Universidad de Alcalá

TEACHING GUIDE

Next-Gen Intelligent and Sustainable Systems

Degree in
Electronic Communications Engineering (GIEC)
Telecommunication Technologies Engineering (GITT)
Telematics Engineering (GIT)

Universidad de Alcalá

Academic Year 2026/2027

4th Year - 2nd Semester (GIEC+GITT+GIT)

Approved by the EPS School Board on June 15th, 2026

TEACHING GUIDE

Course Name:	**Next-Gen Intelligent and Sustainable Systems**
Code:	**350055 (GIEC+GITT+GIT)**
Degree in:	**Electronic Communications Engineering (GIEC)** **Telecommunication Technologies Engineering (GITT)** **Telematics Engineering (GIT)**
Department and area:	**Teoría de la Señal y Comunicaciones** **Teoría de la Señal y Comunicaciones**
Type:	**Optional (Generic) (GIEC+GITT+GIT)**
ECTS Credits:	**6.0**
Year and semester:	**4th Year - 2nd Semester (GIEC+GITT+GIT)**
Teachers:	Pilar Martín Martín
Tutoring schedule:	Consultar al comienzo de la asignatura
Language:	English

1. COURSE SUMMARY

The main objective of this course is to introduce the students to the field of a new generation of Intelligent and sustainable systems (NextGen) in a very simple way. It will provide them the basic knowledge for their professional future.

The course is structured in four main parts:

- Suitable systems for PassivHaus - Photovoltaic Systems
- Blockchain Technology.
- Prompt Engineering, Machine Learning and Deep Learning
- Internet of Things (IoT) & Smart Technologies,

This course provides an overview of emerging digital and sustainable technologies shaping modern industry and smart infrastructures, with a strong practical component in each module. It covers suitable systems for Passive House Institute/PassivHaus environments, focusing on the integration and practical implementation of photovoltaic systems for energy-efficient and sustainable building design. The course also introduces Blockchain Technology and its real-world applications in secure and decentralized digital systems through hands-on activities.

In addition, students develop practical skills in Prompt Engineering, Machine Learning and Deep Learning for intelligent data-driven solutions, and explore Internet of Things (IoT) and smart technologies through applied projects related to connected environments, automation, and industrial digitalization.

The course is designed to provide multidisciplinary, application-oriented training in key technologies driving the transition toward intelligent, sustainable, and interconnected systems.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following generic skills, which are defined in the Section 3 of the Annex to the Orden CIN/352/2009:

en_TR1 - Knowledge, understanding and ability to apply the necessary legislation during the development of the profession of Technical Engineer of Telecommunication and ease of handling specifications, regulations and mandatory rules.

en_TR3 - Aptitude to solve problems with initiative, decision making, creativity, and to communicate and to transmit knowledge, skills and workmanship, comprising the ethical and professional responsibility of the activity of the Technical Engineer of Telecommunication.

en_TR5 - Easy to handle specifications, regulations and mandatory standards.

en_TR7 - Know and apply basic elements of economics and human resources management, organization and planning of projects, as well as legislation,regulation and standardization in telecommunications

en_TR8 - Capacity of working in a multidisciplinary and multilingual team and of communicating, both in spoken and written language, knowledge, procedures, results and ideas related to telecommunications and electronics.

en_TRU1 - Capacity of analysis and synthesis.

en_TRU2 - Oral and written competencies.

en_TRU3 - Ability to manage information.

en_TRU4 - Autonomous learning skills.

en_TRU5 - Team work.

Professional Skills

This course contributes to acquire the following professional skills, which are defined in the Section 5 of the Annex to the Orden CIN/352/2009:

The knowledge, skills, abilities and competences acquired in this course should enable students to be in tune with the combination of factors involved in next-generation intelligent systems. The course does not only aim to provide scientific, technological, regulatory and, to a lesser extent, economic knowledge useful for students' professional development, but also to foster soft skills such as autonomous learning, initiative, and teamwork ability.

2.1. Basic, generic or cross-curricular skills

This course contributes to acquiring the following generic and cross-curricular skills proposed by UAH for its degrees:

- TRU1: Capacity for analysis and synthesis
- TRU2: Oral and written communication.
- TRU3: Information management capacity.
- TRU4: Autonomous learning.
- TRU5: Teamwork.

