INTERNATIONAL
CAMPUS OF
EXCELLENCE

POLITÉCNICA

E.T.S. de Ingenieria y Sistemas
de Telecomunicacion

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

593000500 - Architectures And Service Platforms

DEGREE PROGRAMME

59AH - Master Universitario En Internet Of Things (iot)

ACADEMIC YEAR & SEMESTER

2024/25 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	593000500 - Architectures And Service Platforms
No of credits	4.5 ECTS
Type	Compulsory
Academic year ot the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	59AH - Master Universitario en Internet Of Things (Iot)
Centre	59 - Escuela Tecnica Superior De Ingenieria Y Sistemas De Telecomunicacion
Academic year	2024-25

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Jose Fernan Martinez Ortega (Subject coordinator)	A4407	jf.martinez@upm.es	Sin horario. Tutoring by appointment
Vicente Hernandez Diaz	A4412	vicente.hernandez@upm.es	Sin horario. Tutoring by appointment

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Marta Muriel Elduayen	A4414	marta.muriel.elduayen@upm.es	Sin horario. Tutoring by appointment

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

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

- Distributed Systems For Iot

3.2. Other recommended learning outcomes

- Distributed Applications

- Software Architectures

- Knowledge and usage of telecommunication networking

- Communication Networks

- Systems and services programming skills

4. Skills and learning outcomes *

4.1. Skills to be learned

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

CE.05 - Diseñar y desarrollar sistemas distribuidos para dar soporte a aplicaciones IoT, evaluando las tecnologías mas apropiadas de acuerdo con los diferentes contextos de aplicación como son despositivos móviles, sistemas

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en tiempo real o sistemas ubícuos

CE.07 - Integrar diferentes dispositivos IoT en una arquitectura global teniendo en cuenta los protocolos empleados y los estándares internacionales

CE.08 - Diseñar y desarrollar soluciones tecnológicas para implementar servicios IoT capaces de interactuar con diferentes fuentes de información y dispositivos distribuidos incluyendo el diseño de estructuras de intercambio de información eficientes

CG01 - Los alumnos demostrarán tener una visión del estado actual, las necesidades y los problemas que se plantean en el mundo de la IoT, así como de las arquitecturas y estándares más utilizados

CG03 - Los alumnos demostrarán tener las destrezas necesarias para integrar y aplicar los conocimientos adquiridos de forma que puedan desarrollar soluciones innovadoras y servicios IoT en general

CT.01 - Capacidad de uso de la lengua inglesa para el trabajo en contextos internacionales

4.2. Learning outcomes

RA26 - To explain the technological characteristics of the architectures, platforms, networks and protocols enabling IoT services and applications.

RA27 - To know the technological characteristics of the service architectures and the related platforms to learn how to design and carry out IoT based solutions to be run in such architectures and platforms.

* 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 "*Architectures and Service Platforms*" addresses the IoT Reference Model and the Architecture Model that have been recently standardized by international organizations like ITU-T and others more specifically related to IoT. The proposed Domain Model for IoT is presented, going through all the concepts and elements that are common for every IoT based system, such as Physical Entity, Virtual Entity, User, Resources or Devices, and the relationships among them. That model is studied by means of analyzing several real use cases from real IoT based systems.

A methodology or guideline for planning and developing IoT based applications will be also studied by carrying out at least two use cases. The students will design and develop a small sized IoT based application that will be deployed in a real and well-known IoT platform that several manufacturers already use for exploiting their solutions.

5.2. Syllabus

1. Introduction

2. Internet of Things (IoT) and Ubiquitous Computing

    2.1. Ubiquitous computing and the impact on IoT

    2.2. Technologies preceding and enabling IoT

3. IoT Fundamentals

    3.1. IoT standardization

    3.2. IoT Domain Model

    3.3. IoT Functional Model

4. IoT Architectural Reference Model

    4.1. IoT basic architectural elements

    4.2. Overview of existing IoT platforms

5. Basic guideline for developing IoT based applications

    5.1. Introducing a basic guideline for developing IoT applications

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5.2. Developing of an IoT application

