



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
EXCELLENCE

COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros
Industriales

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

53001545 - Wireless Sensor Networks

DEGREE PROGRAMME

05BG - Master Universitario En Electronica Industrial

ACADEMIC YEAR & SEMESTER

2019/20 - Semester 1

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Learning guide

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1. Description

1.1. Subject details

| | |
|---------------------------------------|--|
| Name of the subject | 53001545 - Wireless Sensor Networks |
| No of credits | 3 ECTS |
| Type | Optional |
| Academic year of the programme | First year |
| Semester of tuition | Semester 1 |
| Tuition period | September-January |
| Tuition languages | English |
| Degree programme | 05BG - Master Universitario En Electronica Industrial |
| Centre | 05 - Escuela Tecnica Superior de Ingenieros Industriales |
| Academic year | 2019-20 |

2. Faculty

2.1. Faculty members with subject teaching role

| Name and surname | Office/Room | Email | Tutoring hours * |
|--|--------------------|-----------------------|-------------------------|
| Jorge Portilla Berrueco (Subject coordinator) | E3 | jorge.portilla@upm.es | Sin horario. |
| Teresa Riesgo Alcaide | E10 | teresa.riesgo@upm.es | Sin horario. |

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

2.2. Research assistants

| Name and surname | Email | Faculty member in charge |
|---------------------------|-----------------------|--------------------------|
| Mujica Rojas, Gabriel Noe | gabriel.mujica@upm.es | Portilla Berrueco, Jorge |

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Sistemas micropocesadores

4. Skills and learning outcomes *

4.1. Skills to be learned

CB06 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

CB07 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio

CB08 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios

CB09 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

CE02 - Ser capaz de desarrollar un proyecto de diseño de un sistema electrónico, identificando sus principales retos, en ámbitos de aplicación tales como el aeroespacial, la automoción, la ingeniería médica, las energías renovables o las comunicaciones

CE03 - Optimizar la gestión energética de los sistemas electrónicos mediante la aplicación de técnicas avanzadas de diseño de circuitos y de métodos de control.

CG02 - Saber aplicar e integrar sus conocimientos, la comprensión de estos, su fundamentación científica y sus capacidades de resolución de problemas en entornos nuevos y definidos de forma imprecisa, incluyendo contextos de carácter multidisciplinar tanto investigadores como profesionales altamente especializados.

CG05 - Saber transmitir de un modo claro y sin ambigüedades a un público especializado o no, resultados procedentes de la investigación científica y tecnológica o del ámbito de la innovación más avanzada, así como los fundamentos más relevantes sobre los que se sustentan

CG06 - Haber desarrollado la autonomía suficiente para participar en proyectos de investigación y colaboraciones científicas o tecnológicas dentro de su ámbito temático, en contextos interdisciplinares y, en su caso, con una alta componente de transferencia del conocimiento.

CT01 - Uso de la lengua inglesa

CT04 - Organización y planificación

4.2. Learning outcomes

RA23 - Recopilar, presentar y resumir información contenido en la literatura en el marco de los sistemas embebidos conectados en red

RA21 - Diseñar y planificar despliegues de redes de sensores inalámbricas (WSN)

RA22 - Analizar y clasificar tecnologías de comunicaciones inalámbricas en el marco de la Internet de las Cosas

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

The subject Wireless Sensor Networks contains the key technological aspects that are used today in the new Internet of Things paradigm.

Topics from radio communications, processing, power supply, sensing circuits and deployment methodologies, among others, are explained in this subject.

There are several practical aspects as distributed applications, low power budget, low data rate constraints, among others, that are faced in the semester.

5.2. Syllabus

1. Introduction to Wireless Sensor Networks
2. Hardware of the nodes
3. WSN architecture. Topologies
4. Routing protocols, self-organization and node discovery in WSNs
5. Power consumption and power saving systems in WSNs
6. Deployment techniques and commissioning
7. Testbeds and debugging
8. Dependability in WSNs

6. Schedule

6.1. Subject schedule*

| Week | Face-to-face classroom activities | Face-to-face laboratory activities | Other face-to-face activities | Assessment activities |
|------|---|--|-------------------------------|--|
| 1 | Introduction Duration: 02:00 | | | |
| 2 | Hardware of the nodes Duration: 02:00 | | | |
| 3 | | Practice 1: Introduction to hardware nodes Duration: 02:00 | | |
| 4 | | Practice 2: Introduction to WSN node programming Duration: 00:00 | | |
| 5 | Routing protocols, self-organization and node discovery in WSNs Duration: 02:00 | | | |
| 6 | Power consumption and power saving systems in WSNs Duration: 02:00 | | | |
| 7 | Deployment techniques and commissioning Duration: 03:00 | | | |
| 8 | | Practice 3: Radio module introduction Duration: 03:00 | | |
| 9 | Testbeds and debugging Duration: 03:00 | | | |
| 10 | | Practice 4: Multi-node application Duration: 03:00 | | |
| 11 | | Practice 6: Deployment Duration: 03:00 | | |
| 12 | | | | Presentation of research work Continuous assessment Duration: 03:00 |

| | | | | |
|----|--|--|--|---|
| 13 | | | | Presentation of practical work Continuous assessment Duration: 03:00 |
| 14 | | | | |
| 15 | | | | |
| 16 | | | | |
| 17 | | | | Final exam Continuous assessment and final examination Duration: 02:00 Final exam Final examination Duration: 00:00 |

The independent study hours are training activities during which students should spend time on individual study or individual assignments.

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The subject schedule is based on a previous theoretical planning of the subject plan and might go through experience some unexpected changes along throughout the academic year.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

| Week | Description | Modality | Type | Duration | Weight | Minimum grade | Evaluated skills |
|------|--------------------------------|----------|--------------|----------|--------|---------------|--|
| 12 | Presentation of research work | | Face-to-face | 03:00 | 30% | 5 / 10 | CT01 CT04 CG05 CB06 |
| 13 | Presentation of practical work | | Face-to-face | 03:00 | 20% | 5 / 10 | CT01 CT04 CG02 CG05 CG06 CB06 CB07 CB08 CE02 CE03 CB09 |
| 17 | Final exam | | Face-to-face | 02:00 | 50% | 5 / 10 | |

7.1.2. Final examination

| Week | Description | Modality | Type | Duration | Weight | Minimum grade | Evaluated skills |
|------|-------------|----------|--------------|----------|--------|---------------|------------------|
| 17 | Final exam | | Face-to-face | 02:00 | 50% | 5 / 10 | |
| 17 | Final exam | | Face-to-face | 00:00 | 50% | 5 / 10 | |

7.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

7.2. Assessment criteria

The score is based on a theory exam, plus a team work on a wireless sensor network application and a presentation of a research work focused on a specific research area within wireless sensor networks

8. Teaching resources

8.1. Teaching resources for the subject

| Name | Type | Notes |
|--|--------------|--|
| System Architecture for Wireless Sensor Networks | Bibliography | PhD thesis Jason Lester Hill, U. C. Berkeley, 2003 |
| Ubiquitous Computing: Smart Devices, Environments and Interactions | Bibliography | book, S. Posland, Wiley & sons. 2009 |
| Wireless Sensor Networks. Technology, Protocols and Applications | Bibliography | book, Wiley InterScience (2007). |