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Course guide
270504 - SEU - Embedded and Ubiquous Systems

Last modified: 12/07/2022

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

Degree: MASTER'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2012). (Compulsory subject).

Academic year: 2022   **ECTS Credits:** 6.0   **Languages:** Catalan

LECTURER

Coordinating lecturer: DANIEL GARCIA SOLÀ

Others: Primer quadrimestre:
DANIEL GARCIA SOLÀ - 10

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CTE1. Capability to model, design, define the architecture, implement, manage, operate, administrate and maintain applications, networks, systems, services and computer contents.
CTE8. Capability to design and develop systems, applications and services in embedded and ubiquitous systems .

Generical:
CG1. Capability to plan, calculate and design products, processes and facilities in all areas of Computer Science.
CG2. Capacity for management of products and installations of computer systems, complying with current legislation and ensuring the quality of service.
CG6. Capacity for general management, technical management and research projects management, development and innovation in companies and technology centers in the area of Computer Science.
CG7. Capacity for implementation, direction and management of computer manufacturing processes, with guarantee of safety for people and assets, the final quality of the products and their homologation.
CG8. Capability to apply the acquired knowledge and to solve problems in new or unfamiliar environments inside broad and multidisciplinary contexts, being able to integrate this knowledge.

Transversal:
CTR2. SUSTAINABILITY AND SOCIAL COMMITMENT : Capability to know and understand the complexity of the typical economic and social phenomena of the welfare society. Capacity for being able to analyze and assess the social and environmental impact.
CTR5. APPROPIATE ATTITUDE TOWARDS WORK: Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.

Basic:
CB6. Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.

TEACHING METHODOLOGY

Teaching methodology is described in Activities

LEARNING OBJECTIVES OF THE SUBJECT

STUDY LOAD

Type	Hours	Percentage
Hours large group	24,0	16.00
Hours small group	24,0	16.00
Self study	96,0	64.00
Guided activities	6,0	4.00

Total learning time: 150 h

CONTENTS

(ENG) Introducció

Description:
(ENG) Que és un sistema encastat? Esquema general d'un sistema encastat i distribuït. Conceptes bàsics.

Fiabilitat i Seguretat.

Abast. Aplicacions.

Specific objectives:
(ENG)

Related activities:
(ENG)

(ENG) Plataformes hardware per a sistemes encastats

Description:
(ENG) Alternatives. Arquitectures, exemples d'aplicació.

Busos i interfícies.

Dispositius d'E/S. Sensors i actuadors.

Instrumentació i adquisició de dades.

Specific objectives:
(ENG)

Related activities:
(ENG)

(ENG) Disseny i desenvolupament de sistemes encastats

Description:
(ENG) Requeriments funcionals d'un sistema.

Disseny conscient de l'arquitectura.

Co-disseny hardware-software.

Eines d'emulació i desenvolupament.

Specific objectives:
(ENG)

Related activities:
(ENG)

(ENG) Sistemes operatius per sistemes encastats

Description:
(ENG) Requeriments: compacitat, eficiència i fiabilitat.

Sistemes crítics. Hard i Soft Real-Time.

Sistemes operatius en temps real.

Specific objectives:
(ENG)

Related activities:
(ENG)

(ENG) Sistemes ubics i mòbils

Description:
(ENG) Interconnexió de dispositius. Topologies.

Xarxes per sistemes encastats.

Intel·ligència ambiental (ambient intelligence).

Exemples d'aplicació: automoció, domòtica, seguretat, robòtica, agricultura, ...

Specific objectives:
(ENG)

Related activities:
(ENG)

(ENG) Avaluació dels sistemes encastats

Description:
(ENG) Fiabilitat i tolerància a fallades.

Seguretat: estàndards de seguretat (SIL).

Eficiència.