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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	**Introduction** Duration: 01:30 Lecture **Internet of Things (IoT) and Ubiquitous Computing** Duration: 02:00 Lecture **IoT Fundamentals** Duration: 02:00 Lecture			
2	**IoT Fundamentals** Duration: 01:30 Lecture **Description of the projects to be developed along the subject** Duration: 02:00 Cooperative activities **IoT Architectural Model Reference** Duration: 02:00 Lecture			
3	**Introduction to Lab. Development Environment** Duration: 01:30 Laboratory assignments **Basic guideline for developing IoT based applications** Duration: 02:00 Lecture **PART I: IoT Application Development** Duration: 02:00 Laboratory assignments			**Use Case Report** Individual work Progressive assessment Not Presential Duration: 00:10
4	**PART I: IoT Application Development** Duration: 03:30 Laboratory assignments			
5	**PART II: IoT Application Development** Duration: 03:30 Laboratory assignments **IoT Application Defense I** Duration: 02:00 Additional activities **IoT Application Functional Assesment I** Duration: 01:30			**IoT Application Defense I** Group presentation Progressive assessment Presential Duration: 02:00 **IoT Application Functional Assesment I** Group work Progressive assessment Presential

#				
	Additional activities			Duration: 01:30 **IoT Application Report I** Group work Progressive assessment Not Presential Duration: 00:10
6	**PART II: IoT Application Development** Duration: 07:00 Laboratory assignments			
7	**PART II: IoT Application Development** Duration: 07:00 Laboratory assignments **IoT Application Defense II** Duration: 02:00 Additional activities **IoT Application Functional Assesment II** Duration: 01:30 Additional activities			**IoT Application Defese II** Group presentation Progressive assessment and Global Examination Presential Duration: 02:00 **IoT Application Report II** Group work Progressive assessment and Global Examination Not Presential Duration: 00:10 **IoT Application Functional Assesment II** Group work Progressive assessment and Global Examination Presential Duration: 01:30 **Use Case Report** Individual work Global examination Not Presential Duration: 00:10
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				

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 schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Use Case Report	Individual work	No Presential	00:10	20%	4 / 10	CB08 CB09 CG01 CG03 CT.01 CE.07
5	IoT Application Defense I	Group presentation	Face-to-face	02:00	10%	/ 10	CB09 CG03 CT.01 CE.05 CE.07 CE.08
5	IoT Application Functional Assesment I	Group work	Face-to-face	01:30	10%	/ 10	CB09 CG03 CT.01 CE.05 CE.07 CE.08
5	IoT Application Report I	Group work	No Presential	00:10	20%	/ 10	CB09 CG03 CT.01 CE.05 CE.07 CE.08
7	IoT Application Defese II	Group presentation	Face-to-face	02:00	10%	4 / 10	CB09 CG03 CT.01 CE.05 CE.07 CE.08
7	IoT Application Report II	Group work	No Presential	00:10	20%	4 / 10	CB09 CG03 CT.01 CE.05 CE.07 CE.08

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7	IoT Application Functional Assesment II	Group work	Face-to-face	01:30	10%	4 / 10	CB09 CG03 CT.01 CE.05 CE.07 CE.08

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	IoT Application Defese II	Group presentation	Face-to-face	02:00	10%	4 / 10	CB09 CG03 CT.01 CE.05 CE.07 CE.08
7	IoT Application Report II	Group work	No Presential	00:10	20%	4 / 10	CB09 CG03 CT.01 CE.05 CE.07 CE.08
7	IoT Application Functional Assesment II	Group work	Face-to-face	01:30	10%	4 / 10	CB09 CG03 CT.01 CE.05 CE.07 CE.08
7	Use Case Report	Individual work	No Presential	00:10	20%	4 / 10	

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Use Case report t and IoT Application Report	Individual work	Face-to-face	00:40	30%	4 / 10	CB08 CB09 CG01 CG03 CT.01 CE.07
Project Functional Assessmen	Problem-solving test	Face-to-face	02:30	50%	4 / 10	CB09 CG03 CT.01 CE.05 CE.07 CE.08

Project Defense	Individual presentation	Face-to-face	02:00	20%	4 / 10	CB09 CG03 CT.01 CE.05 CE.07

7.2. Assessment criteria

The dates of the different activities of the course depend on the organization of the Semester Evaluation Plan, coordinated by the SOA, and are published in the Annual Teaching Plan of the Faculty. In the event of any discrepancy that may arise between the information published in this guide and that published in the Annual Teaching Plan, the information published in the latter should be taken into account, since the appropriate updates are made therein.