2.2. Learning Outcomes

After succeeding in this course, the students will have the:

- RA1. Knowledge of designing a Photovoltaic Systems for off and on-Grid systems.
- RA2. Basic Knowledge of the new decentralized Blockchain technology.
- RA3. Basic knowledge of prompt engineering, machine learning and deep learning.
- RA4. Basic Knowledge of the different IoT Platforms and its use for real problems.

3. CONTENTS

Contents Blocks	Total number of hours
Block 0. Current and prospective overview. Course organization Basic concepts. The cohesion of new technologies with existing ones. Course organization.	2 hours
Block 1. PassivHaus, Sustainable Systmes for Energy friendly buildings. Main construction concepts in passive houses. Standards PasivHaus, Photovoltaic Systme Design. Laboratory practice.	14 hours
Block 2. Blockchain Technology. Cryptocurrency. Definition of Blockchain. Cryptocurrencies. Other applications. Laboratory practice.	12 hours
Block 3. Context Prompt Engineering. Agents. Machine learning. Deep Learning Definition and Introduction to Artificial Intelligent technologies. Laboratory practice.	16 hours
Block 4. Intenet of Things (IoT) Definition of IoT. Iot platforms. Technologies. Laboratory practice.	14 hours

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	29 hours in large group. 29 hours in small group.
Number of hours of student work:	92 hours
Total hours	150 hours

4.2. Methodological strategies, teaching materials and resources

The formative activities that are going to be considered during the teaching process are the following:

- Theoretical lessons:During these classes, the teacher will present and explain the contents of the course. In that way, the student will acquire the specific competences of the subject.
- Individual or group projects with the corresponding exposition and debate in class, contrasting ideas among the students.
- Software simulations and Hardware laboratory classes:The practical classes will be held in the laboratory. The teacher will provide the students with a project script and the student will have a place with the appropriate software and hardware to carry out the different proposed activities. For each of the projects, the students will deliver a memory that includes the work done and the proposed solutions to solve the problem. The delivery date will be set by the teacher at the beginning of the session.
- Individual or group tuitions: the teacher could solve doubts or brainstorm matters related to the course. The students will have the possibility to establish a more personal relationship so that they could address questions impossible to discuss in a greater group. These tuitions may be requested via email with the address of the institution or in-person.

The teaching-learning methodology and the assessment process will be adapted as needed, in accordance with the guidelines of the Diversity Support Unit, to implement curricular adaptations for students with specific needs.

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Learning Assesment Guidelines, LAG, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the Learning Assesment Guidelines (last modified in the Governing Board of October 31, 2019) as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one ordinary and one extraordinary.

EVALUATION CRITERIA

- CE1: Design capacity of Photovoltaic Systems for isolated buildings or buildings connected to the electrical grid.
- CE2: Design capacicity of a decentralized Blockchain network.
- CE3: Ability to choose and apply different prompt engineering, machine learning and deep learning tools to solve real problems.
- CE4: Ability to choose and apply different prompt engineering, machine learning and deep learning tools to solve real problems.

The evaluation aims to specify what is going to be assessed in relation to the competences to be acquired. The student has two calls to pass the subject, one ordinary and one extraordinary.

The teaching-learning methodology and the assessment process will be adapted as needed, in accordance with the guidelines of the Diversity Support Unit, to implement curricular adaptations for students with specific needs.

5.2. EVALUATION

ORDINARY CALL

Students have two ordinary assessment models: continuous or final assessment.

Continuous assessment has been designed to encourage progressive and continuous study by the student, and so that the student has an idea of â€‹â€‹his degree of progression in learning the subject, so it is advisable to choose this type of call. However, in accordance with the regulations of the University of Alcalá, a final evaluation model is made available to the student.

The regulations in the UAH about the learning assessment processes (approved by the Governing Council on March 24, 2011), in Article 10, paragraph 2, says that students will have a period of fifteen days to request their intention to avail themselves of the final evaluation model, citing the reasons they deem appropriate. The evaluation of the learning process of all students who do not apply in this regard or have it denied will be carried out, by default, in accordance with the continuous evaluation model.

Continuous evaluation

The continuous assessment is based on the completion of a set of deliverables of practical cases proposed by the teacher in each of the parts of the subject. Students will be considered to have passed the course following the continuous assessment if they have completed the TR deliverables necessary throughout the semester and the final grade obtained as a weighted sum of the grade of each of them is equal to or greater than 5 out of 10.

The number of deliverables may vary from one academic year to another. But in no case will a deliverable have a weight greater than 40% of the final grade for the subject.

On the other hand, the student will be considered not presented in the continuous assessment model when they do not deliver any of the TR deliverables.

In the ordinary call through continuous evaluation, the relationship between the criteria, instruments and qualifications is as follows:

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
en_TR1, en_TR3, en_TR5, en_TR7, en_TR8, en_TRU1, en_TRU2, en_TRU3, en_TRU4, en_TRU5	RA1	CE1	TR1	25 %
en_TR1, en_TR3, en_TR5, en_TR7, en_TR8, en_TRU1, en_TRU2, en_TRU3, en_TRU4, en_TRU5	RA2	CE2	TR2	25 %
en_TR1, en_TR3, en_TR5, en_TR7, en_TR8, en_TRU1, en_TRU2, en_TRU3, en_TRU4, en_TRU5	RA3	CE3	TR3	25 %
en_TR1, en_TR3, en_TR5, en_TR7, en_TR8, en_TRU1, en_TRU2, en_TRU3, en_TRU4, en_TRU5	RA4	CE4	TR4	25 %

Final assessment

Those students who are accepted to the final evaluation system (exclusively by final test) will obtain 100% of the grade by taking a final test. This final test (PEF) will consist, at the student's choice, either in an exam where the student will explain their knowledge about the subject or the delivery of simplified TA deliverables proposed by the teacher. Its objective is to evaluate that the student has acquired an integrated knowledge of the subject.

Students will be considered to have passed the subject following the final assessment if they have completed the necessary simplified TR deliverables and their final grade as a weighted sum of the grade of each of them is equal to or greater than 5 out of 10 or if they selected final exam, the grade must be equal to or greater than 5 out of 10. The student will be considered not presented in this call when they do not take the final assessment test or submit the simplified TRs.

In the ordinary call, for students not covered by the continuous assessment system, the relationship between the criteria, instruments and qualification is as follows.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
en_TR1, en_TR3, en_TR5, en_TR7, en_TR8, en_TRU1, en_TRU2, en_TRU3, en_TRU4, en_TRU5	RA1-RA4	CE1-CE4	PEF	100 %

EXTRAORDINARY CALL

Students who do not pass the ordinary call (be it continuous or final assessment) will have the right to an extraordinary call consisting of a test of the same characteristics as that carried out by the students evaluated through the final test in the ordinary call, from which it will be obtained 100% of the rating.

The student will be considered not presented in this call when they do not take the final assessment test or submit the simplified TRs.

In the extraordinary call, the relationship between the criteria, instruments, and rating is:

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TRU1-TRU2-TRU3-TRU4-TRU5	RA1-RA4	CE1-CE4	PEF	100 %

The teaching-learning methodology and the assessment process will be adapted as needed, in accordance with the guidelines of the Diversity Support Unit, to implement curricular adaptations for students with specific needs.

6. BIBLIOGRAPHY

6.1. Basic Bibliography

- Due to the nature of this course based on very new advanced technologies, the documentation provided by the teacher will be articles from scientific magazines, newspaper articles, current reports, web pages ..
- In addition, for the study and analysis of current topics, the documentation provided by the teacher will be used, based on scientific journal articles, newspaper publications, current reports, and relevant websites.
- However, the basic bibliography to be used will be the one generated throughout the course.

Disclosure Note

During the evaluation tests, the guidelines set out in the Regulations establishing the Rules of Coexistence of the University of Alcalá must be followed, as well as the possible implications of the irregularities committed during said tests, including the consequences for committing academic fraud according to the Regulation of Disciplinary Regime of the Students of the University of Alcalá.