Specific objectives:
(ENG)

Related activities:
(ENG)

ACTIVITIES

(ENG) Desenvolupament del tema 1 de l'assignatura

Description:
(ENG)

Specific objectives:
(ENG) 1

Material:
(ENG)

Delivery:
(ENG)

Related competencies :
CG2. Capacity for management of products and installations of computer systems, complying with current legislation and ensuring the quality of service.
CG6. Capacity for general management, technical management and research projects management, development and innovation in companies and technology centers in the area of Computer Science.
CG1. Capability to plan, calculate and design products, processes and facilities in all areas of Computer Science.
CG7. Capacity for implementation, direction and management of computer manufacturing processes, with guarantee of safety for people and assets, the final quality of the products and their homologation.
CG8. Capability to apply the acquired knowledge and to solve problems in new or unfamiliar environments inside broad and multidisciplinary contexts, being able to integrate this knowledge.
CTE1. Capability to model, design, define the architecture, implement, manage, operate, administrate and maintain applications, networks, systems, services and computer contents.
CTE8. Capability to design and develop systems, applications and services in embedded and ubiquitous systems .
CTR2. SUSTAINABILITY AND SOCIAL COMMITMENT : Capability to know and understand the complexity of the typical economic and social phenomena of the welfare society. Capacity for being able to analyze and assess the social and environmental impact.
CTR5. APPROPIATE ATTITUDE TOWARDS WORK: Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.
CB6. Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.

Full-or-part-time: 8h
Theory classes: 3h
Laboratory classes: 2h
Self study: 3h

(ENG) Desenvolupament del tema 2 de l'assignatura

Description:
(ENG)

Specific objectives:
(ENG) 1

Material:
(ENG)

Delivery:
(ENG)

Related competencies :
CG2. Capacity for management of products and installations of computer systems, complying with current legislation and ensuring the quality of service.
CG6. Capacity for general management, technical management and research projects management, development and innovation in companies and technology centers in the area of Computer Science.
CG1. Capability to plan, calculate and design products, processes and facilities in all areas of Computer Science.
CG7. Capacity for implementation, direction and management of computer manufacturing processes, with guarantee of safety for people and assets, the final quality of the products and their homologation.
CG8. Capability to apply the acquired knowledge and to solve problems in new or unfamiliar environments inside broad and multidisciplinary contexts, being able to integrate this knowledge.
CTE1. Capability to model, design, define the architecture, implement, manage, operate, administrate and maintain applications, networks, systems, services and computer contents.
CTE8. Capability to design and develop systems, applications and services in embedded and ubiquitous systems .
CTR2. SUSTAINABILITY AND SOCIAL COMMITMENT : Capability to know and understand the complexity of the typical economic and social phenomena of the welfare society. Capacity for being able to analyze and assess the social and environmental impact.
CTR5. APPROPIATE ATTITUDE TOWARDS WORK: Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.
CB6. Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.

Full-or-part-time: 15h
Theory classes: 3h
Laboratory classes: 6h
Self study: 6h

(ENG) Desenvolupament del tema 3 de l'assignatura

Description:
(ENG)

Specific objectives:
(ENG) 1

Material:
(ENG)

Delivery:
(ENG)

Related competencies :
CG2. Capacity for management of products and installations of computer systems, complying with current legislation and ensuring the quality of service.
CG6. Capacity for general management, technical management and research projects management, development and innovation in companies and technology centers in the area of Computer Science.
CG1. Capability to plan, calculate and design products, processes and facilities in all areas of Computer Science.
CG7. Capacity for implementation, direction and management of computer manufacturing processes, with guarantee of safety for people and assets, the final quality of the products and their homologation.
CG8. Capability to apply the acquired knowledge and to solve problems in new or unfamiliar environments inside broad and multidisciplinary contexts, being able to integrate this knowledge.
CTE1. Capability to model, design, define the architecture, implement, manage, operate, administrate and maintain applications, networks, systems, services and computer contents.
CTE8. Capability to design and develop systems, applications and services in embedded and ubiquitous systems .
CTR2. SUSTAINABILITY AND SOCIAL COMMITMENT : Capability to know and understand the complexity of the typical economic and social phenomena of the welfare society. Capacity for being able to analyze and assess the social and environmental impact.
CTR5. APPROPIATE ATTITUDE TOWARDS WORK: Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.
CB6. Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.

