

Course guide

340240 - SIPI-K7P07 - Integrated Production Systems

Last modified: 03/04/2024

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

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

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

LECTURER

Coordinating lecturer: LUIS MIGUEL MUÑOZ MORGADO

Others: LUIS MIGUEL MUÑOZ MORGADO

PRIOR SKILLS

Previous knowledge on programming, control theory and automation

REQUIREMENTS

Q5: Automatització Industrial; Informàtica Industrial

Q6: Sistemes Robotitzats

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. CE15. Basic knowledge of production and fabrication systems.
2. CE29. Ability to design automation control systems.

TEACHING METHODOLOGY

This subject is an example of learning by doing methodology. A relation between theoretic concepts and applied knowledge. We will use the project based learning and the model role playing approaches. The aim is use learnings tools in order to achieve the autonomy of the engineering students.

LEARNING OBJECTIVES OF THE SUBJECT

- 1 General characteristics of the integrated production systems (from plant level to supervisory control level)
- 2 Skill acquisition in modelling and simulation systems
- 3 Identify essential elements on robotic production systems
- 4 Skill acquisition in developing robotic and computer vision applications over production systems

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	20.00
Hours small group	30,0	20.00
Self study	90,0	60.00



Total learning time: 150 h

CONTENTS

(ENG) Introduction to Computer Integrated Manufacturing

Description:

(ENG) Definitions
The flexible manufacturing
Components of a manufacturing system

Specific objectives:

(ENG) Acquire knowledge about the automation in the different phases of a production process and their interrelationship in the context of CIM systems.

(ENG) Modeling

Description:

(ENG) Modeling and simulation of production processes and logistics
Modeling with Petri Nets
Random effects model

Specific objectives:

(ENG) Modeling physical systems associated with production environments using Petri Nets

Related activities:

(ENG) PR1 Modeling

(ENG) Simulation

Description:

(ENG) Introduction
Simulation of discrete event systems
Verification and validation of models
Analysis of results

Specific objectives:

(ENG) Learn to transfer models and simulation environment to evaluate the performance of production systems

Related activities:

(ENG) PR2 Simulation

(ENG) Computer Vision

Description:

(ENG) Introduction to Computer Vision
Acquisition and image processing
Segmentation and recognition
Industrial vision systems

Specific objectives:

(ENG) Learning the basics of computer vision systems and the techniques applied in production systems

Related activities:

(ENG) PR3 Vision



(ENG) Robotics

Description:

(ENG) Application of robots in production lines Special robots: robotic warehouses, parallel robots, mobile robots, machine tools.

Specific objectives:

(ENG) Learning to identify different types of robotic systems present in production lines. Learn about the application of certain robotic production lines, like those of the production lines of the automotive (welding, painting, ...).

Related activities:

(ENG) PR4 Robotics

Full-or-part-time: 5h

Theory classes: 1h

Practical classes: 4h

(ENG) PR1 Modeling

Description:

(ENG) Introduction to simulation software ARENA
Representation of Petri Nets arena on environment
Petri Nets applied to case studies of production systems
Modeling machines

Specific objectives:

(ENG) Applying knowledge modeling to model production systems and logistics

(ENG) PR2 Simulation

Description:

(ENG) ARENA applied to case studies of production systems
Case studies. Comparison of alternatives

Specific objectives:

(ENG) Apply the concepts of modeling and simulation for the dynamic behavior of systems and evaluate their performance

(ENG) PR3 Vision

Description:

(ENG) Introduction to the toolbox "Image Processing" toolbox of Matlab and National Instruments tools.

Specific objectives:

(ENG) Vision techniques applied to basic applications using computer vision software.

(ENG) PR4 Robotics

Description:

collaborative robot programming
Introduction to the programming of CNC machines

Specific objectives:

(ENG) Learning the programming language of UR robots and CNC machines.

Full-or-part-time: 2h

Guided activities: 2h

GRADING SYSTEM

The final qualification is:

$NF = 0,6X_{Ex} + 0,4X_{Team\ Group}$

Re-evaluation of the individual part

EXAMINATION RULES.

The evaluation is a set of proofs (individual and/or in group), in class or virtual approach:

- Ex individual proof about the theoretical parts of the subject (in class)
- Practicum: guided lessons in the laboratory

BIBLIOGRAPHY

Basic:

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- Computer vision : theory and industrial applications. Berlin [etc.]: Springer-Verlag, 1992. ISBN 3540510368.
- Banks, Jerry [et al.]. Discrete-event system simulation [on line]. 5th ed. Upper Saddle River, NJ: Prentice Hall, 2010 [Consultation: 05/03/2024]. Available on : <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5174427>. ISBN 9780138150372.
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- Guasch, Antoni; Piera, Miguel Àngel; Casanovas, Josep; Figueras, Jaume. Modelado y simulación : aplicación a procesos logísticos de fabricación y servicios [on line]. 2a ed. Barcelona: Edicions UPC, 2003 [Consultation: 20/04/2022]. Available on: <https://upcommons.upc.edu/handle/2099.3/36767>. ISBN 8483017040.
- Fu, K. S. Robótica : Control, detección, visión e inteligencia. Madrid: McGraw-Hill, 1988. ISBN 8476152140.
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- Kelton, W. David; Zupick, Nancy B.; Ivey, Nathan J. Simulation with Arena. 7th ed. New York: McGraw-Hill, 2024. ISBN 9781266275722.
- Escalera Hueso, Arturo de la. Visión por computador : fundamentos y métodos. Madrid [etc.]: Prentice Hall, 2001. ISBN 8420530980.