Last update: 06-05-2019

230610 - RADN - Radar, Radionavigation and Location Systems

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 739 - TSC - Department of Signal Theory and Communications

Academic year: 2019

Degree: MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Teaching unit Optional)
MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN INFORMATION AND COMMUNICATION TECHNOLOGIES (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: J. O'CALLAGHAN

Others: A. AGUASCA, S. BLANCH, J. MALLORQUI

Prior skills

The student is supposed to know basic concepts in communication systems and fundamentals of radiation and propagation of radio signals.

Degree competences to which the subject contributes

Specific:

1. Ability to design radio-navigation and location systems, as well as radar systems.

2. Ability to develop radio-communication systems: antennas design, equipment and subsystems, channel modeling, link dimensioning and planning.
3. Ability to integrate Telecommunication Engineering technologies and systems, as a generalist, and in broader and multidisciplinary contexts, such as bioengineering, photovoltaic conversion, nanotechnology and telemedicine.

Transversal:

4. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
5. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
6. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

Teaching methodology

Lectures
Group work (distance)
Oral presentations of the group work results.

Learning objectives of the subject

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The learning objectives of the course are the fundamentals of systems used for detection, guidance and positioning using radio waves. These principles will be studied in a number of representative systems such as primary and secondary radars, satellite positioning systems (GPS, Galileo), and navigation and guidance aids used in civil aviation (VOR, DME, ILS).

Learning results of the subject:

- Ability to grasp an overall system perspective of modern radar, navigation and positioning systems, with the ability to predict their performance from the fundamental system parameters.

Study load

Total learning time: 125h	Hours large group:	39h	31.20%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	0h	0.00%
	Self study:	86h	68.80%

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Content

1. Basic principles

Learning time: 22h

Theory classes: 9h
Self study : 13h

Description:
- Types of navigation.
- Mathematical models for representing the Earth.
- Propagation effects.

2. Terrestrial systems

Learning time: 22h

Theory classes: 9h
Self study : 13h

Description:
- Hyperbolic systems Loran C, Decca, Omega.
- Air traffic support systems: Primary and Secondary radar, ILS, MLS, VOR, DME, TACAN.

3. Satellite systems

Learning time: 81h

Theory classes: 19h
Practical classes: 2h
Self study : 60h

Description:
- Orbits and geometry.
- Principles of satellite navigation. Observables. Integration with inertial sensors.
- Systems based on the Doppler effect. Traffic Cospass-SAR, Argos.
-GPS and Galileo.

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Planning of activities

PRACTICE

Description:
Use of a handheld GPS in campus. Observation of number of available satellites and Expected Position Error in various reception scenarios.

ORAL PRESENTATION

Description:
Presentation of a work group.

SHORT ANSWER TEST (TEST)

Description:
Partial evaluation test with theoretical questions and short exercises.

Qualification system

The final mark is the highest between:

* The mark from the final examination.
* The mark obtained by averaging: 60 % Final examination + 40 % Work assignment.

For the work assignment, 70 % is the written report and 30 % the oral presentation.

Regulations for carrying out activities

Short answer test (Test)

Bibliography

Basic:

Parkinson, B.W.; Spilker,J.J. (Eds.). Global positioning system: theory and applications. Washington: American Institute of Aereonautics and Astronautics, 1996. ISBN 156347106X.

Forsell, B. Radionavigation systems. Boston ; London: Artech House, 2008. ISBN 9781596933545.

Kaplan, E.D. (ed). Understanding GPS principles and applications. 2nd ed. Boston: Artech House, 2006. ISBN 9781580538947.

Complementary:

Kayton, M.; Fried, W. Avionics navigation systems. 2nd ed. New York: John Wiley and Sons, 1997. ISBN 0471547956.

Skolnik, M.E. Introduction to radar systems. 3rd ed. Boston (Mass.): Mc Graw-Hill, 2001. ISBN 0072909803.