Full-or-part-time: 16h
Theory classes: 4h
Laboratory classes: 6h
Self study: 6h

(ENG) Desenvolupament del tema 4 de l'assignatura

Description:
(ENG)

Specific objectives:
(ENG) 1

Material:
(ENG)

Delivery:
(ENG)

Related competencies :
CG2. Capacity for management of products and installations of computer systems, complying with current legislation and ensuring the quality of service.
CG6. Capacity for general management, technical management and research projects management, development and innovation in companies and technology centers in the area of Computer Science.
CG1. Capability to plan, calculate and design products, processes and facilities in all areas of Computer Science.
CG7. Capacity for implementation, direction and management of computer manufacturing processes, with guarantee of safety for people and assets, the final quality of the products and their homologation.
CG8. Capability to apply the acquired knowledge and to solve problems in new or unfamiliar environments inside broad and multidisciplinary contexts, being able to integrate this knowledge.
CTE1. Capability to model, design, define the architecture, implement, manage, operate, administrate and maintain applications, networks, systems, services and computer contents.
CTE8. Capability to design and develop systems, applications and services in embedded and ubiquitous systems .
CTR2. SUSTAINABILITY AND SOCIAL COMMITMENT : Capability to know and understand the complexity of the typical economic and social phenomena of the welfare society. Capacity for being able to analyze and assess the social and environmental impact.
CTR5. APPROPIATE ATTITUDE TOWARDS WORK: Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.
CB6. Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.

Full-or-part-time: 15h
Theory classes: 3h
Laboratory classes: 6h
Self study: 6h

(ENG) Desenvolupament del tema 5 de l'assignatura

Description:
(ENG)

Specific objectives:
(ENG) 1

Material:
(ENG)

Delivery:
(ENG)

Related competencies :
CG2. Capacity for management of products and installations of computer systems, complying with current legislation and ensuring the quality of service.
CG6. Capacity for general management, technical management and research projects management, development and innovation in companies and technology centers in the area of Computer Science.
CG1. Capability to plan, calculate and design products, processes and facilities in all areas of Computer Science.
CG7. Capacity for implementation, direction and management of computer manufacturing processes, with guarantee of safety for people and assets, the final quality of the products and their homologation.
CG8. Capability to apply the acquired knowledge and to solve problems in new or unfamiliar environments inside broad and multidisciplinary contexts, being able to integrate this knowledge.
CTE1. Capability to model, design, define the architecture, implement, manage, operate, administrate and maintain applications, networks, systems, services and computer contents.
CTE8. Capability to design and develop systems, applications and services in embedded and ubiquitous systems .
CTR2. SUSTAINABILITY AND SOCIAL COMMITMENT : Capability to know and understand the complexity of the typical economic and social phenomena of the welfare society. Capacity for being able to analyze and assess the social and environmental impact.
CTR5. APPROPIATE ATTITUDE TOWARDS WORK: Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.
CB6. Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.

Full-or-part-time: 14h
Theory classes: 3h
Laboratory classes: 5h
Self study: 6h

(ENG) Desenvolupament del tema 6 de l'assignatura

Description:
(ENG)

Specific objectives:
(ENG) 1

Material:
(ENG)

Delivery:
(ENG)

Related competencies :
CG2. Capacity for management of products and installations of computer systems, complying with current legislation and ensuring the quality of service.
CG6. Capacity for general management, technical management and research projects management, development and innovation in companies and technology centers in the area of Computer Science.
CG1. Capability to plan, calculate and design products, processes and facilities in all areas of Computer Science.
CG7. Capacity for implementation, direction and management of computer manufacturing processes, with guarantee of safety for people and assets, the final quality of the products and their homologation.
CG8. Capability to apply the acquired knowledge and to solve problems in new or unfamiliar environments inside broad and multidisciplinary contexts, being able to integrate this knowledge.
CTE1. Capability to model, design, define the architecture, implement, manage, operate, administrate and maintain applications, networks, systems, services and computer contents.
CTE8. Capability to design and develop systems, applications and services in embedded and ubiquitous systems .
CTR2. SUSTAINABILITY AND SOCIAL COMMITMENT : Capability to know and understand the complexity of the typical economic and social phenomena of the welfare society. Capacity for being able to analyze and assess the social and environmental impact.
CTR5. APPROPIATE ATTITUDE TOWARDS WORK: Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.
CB6. Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.

