interbus 2.12 Industrial Ethernet 2.13 Network interaction devices 2.14 Redundancy 2.15 Industrial network design project		
<b>Readings and other resources</b>	Basic book for the subject	
<b>Teaching Methodologies</b>	CLASSROOM AND PRACTICES IN LABORATORY	
<b>Learning Activities</b>	CLASSROOM AND PRACTICES IN LABORATORY	



<b>3. CONFIGURATION OF A FIELD NETWORKS AND ITS DEVICES</b>		<b>12 Hours</b>
Specific Objective:	<b>The student will be able to perform network configuration, programming the PLC and the sensors and actuators that it holds</b>	
3.1 Configuring a programmable controller in a network 3.2 Configuring intelligent sensors in a network 3.3 Configuring intelligent actuators in a network 3.4 Interaction among devices in a network 3.5 Intelligent devices		
<b>Readings and other resources</b>	Basic book for the subject	
<b>Teaching Methodologies</b>	CLASSROOM AND PRACTICES IN LABORATORY	
<b>Learning Activities</b>	CLASSROOM AND PRACTICES IN LABORATORY	

<b>4. HIERARCHY IN FIELD NETWORKS (MASTER/SLAVE)</b>		<b>7 Hours</b>
Specific Objective:	<b>The student will be able to integrate a network with multiple controllers, knowing choose the main drivers and the communication between them will</b>	
4.1 Master concept 4.2 Slave concept 4.3 Master-slave configuration in a network		
<b>Readings and other resources</b>	Basic book for the subject	
<b>Teaching Methodologies</b>	CLASSROOM AND PRACTICES IN LABORATORY	
<b>Learning Activities</b>	CLASSROOM AND PRACTICES IN LABORATORY	

<b>5 INTEGRATOR PROJECT DESIGN</b>		<b>14 Hours</b>
Specific Objective:	<b>The student will be able to integrate a network with multiple controllers, knowing choose the main drivers and the communication between them will</b>	
5.1 Application definition 5.2 Network design 5.3 Cost analysis 5.4 Technical documentation 5.5 Implementation proposal		
<b>Readings and other resources</b>	Basic book for the subject	
<b>Teaching Methodologies</b>	CLASSROOM AND PRACTICES IN LABORATORY	
<b>Learning Activities</b>	CLASSROOM AND PRACTICES IN LABORATORY	

**E) TEACHING AND LEARNING METHODOLOGIES**

The teacher will present the topics theoretically, with practical demonstrations. The student will make exercises in which the concepts presented are implemented, will present specific topics and carry out practical work.

At the end of the course, an integrated project where you have to configure multiple devices on a network that contains masters and slaves, give them direction in the controller programming and simulate a production line will be made. It will analyze associated costs, will present the technical documentation and an implementation proposal which argue the advantages thereof.



**F) EVALUATION CRITERIA:**

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
1st Term	3rd week	Exam 85%, Homework 15%,	Units 1
2nd Term	6th week	Exam 85%, Homework 15%,	Unit 2
3rd Term	9th week	Exam 85%, Homework 15%,	Unit 3
4rd Term	13th week		Unit 4
Final evaluation	15th week	100% (Average of the partial evaluations)	Desarrollo y Presentación de proyecto
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**

- a) Guerrero Jiménez, Vicente; Martínez Novoa, Lluís; Yuste Yuste, Ramón Luis. Comunicaciones Industriales. Ed. Marcombo. 1ª ed., 2010. ISBN: 8426715745, ISBN-13: 9788426715746
- b) Rubio Calin, José Miguel. Buses industriales y de campo. Prácticas de laboratorio. Ed. Marcombo. 1ª ed., 2009.  
ISBN: 8426715850, ISBN-13: 9788426715852
- Sempere Payá, Víctor M.; Cerdá Fernández, Sergio. Comunicaciones Industriales con Simatic S7. Universidad Politécnica de Valencia. Servicio de Publicaciones. 1ª ed., 2005. ISBN: 8497058585, ISBN-13: 9788497058582

**Complementary Books**

- a) Thompson, Lawrence. Industrial Data Communications. ISA: The Instrumentation, Systems, and Automation Society; 4th edition, 2008. ISBN-10: 1934394246, ISBN-13: 978-1934394243
- b) Academia de Networking de Cisco Systems: Guía del primer año CCNA 1 y 2, 3ª Ed.
- c) Manuales de los fabricantes

**Internet Links**

ODVA  
<http://www.odva.org/>



CANopen Solutions

<http://www.canopensolutions.com>

CANopen: An overview

<http://www.softing.com/home/en/industrial-automation/products/can-bus/more-can-open/index.php?navanchor=3010572>

Modbus Application Protocol Specification

[http://www.modbus.org/docs/Modbus\\_Application\\_Protocol\\_V1\\_1b.pdf](http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf)

Profibus & Profinet International

<http://www.profibus.com/>

Interbus Basics

<http://www.interbusclub.com/get.php?object=497>