COURSE DATA

Data Subject	
Code	43855
Name	Radar and radio navigation
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
2174 - M.U. en Ingeniería de Telecomunicación 13-V.2	School of Engineering	1	First term

Subject-matter

Degree	Subject-matter	Character
2174 - M.U. en Ingeniería de Telecomunicación 13-V.2	9 - Radar and radio navigation	Obligatory

Coordination

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

SUMMARY

"Radar and Radionavigation" aims to give an integral and globalizing vision of remote detection and radio location techniques: to know and understand the basic principles of radar systems and navigation and radio location systems, the existing systems, as well as the characteristics they must have depending on the application. Thus, the fundamentals and main parameters of these systems (range, resolution,...) will be presented, discussing the most common specific applications and particular characteristics of popular systems such as GPS or Galileo.

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 design radio navigation and positioning systems, as well as radar systems.

LEARNING OUTCOMES

Students are expected to achieve the following learning outcomes:

- Ability to dimension a radar system (continuous or pulsed wave) for a particular application.

- Ability to calculate the fundamental parameters of a radar system.

- Understanding the fundamentals of radiolocation techniques.

- Understanding the characteristics of current systems.

DESCRIPTION OF CONTENTS

1. The Radar Equation

Friis RADAR equation.

2. Atmospheric propagation effects

Atmospheric propagation properties as a function of the frequency related to the RADAR type.

3. RADAR cross section

Measuring a target's ability to reflect radar signals in the direction of the radar receiver.

4. RADAR Clutter

RADAR signal detection problems and clutter definition.

5. Radar waveforms and pulse compression techniques

Waveform techniques for achieving good accuracy and resolution.

6. Clutter Rejection Techniques

MTI -Pulse Doppler Processing: RADAR MTI and pulsed wave Doppler.

7. Radar estimation and tracking

RADAR signal analysis, estimation and target tracking.

8. Transmitters and Receivers

Generators and receivers.

9. Synthetic aperture radar (SAR)

Synthetic aperture radar.

10. Electronic Counter Measures (ECM)

Electronic Counter Measures.

11. Weather radars

Fundamentals of radar for weather applications.

12. Ground penetration radars

Ground penetration radars.

13. First navigation systems

Omega, Loran.

14. Global Navigation Satellite System (GNSS)

GPS-Galileo, Glonass, BeiDou.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	14,00	100
Laboratory practices	8,00	100
Tutorials	5,00	100
Classroom practices	3,00	100
Attendance at events and external activities	1,00	0
Development of group work	5,00	0
Development of individual work	5,00	0
Study and independent work	9,00	0
Readings supplementary material	9,00	0
Preparation of evaluation activities	8,00	0
Preparing lectures	3,00	0
Preparation of practical classes and problem	2,00	0
Resolution of case studies	5,00	0

TOTAL	**77,00**

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

- SKOLNIK, M. I.: RADAR Handbook, McGrawHill,tercera edición 2008
- JAIME-PÉREZ R: Radionavegació. Edicions UPC, 1995
- CARDAMA, A., et al., Antenas, ISBN 970-15-1031-3, 2ª Edición, Edicions UPC, 2002.
- Apuntes del curso de Radar del MIT: https://ocw.mit.edu/resources/

Additional

- LEVANON, N.: Radar principles, John Wiley, 1988
- TOOMAY, J.C.: Radar Principles for the non-specialist, second edition,,van Nostrand. Reinhold, 1989.
- KAPLAN E.D., HEGARTY C. : Understanding GPS: principles and applications. Artech House, 2006.
- KAYTON, M, FRIED, W.: Avionics Navigation Systems. Wiley 1997