230313 - COGRAD - Cognitive Radio

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications
Academic year: 2017
Degree: BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Optional)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 2  
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Casadevall Palacio, Fernando-Jose
Others: Casadevall Palacio, Fernando-Jose

Opening hours
Timetable: Tuesday 10 to 12 am
           Thursday 12 am to 2 pm

Prior skills
Knowledge of mobile communications

Requirements
Per GR ENG SIST TELECOM
  RADIOCOMMUNICATIONS - Corequisite
Per GR ENG TELEMÁTICA
  MOBILE COMMUNICATIONS SUPPORT SYSTEMS- Corequisite
Per GR CIÈNC I TECN TELE
  RADIOCOMMUNICATIONS - Corequisite

Degree competences to which the subject contributes

Generical:
  09 CSCT N3. ABILITY TO CONCEIVE, DESIGN, IMPLEMENT AND OPERATE COMPLEX ICT SYSTEMS. Level 3. To identify market needs and opportunities. To collect information to prepare specifications for a new product, process or service. To prepare a basic business plan. To conceive a new product, process or service. To develop and implement planning of a design process. To carry out the various phases of the design process.

Transversal:
  07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.
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Teaching methodology

- Lecturers
- Laboratory activities

Learning objectives of the subject

Most of the today's Wireless System are allocated in spectrum bands devoted for exclusive use of licensed users (licensed bands). Technological advancement has resulted in the huge development of personal wireless technologies. As the result spectrum scarcity happens. A solution to this problem is to let unlicensed users use the licensed frequencies, provided they can guarantee interference perceived by the primary license holders will be minimal. This new concept is called Cognitive Radio.

In this seminar you will know and understand the concept of:
- Cognitive Radio and their applications and limitations
- TV White Spaces and applications
- Dynamic spectrum management, particularly the LSA (Licensed Shared Access) concept

Study load

<table>
<thead>
<tr>
<th>Total learning time: 50h</th>
<th>Hours large group: 20h</th>
<th>40.00%</th>
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<tbody>
<tr>
<td></td>
<td>Self study: 30h</td>
<td>60.00%</td>
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<table>
<thead>
<tr>
<th>Content</th>
<th>Learning time: 20h</th>
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<tbody>
<tr>
<td><strong>Cognitive Radio: The smart radio of the next future</strong></td>
<td>Theory classes: 20h</td>
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**Description:**

**Topic 1 - Introduction**

1.1 Reasons for the deployment of Cognitive Radio:
   1.1.1 Evolution in terms of users and data traffic of mobile communication systems.
   1.1.2 Capacity fundamental limits of the transmission systems.
   1.1.3 Available band: Spectrum measurements in BCN
1.2 Evolution of cellular systems and wireless mobile communications.
1.3 Cognitive Radio concept
1.4 Possible wireless and cellular applications.

**Topic 2 - Cognitive Radio Properties**

2.1 Cognitive Radio Concept
2.2 Functionalities. Concept Cognitive level:
   2.2.1 Spectrum Awareness
   2.2.2 Spectrum Selection
   2.2.3 Spectrum Sharing
   2.2.4 Mobility Spectrum
2.3 Structure of Cognitive Transceiver

**Topic 3 - Spectrum Awareness Techniques**

3.1 Spectrum Sensing techniques: Classification and performances
3.2 Databases (REM-Radio Environmental Maps)
3.3 Cognitive Pilot Channel

**Topic 4 - TV White Spaces**

4.1 Concept and scenarios
4.2 Architectures
4.3 Procedures and functionalities
4.4 Standardization
   4.4.1 Description of the standard IEEE 802.22

**Topic 5 - Models of the spectrum usage**

5.1 Methodologies for spectrum measurements
5.2 Time, Frequency and Space models

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**Qualification system**

Continuous assessment  50% of the final score
Final exam  50%  of final score
Bibliography

Basic:


Others resources:

Audiovisual material

Transparències del seminari

Seminari slides