Full-or-part-time: 9h
Theory classes: 3h
Self study: 6h

(ENG) Primer parcial

Description:
(ENG)

Specific objectives:
(ENG) 1

Material:
(ENG)

Delivery:
(ENG)

Related competencies :
CG2. Capacity for management of products and installations of computer systems, complying with current legislation and ensuring the quality of service.
CG6. Capacity for general management, technical management and research projects management, development and innovation in companies and technology centers in the area of Computer Science.
CG1. Capability to plan, calculate and design products, processes and facilities in all areas of Computer Science.
CG7. Capacity for implementation, direction and management of computer manufacturing processes, with guarantee of safety for people and assets, the final quality of the products and their homologation.
CG8. Capability to apply the acquired knowledge and to solve problems in new or unfamiliar environments inside broad and multidisciplinary contexts, being able to integrate this knowledge.
CTE1. Capability to model, design, define the architecture, implement, manage, operate, administrate and maintain applications, networks, systems, services and computer contents.
CTE8. Capability to design and develop systems, applications and services in embedded and ubiquitous systems .
CTR2. SUSTAINABILITY AND SOCIAL COMMITMENT : Capability to know and understand the complexity of the typical economic and social phenomena of the welfare society. Capacity for being able to analyze and assess the social and environmental impact.
CTR5. APPROPIATE ATTITUDE TOWARDS WORK: Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.
CB6. Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.

Full-or-part-time: 12h
Guided activities: 2h
Self study: 10h

(ENG) Segon parcial

Description:
(ENG)

Specific objectives:
(ENG)

Material:
(ENG)

Delivery:
(ENG)

Full-or-part-time: 12h
Guided activities: 2h
Self study: 10h

(ENG) Proposta Treball Dirigit (P1)

Description:
(ENG)

Specific objectives:
(ENG)

Material:
(ENG)

Delivery:
(ENG)

Full-or-part-time: 6h 18m
Guided activities: 0h 18m
Self study: 6h

(ENG) Pre-projecte Treball Dirigit (P2)

Description:
(ENG)

Specific objectives:
(ENG)

Material:
(ENG)

Delivery:
(ENG)

Full-or-part-time: 10h 42m
Guided activities: 1h 42m
Self study: 9h

(ENG) Defensa Projecte Treball Dirigit (P3)

Description:
(ENG)

Specific objectives:
(ENG)

Material:
(ENG)

Delivery:
(ENG)

Full-or-part-time: 12h 42m
Guided activities: 2h
Self study: 10h 42m

GRADING SYSTEM

Not yet translated

BIBLIOGRAPHY

Basic:

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- Zurawski, R. Embedded systems handbook [on line]. 2nd ed. CRC Press, 2009 [Consultation: 10/05/2023]. Available on: https://www-taylorfrancis-com.recursos.biblioteca.upc.edu/books/mono/10.1201/9781315218281/embedded-systems-handbook-richard-zurawski. ISBN 9781315222301.
- Marwedel, P. Embedded system design: embedded systems, foundations of cyber-physical systems, and the internet of things [on line]. 4th edition. Springer, 2021 [Consultation: 18/01/2023]. Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/978-3-030-60910-8. ISBN 9783030609108.
- Valvano, J. Embedded systems: real-time operating systems for ARM CortexTM-M microcontrollers. 4th ed, 5th printing. Jonathan W. Valvano, 2019. ISBN 9781466468863.
- Kopetz, H. Real-time systems: design principles for distributed embedded applications. 2nd ed. Springer, 2011. ISBN 978-1-4419-8236-0.