The final mark for each student in this course will be a number between 0 and 10 points. The course is passed if the mark is equal or above 5 points.

The course is designed to be passed by means of a continuous assessment system, also called progressive assessment system. The students following this system will have to attend the face-to-face activities that will let professors check the correct progress of the students as well as provide them with the accurate feedback, so that they can achieve the objectives of the subject in a proper way. The progressive assessment system is made of 7 activities described in the table above.

There is also a global assessment system, also referred as Global Assessment Activity in this document, intended for the students that are not able to pass the course following completely the progressive assessment system. In that case, those students must repeat again the assessment activities that have been failed in the progressive assessment system, those that the student has not got the minimum required mark (4 points). The global assessment system is carried out once the lecturing and lab activities are over, according to the schedule in the previous sections. It is important to mention that the maximum grade for this global activity is 6.0.

The following criteria will be considered when assessing each of the evaluated activities:

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1. Written documents:

    - Technical correctness, completeness, originality, and accuracy.

    - Presentation: correctness, clarity, grammar, and format.

2. Defense (oral) presentations:

    - Execution: clarity, conciseness, correctness, faithfulness of the presentation to the written document, quality of the auxiliary means (power point slides, use of the blackboard, etc.).

    - Questions: accuracy and correctness when answering to questions.

3. Practical work: correct functioning.

    - The service or application correctly functions as specified by the own students' practical work documents describing their applicactions

- Questions: accuracy and correctness when answering to questions related to any aspect of their application.

The students that fail to pass this course by means of either assessment system (progressive or global) have a second opportunity (Extraordinary Assessment). This extraordinary assessment consists of three activities based on the same project executed along the semester, as is depicted in the table above.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Enabling things to talk, A. Bassi, M. Bauer et al.	Bibliography	"Enabling Things to Talk. Designing IoT solutions with the IoT Architectural Reference Model", Bassi, A., Bauer, M., et al., 2013, Springer-Verlag Berlin Heidelberg, doi://10.1007/978-3-642-40403-0, https://www.springer.com/gp/book/9783642404023

Personal Computer	Equipment	Personal computer with Internet connection for carrying out practical exercises.
IoT Platform	Equipment	IoT platform for developing IoT applications.
Networked sensors	Equipment	The sensors and communication platform previously studied in the subjects "Embedded systems and IoT devices" and "Sensor Networks" are to be used in this subject to provide the IoT platform with data.
Subject Moodle based web site	Web resource	UPM web site based on Moodle where short technical documents, bibliographic resources, practical exercises instructions and subject slides will be published. Several educational forums will be also available for discussions.

9. Other information

9.1. Other information about the subject

Sustainable Development Goals

The topics addressed in this course can contribute positively to the following Sustainable Development Goals of the United Nations: 4 and 9 devoted respectively to *Quality Education* and *Industry, Innovation and Infrastructure,* as the number of people with high qualified technical and professionals skills will be increased (goal 4.4), as well as the opportunity for developing reliable, resilient and high quality infrastructure (goal 9.1).

Actions to prevent plagiarism and copying (cheating).

Anti-plagiarisms tools like Turnitin will be used whenever feasible in order to detect plagiarisms attempts. Should a student plagiarizes or cheats during an assessment activity, such assessment activity will be graded with 0 points, and even the assessment activity might be interrupted.

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The subject's academic board or the Chair of the Department could report such events to the University Rector so that corresponding disciplinary actions could be taken.

Disclaimer

- The information in this learning guide is illustrative and so might be changed due to typos, omissions, unpredictable events that might occur along the course or whenever required for the proper progress of the subject.