11672 - SISRAD - Radio Navigation Systems

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications
Academic year: 2014

Degree: DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 1992). (Teaching unit Optional)
DEGREE IN ELECTRONIC ENGINEERING (Syllabus 1992). (Teaching unit Optional)
DOCTORATE IN SIGNAL THEORY AND COMMUNICATIONS (Syllabus 2007). (Teaching unit Optional)
MASTER OF SCIENCE IN INFORMATION AND COMMUNICATION TECHNOLOGIES (Syllabus 2009).
(Teaching unit Optional)
ERASMUS MUNDUS MASTER OF RESEARCH ON INFORMATION AND COMMUNICATION TECHNOLOGIES (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 5

Teaching staff
Coordinator: Jordi J. Mallorqui
Others: Albert Aguasca, Sebastià Blanch, Jordi J. Mallorqui, Joan O’Callaghan

Prior skills

It is recommended that students take the following subjects beforehand: Radiation and Guided Waves, Signal Processing, Radiocommunications, Antennas, Microwaves and Radar. Any gaps in students' knowledge of the topics will be filled in by consulting a basic reading list.

The course will be held in Spanish/Catalan in the Fall term and in English in the Spring term.

Requirements


Teaching methodology

The students must attend the course lectures imparted mostly using power point presentations. A copy of the slides can be downloaded from the Atenea course web page.
The course also includes field practices with GPS receivers. The students can experiment with the GPS and see how it works in a real environment.
The students have to develop in groups of two people a particular subject proposed by one of the professors. This professor will act as tutor and will guide the students. At the end, each group will make a presentation of the subject to the rest of the class and will deliver a written report.

Learning objectives of the subject

Radionavigation technologies, particularly satellite based ones such as GPS or the future Galileo system in Europe, are becoming widespread in the following sectors: telecommunications; transport by land, air and sea; public works, etc. This subject aims to provide future engineers with the plethora of technical knowledge needed to successfully develop
positioning and navigation applications that cater for the needs of a user sector in full expansion.
## Content

1. Basic principles

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<th>Degree competences to which the content contributes:</th>
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1.1. Types of navigation.

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1.2. Mathematical models for representing the Earth.

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1.3. Propagation effects.

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2. Terrestrial systems

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2.1. Hyperbolic systems Loran C, Decca, Omega.

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2.2. Determination of direction.

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2.3. Air traffic support systems: Secondary radar, ILS, MLS, VOR, DME, TACAN.

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3. Satellite systems

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3.1. Orbits and geometry.

Degree competences to which the content contributes:

3.2. Principles of satellite navigation Observables.

Degree competences to which the content contributes:


Degree competences to which the content contributes:

3.4. Broadened spectrum signals.

Degree competences to which the content contributes:

3.5. Navstar GPS and Glonass.

Degree competences to which the content contributes:

3.6. Position determination.

Degree competences to which the content contributes:

3.7. Errors and precision.

Degree competences to which the content contributes:

3.8. GPS receivers.

Degree competences to which the content contributes:

3.9. GPS-complementary sensors.

Degree competences to which the content contributes:
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### 3.10. Tracking with the Kalman filter.

Degree competences to which the content contributes:

### 3.11. Augmentation systems: Differential systems and pseudosatellites.

Degree competences to which the content contributes:

### 3.12. Integration with other systems.

Degree competences to which the content contributes:

### 3.13. Intelligent transport systems (ITS).

Degree competences to which the content contributes:

### 3.14. GNSS-1 systems and future constellations.

Degree competences to which the content contributes:

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**Qualification system**

The final mark is obtained averaging:

- Work assignments: 40%
- Final examination: 60%

The students have always the option of taking only the final examination.

**Regulations for carrying out activities**

The work assignments are evaluated with both a public presentation and a written report. The works are done in groups of two people.

The final examination is a 25 questions test.
Bibliography

Basic:


Complementary:


Others resources: