COURSE DATA

DATA SUBJECT

Code: 34900
Name: Mobile and wireless communications
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1403 - Degree in Telematics Engineering	Escola Tècnica Superior d'Enginyeria	4	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1403 - Degree in Telematics Engineering	Optional subjects	ELECTIVES

COORDINATION

BOTELLA MASCARELL CARMEN

SUMMARY

The course "Advanced Communications I" belongs to the fourth year, second semester of the Grado en Ingeniería Telemática. This elective course establishes the basic principles that control the functioning of wireless communication systems. The aim of the course is to acquire both theoretical and practical knowledge about the techniques and algorithms that are used to design and implement digital communication links in wireless and mobile communications, illustrating the concepts and designs through practical examples taken from current modern systems, such as GSM, UMTS, LTE, 5G-NR, IEEE 802.16 WiMAX and IEEE 802.11 WiFi.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

No specific restrictions have been specified with respect to other courses of the Study Plan

COMPETENCES / LEARNING OUTCOMES

DESCRIPTION OF CONTENTS

1. Introduction to wireless and mobile communication systems

Historical perspective and evolution of wireless and mobile communication systems, technical challenges, wireless spectrum, general overview of current wireless systems.

2. Channel modeling of wireless channels

Path-loss and large-scale fading (shadowing), small-scale multi-path fading, flat and frequency selective fading, statistical fading models. Key parameters: delay spread, coherence bandwidth, coherence time, Doppler spread. Discrete-time complex baseband equivalent channel representation of wireless channels. 5G-NR channel models.

3. Transmission and Reception Techniques in Wireless Networks

Channel capacity (with and without channel state information); diversity techniques, antenna diversity (transmit and receive diversity, Alamouti scheme). Impact of available channel state information. Systems with multiple inputs and multiple outputs (MIMO): channel parallelization, capacity calculations, beamforming and diversity-multiplexing trade-off. Space-time codes.

4. Multiple access and Interference management in cellular systems

Uplink channels vs. downlink channels. Spread spectrum techniques (DSSS, FHSS). Multicarrier communications (OFDM). Multiple access (TDMA, FDMA, CDMA, SDMA, hybrids). Random access techniques (ALOHA, slotted ALOHA, CSMA). Cellular concept and architecture, co-channel interference, frequency reuse, sectorization, channel assignments, mobility and hands-off.

Evolution of cellular systems. Standards (GSM, UMTS, LTE, WiMAX and mobile WiMAX). Future of cellular communications (5G-NR and beyond).

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Laboratory	20,00
Classroom practices	10,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	20,00
Preparation of lessons	25,00
Preparation for assessment activities	20,00
Resolution of case studies	15,00
Total hours	**90,00**

TEACHING METHODOLOGY

1) In-class work in the course:

1. Theory sessions, including short activities for the students.
2. Problem solving sessions, to practice the concepts from the theory sessions.
3. Lab sessions, understanding by means of simulations the most important concepts from the theory sessions.
4. Oral topic presentation.

2) Student's own work:

1. Homework and exposition in class of the solution.
2. Exam preparation.
3. Lab sessions preparation, reading the lab description and the related theoretical concepts.

3) Consulting sessions: A certain number of hours are established each week, which the students can attend in order to solve doubts.

EVALUATION

The following items and assessments are taken into account:

Assessment of attendance and participation (5% of the final grade)

Individual project (15% of the final grade)

Attendance, realization (5%) and final exam of laboratory practices (15% of the final grade)

Resolution of proposed exercises (15% of the final grade)

Final exam (45% of the final grade)

It is considered that a student regularly attends class when he/she attends at least 80% of the hours of theory and problems or when he/she adequately justifies the impossibility of attending the rest of the hours necessary to reach the percentage.

The attendance to the laboratory classes will be mandatory for the evaluation of the same. Failure to attend more than one session without justification will result in a zero in the laboratory part of the evaluation. Students who, for justified reasons, cannot systematically attend the laboratory sessions, must inform the professors before the beginning of the sessions and, if necessary, an alternative evaluation will be agreed upon. The practices and the resolution of proposed exercises are not recoverable activities, since they are items related to the continuous evaluation.

In the second call, the percentages and grades corresponding to the non-recoverable activities of the lab sessions and project are maintained. Students must inform the faculty before the exam if they wish to increase the weight of the final exam to 60%.

For students who cannot attend class regularly, an alternative model is offered in which the evaluation of attendance and participation will be substituted by additional work with an equivalent total percentage. This circumstance must be communicated to the faculty at the beginning of the course.

The minimum required to pass the course will be the equivalent of a 4 out of 10 in the final exam. The rest of the evaluable items are not subject to a minimum. If the minimum required is not reached, it will not be possible to make average with the rest of the evaluable items and the final grade of the course will be the one obtained in the items of continuous evaluation (attendance, participation, laboratories, proposed exercises and project). If the grade obtained in this way exceeds 5, the final grade of the course will be the one obtained in the items of laboratories, proposed exercises and project.

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

In any case, the system of evaluation will be ruled by the established in the Regulation of Evaluation and Qualification of the University of Valencia for Degrees and Masters. (http://www.uv.es/graus/normatives/2017_108_Reglament_avaluacio_qualificacio.pdf).

REFERENCES

- Wireless Communications by Andrea Goldsmith (Cambridge University press, 2005). https://www.vlebooks.com/Vleweb/Product/Index/365634?page=0
- Principles of Mobile Communications by G. L. Stuber. Third Ed. Kluwer Academic Publishers, 2012
- Fundamentals of Wireless Communication by D. Tse and P. Viswanath, Cambridge University Press, 2005 https://ebookcentral.proquest.com/lib/univalencia/detail.action?pq-

origsite=primo&docID=237613

- Wireless communications by Andreas Molisch, Wiley-IEEE Press, 2nd Ed. 2011