VNIVERSITAT DE VALÈNCIA

Course Guide
43860 RF communication systems and antennas

COURSE DATA

Data Subject	
Code	43860
Name	RF communication systems and antennas
Cycle	Master's degree
ECTS Credits	5.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
2174 - M.U. en Ingeniería de Telecomunicación 13-V.2	School of Engineering	2	First term

Subject-matter

Degree	Subject-matter	Character
2174 - M.U. en Ingeniería de Telecomunicación 13-V.2	14 - RF communication systems and antennas	Obligatory

Coordination

Name	Department
NAVARRO CAMBA, ENRIQUE	175 - Applied Physics and Electromagnetism

SUMMARY

We present a synthetic and global view of the state of the art of antennas for wireless communications, Radiofrequency (RF) systems and subsystems found in modern telecommunication systems. Modeling, design, and optimization techniques are introduced, also the knowledge to understand channel modeling, wireless links under a variety of scenarios and planning.

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 additional knowledge to the normal requirements of access to the Master.

OUTCOMES

2174 - M.U. en Ingeniería de Telecomunicación 13-V.2

- To have critical thinking capabilities to investigate independently and self-critically, and to search and utilize information for documenting ideas.
- To have the ability of standing up for fair criteria with rigor and arguments, reporting them publicly in a clear way and in a multilingual environment.
- To have the ability to participate in diffusion forums, journals, conferences, etc. and to work cooperatively and effectively in transnational teams.
- To have the capability to identify and solve the critical points to conduct an effective technology transfer, transforming theoretical results into products and services that are useful for the society.
- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Be able to access to information tools in other areas of knowledge and use them properly.
- To be able to assess the need to complete the scientific, historical, language, informatics, literature, ethics, social and human background in general, attending conferences, courses or doing complementary activities, self-assessing the contribution of these activities towards a comprehensive development.
- Ability to develop radio communication systems: antenna design, equipment and subsystems, channel modeling, link calculations and planning.
- Ability to implement cable, transport and satellite systems in wired and mobile environments.
- Ability to design and planning transport, diffusion and distribution networks for multimedia signals.
- Ability to design radio navigation and positioning systems, as well as radar systems.

LEARNING OUTCOMES

Ability to understand how antennas work.
Ability to recognize the most important characteristics and parameters of antennas, including: antenna arrays, wire antennas, aperture antennas, or microstrip antennas.
Ability to apply numerical analysis and antenna design techniques.
Ability to understand the operation of the most common microwave devices.

DESCRIPTION OF CONTENTS

1. Fundamentals of electromagnetism

Maxwell equations. Retarded potentials.

2. Radiation of the elemental dipole

Study of the elementary dipole.

3. Antenna parameters

Characteristic parameters of antennas, definitions and relationships between them.

4. Polarization

Polarization properties of waves.

5. Friis equation

Friis equation of the radio link.

6. Noise

Noise in antennas.

7. Antenna measurements

Basic measurements and antenna measurement systems.

8. Wire antennas

Study of wire antennas.

9. Antenna Impedance

Impedance of cylindrical antennas, adaptation and balunization techniques.

10. Loop antennas

Loop antennas.

11. Antenna arrays

Linear and planar arrays. Broadside and endfire. Properties and parameters. Electronic scanning.

12. Aperture atennas

Principle of equivalence and its application to apertures.

13. Reflectors

Reflectors.

14. Microstrip antennas

Printed technology atennas.

15. Numerical methods in antenna analysis

FDTD, FEM, MM.

16. Design optimization techniques

Optimization techniques, genetic algorithms.

17. LABS

RF devices. Waveguides. Adaptation, SWR. Oscillators and mixers. Gunn diode. Klystron. Horn antennas. Radiation and gain diagram measurements.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	23,00	100
Classroom practices	18,00	100
Laboratory practices	7,00	100
Tutorials	2,00	100
Attendance at events and external activities	4,00	0
Development of group work	10,00	0
Development of individual work	10,00	0
Study and independent work	10,00	0
Readings supplementary material	8,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	8,00	0
Preparation of practical classes and problem	10,00	0
Resolution of case studies	5,00	0
TOTAL	**125,00**	

TEACHING METHODOLOGY

Teaching Methodology

- MD1.- Theoretical activity.

AF1.- Development of the lectures, analyzing with a large detail the key elements and more complexity subjects, encouraging the student participation.

- MD2.- Practical activity.

Practical activity will be focused in the use of basic concepts and far beyond with the experience the students develop during the completition of the proposed homework. It will include the following activities in the classroom:

- AF2:
- - Problems and questions inside the teaching room.

- Sessions of discussion and execution of problems and exercises previously prepared by the student.

- Laboratories.

- AF5 Programmed tutorials (individual or in group).

- AF3:

  -Personal student homework.

  - Problems and questions solved outside the classroom, classes and exam preparation (study).

This activity will be individually carried out in order to promote the autonomy of the student.

The *e-learning* platforms (Aula Virtual) of the Universitat de Valencia will be used to support the communication with the student. By using the *e-learning* platforms students will have acces to the teaching material and documents used in the teaching room, also the problems, questions and homework they have to do along the course.

EVALUATION

Evaluation:

1C: Percentage SE3: 35% , Percentage SE2:55%, Percentage SE1: 10%

2C: Percentage SE3: 10% , Percentage SE2:35%, Percentage SE1: 55%

SE3-Evaluation of continuous work of the student based on the participation and personal implication in course teaching-learning process. Attendance to regular activities and lectures and activities in solving exercises, questions and problems at the classroom..SE2-Evaluation of practical activities of small projects/reports and/or powerpoint oral presentations.SE1-Test, one or more exams that will include theoretical/practical questions and problems

The final grade will be obtained by weighting the points SE1-SE2-SE3 with the given percentages.

If a student cannot attend class regularly, and therefore cannot benefit from the model of continuous evaluation, he should inform at the beginning of the course, and then the method corresponding to the 2nd call assessment will apply regardless of attendance in SE3 section.

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

Basic

- POZAR, D. M. : Microwave Engineering, John Wiley & Sons 2005.
- BALANIS, C.A. , Antenna Theory: Analysis and Design, John Wiley & Sons 2005.
- CARDAMA, A., et al., Antenas, ISBN 970-15-1031-3, 2ª Edición, Edicions UPC, 2002.
- -Apuntes de antenas de la asignatura

Additional

- COLLIN, R. E.: Antennas and Radiowave propagation, McGraw-Hill, 1999.
- KRAUS, J.D.: Antennas, 2ª edición, Mac-Graw-Hill, 1988.
- COLLIN, R. E.: Fundations For Microwave Engineering, R.E. Collin, IEEE Press 2001.
- JOHNSON, R. C.: Antenna Engineering Handbook, 3rd edition, Mc-Graw-Hill Professional Publishing, 1993.