Course guide
820229 - SICIEIA - Information Systems and Industrial Communication

Last modified: 28/06/2024

Unit in charge: Barcelona East School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: PEDRO PONSA ASENSIO

Others:

Primer quadrimestre:
JAVIER FRANCISCO GÁMIZ CARO - Grup T1
MARC LLUVA SERRA - Grup: T23, Grup: T24
MANUEL LOZANO GARCÍA - Grup: T21, Grup: T22

Segon quadrimestre:
PEDRO PONSA ASENSIO - Grup: M1, M2, Grup: M13, Grup: M23,
FERNANDO GUILLERMO SANABRIA ORTEGA - Grup: M11, Grup: M12, Grup; M21, Grup: M22

REQUIREMENTS

CONTROL INDUSTRIAL I AUTOMATITZACIÓ - Precorequisit

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
2. Apply their knowledge to industrial informatics and communications.
3. Design automatic control systems.

Transversal:
06 URI N2. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.
1. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

TEACHING METHODOLOGY

The course uses the teaching class, case study, examples, exercises and project based learning approach.
We recommend the schedule: first CIA, next SICI and finally Automated Systems Integration (ISA).

LEARNING OBJECTIVES OF THE SUBJECT

1. Enter the student the concepts of the diverse industrial communication techniques, terminology used, reference standards and programming protocols.
2. To enable the student / a to discern the functional characteristics of wireless communications and communication networks to plan based industrial field buses.
4. Enter the student / the basic concepts of systems Supervisory Control and Data Acquisition and enable the student / a to define and configure the functionality of the (input-output historical databases, synoptic charts, etc..).

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	15,0	10.00
Hours large group	45,0	30.00

Total learning time: 150 h

CONTENTS

[ENG] Tema1: Presentation

Description:
1.1. Presentation.
1.2. Information systems.
1.3. Communication systems.
1.4. Plan and schedule.

Specific objectives:
This is the presentation of the subject, defining all the systems inside it, and with the plan and schedule of the activities.

Full-or-part-time: 1h
Theory classes: 1h

(ENG) Tema 2: Communication Systems

Description:
2.1. History introduction.
2.2. Communications media.
2.3. Transmission modes.
2.4. Methods of access to the media.
2.5. Reference models. OSI, TCP/IP.
2.6. Communications protocols. Error detection.
2.7. Tool: wireless signal quality analyzer.

Specific objectives:
Student will be able to:
Classify and modelling of communications systems.

Related activities:
- Exam
- Exercises
- Practice Laboratory

Related competencies :
CEEIA-29. Design automatic control systems.
CEEIA-28. Apply their knowledge to industrial informatics and communications.
06 URI N2. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

Full-or-part-time: 24h
Theory classes: 12h
Self study : 12h

(ENG) Tema 3: Industrial networks

Description:
3.1 Communications networks in CIM and ISA95 architectures.
3.2. Network topologies.
3.3. Field bus. Serial communications. MODBUS TCP.
3.4. Ethernet/IP. Time sensitive networking. TSN.
3.5. Gateway.
3.6. Wireless networks.
3.7. Tool: network traffic monitoring.

Specific objectives:
Studnets will be able to
Configure LAN networks and field buses in the A5.4 Laboratory.

Related activities:
- Examen
- Exercises
- Practice laboratory

Related competencies :
CEEIA-29. Design automatic control systems.
CEEIA-28. Apply their knowledge to industrial informatics and communications.
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Full-or-part-time: 24h
Theory classes: 12h
Self study : 12h

(ENG) Tema 4: Supervisory control systems

Description:
4.1. Supervisory control. Monitoring, alarms and fault detection.
4.2. Design and programming of SCADA, HMI applications.
4.3. Flexible assembly system. PLC network configuration with Ethernet/IP..
4.4. Configuration of the communication SCADA-PLC-Flexible assembly system with OPC protocol.
4.5. Communications using MQTT protocol.
4.6. Communications client SCADA/IIoT industrial gateway with OPC UA protocol.
4.7 Examples of PLC-HMI communications.

Specific objectives:
Students will be able to:
Apply a SCADA system into a flexible assembly system.

Related activities:
- Practice Laboratory

Related competencies :
CEEIA-29. Design automatic control systems.
CEEIA-28. Apply their knowledge to industrial informatics and communications.
06 URI N2. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

Full-or-part-time: 8h
Theory classes: 4h
Self study : 4h

(ENG) Tema 5: Information systems

Description:
5.1. Data, instrumentation and knowledge..
5.2. Data visualization with Python.
5.3. Time data analysis. Patterns.
5.4. Database and structured query language.
5.5. Connected enterprise and software development.
5.6. Nachine learning with Python.
5.7. Online exercises using Colab.

Specific objectives:
Students will be able to:
data gathering, data processing, visualization of information, use of Python libraries for data science.

Related activities:
- Autonomous study
- Exercises in classsroom with laptop
- Exam

Related competencies :
CEEIA-29. Design automatic control systems.
CEEIA-28. Apply their knowledge to industrial informatics and communications.
06 URI N2. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

Full-or-part-time: 16h
Theory classes: 8h
Self study : 8h

(ENG) Tema 6: Connected Industry

Description:
6.1. Connected industry. Disruptive technologies.
6.2. Virtual private networks VPN.
6.3. Network security techniques.
6.4. M2M communications. Industrial IoT.
6.5, MQTT protocol.
6.6. Ethernet APL.
6.7. Cloud communications.
5.8. Tool: cryptography and information encryption algorithms.

Specific objectives:
The basic objectis is learn the basic concepts about information and communication related to connected factory.

Related activities:
The associated activity is the AD.
Report.

Full-or-part-time: 7h
Theory classes: 7h

(ENG) Tema 7: Practices of Laboratory

Description:
7.1. SCADA definition. Design and script programming SCADA applications. P&ID diagrams inside SCADA screen.
7.2. FAS201 station.
7.3. PLC network with Ethernet over an assembly academic system.
7.4. SCADA-PLC and OPC comunications.
7.5. Security communications with OPC UA.
7.6. SCADA- IIoT gateway communications.
7.7. Communications with MQTT protocol.

Specific objectives:
Students will be able to:
acquire skills in advanced automation systems: PLC programming and configuration, communication protocols, SCADA application design.

Related activities:
- Autonomous study and group study,
- Exercises
- Searching for data sheets
- Laboratory practices

Related competencies :
CEEIA-29. Design automatic control systems.
CEEIA-28. Apply their knowledge to industrial informatics and communications.
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Full-or-part-time: 45h
Laboratory classes: 15h
Self study : 30h

ACTIVITIES

AD: Connected Industry in action

Description:
The skill in this subject is search of Information resources. Following examples and technical study cases, the students will be able to search information about the connected enterprise (industry 4.0).
For instance: wireless communications, case of success in automation systems, Industrial IoT, cibersecurity cases, advanced graphical HMI (dashboard) or Artificial Intelligence applied to industrial automation systems.

Specific objectives:
Understand the new industrial paradigm.
Industrial study case analysis.
Enterprises and job opportunities.
Writting a polite technical report.
Developing a video-presentation.

Material:
Papers in technical journals. Automática e instrumentación. InfoPLC or in INCIBE-CERT center.
Access to Advanced Factory fair or similar.

Delivery:
Month assessment of the technical report
Deadline at the last weeks of the semester of a video-presentation.

Related competencies :
06 URI N2. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

Full-or-part-time: 18h
Self study: 17h
Guided activities: 1h

GRADING SYSTEM

First exam: 30%
Second exam: 25%
Practice Lab: 25%
Other controls AD: 20%

EXAMINATION RULES.

The evaluation method of this course meets the current academic regulations to be qualified: NO REVALUABLE.

BIBLIOGRAPHY

Basic:
- Valdivia Miranda, Carlos. Comunicaciones industriales. Madrid: Paraninfo, 2019. ISBN 9788428338653.
- Rodríguez Penin, Aquilino. Sistemas SCADA [on line]. 2a ed. Barcelona: Marcombo, 2012 [Consultation: 11/06/2020]. Available on: https://ebookcentral.proquest.com/lib/csuc-ebooks/detail.action?docID=3175459. ISBN 9788426714503.
- Buttu, Marco. El gran libro de Python [on line]. Barcelona: Marcombo, 2016 [Consultation: 02/07/2020]. Available on: https://github.com/marco-buttu/the-pythonic-way.

Complementary:
- Angulo Bahón, Cecilio; Raya Giner, Cristóbal. Tecnología de sistemas de control [on line]. Barcelona: Edicions UPC, 2004 [Consultation: 29/09/2021]. Available on: http://hdl.handle.net/2099.3/36817. ISBN 8483017784.

- Postigo Palacios, Antonio. Seguridad informática. Madrid: Ediciones Paraninfo, S. A, 2020. ISBN 9788428344555.
- Valdivia Miranda, Carlos. Redes telemáticas. Madrid: Paraninfo, 2015. ISBN 9788428334877.
- Castro Gil, Manuel-Alonso. Comunicaciones industriales : sistemas distribuidos y aplicaciones. Unidades didácticas. Madrid: UNED, 2007. ISBN 9788436254679.
- Automática e instrumentación [on line]. Barcelona: CETISA, 1985-Available on: http://www.automaticaeinstrumentacion.com/.- Infoplc++ [on line]. Barcelona, 2018 [Consultation: 28/08/2018]. Available on: http://www.infoplc.net/plus-plus.

RESOURCES

Other resources:
Teaching material in Virtual Campus.
Teaching help support (Wonderware, Rockwell Automation, Mitsubishi i SMC),
On line Python libraries for development and visualization of data.