Learning objectives:
The aim of this course is to introduce new subjects and technologies related to wireless communication systems, focusing on those used as access networks. The main objective is to introduce concepts and technologies and to offer the...
analytical tools to understand its performance and to been able to dimension its capacity

Learning results:
- Ability to design radio systems for providing voice and data services, at any time and place.
- Ability to understand the behaviour and dimension certain wireless systems used commonly.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>26h</th>
<th>20.80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total learning time: 125h</td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>13h</td>
<td>10.40%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>86h</td>
<td>68.80%</td>
</tr>
</tbody>
</table>
# 1. Introduction to Wireless Access Networks

**Description:**
- Parts of a network.
- Wireless Access Networks.
- Radioelectric spectrum.
- Spectrum division techniques: TDMA, FDMA, CDMA, OFDMA.
- Duplexing techniques: TDD and FDD.

**Learning time:** 11h
- Theory classes: 2h
- Laboratory classes: 1h
- Self study: 8h

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# 2. Resources Allocation Strategies.

**Description:**
- Frequency reuse.
- Code reuse.
- Optimized systems.
- Examples of use.

**Learning time:** 11h
- Theory classes: 2h
- Laboratory classes: 1h
- Self study: 8h

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# 3. LPWAN Networks.

**Description:**
- Sigfox.
- Lora.

**Learning time:** 11h
- Theory classes: 2h
- Laboratory classes: 1h
- Self study: 8h

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# 4. Point to Multipoint Systems.

**Description:**
- WiMAX.

**Learning time:** 11h
- Theory classes: 2h
- Laboratory classes: 1h
- Self study: 8h
## 5. Trunking Systems.

**Learning time:** 22h
- Theory classes: 4h
- Laboratory classes: 2h
- Self study: 16h

**Description:**
- Analog technologies.
- Digital technologies. TETRA.
- Dimensioning.

## 6. Delay Tolerant Networks (DTN).

**Learning time:** 11h
- Theory classes: 2h
- Laboratory classes: 1h
- Self study: 8h

**Description:**
- Architecture.
- Routing.
- Applications.


**Learning time:** 11h
- Theory classes: 2h
- Laboratory classes: 1h
- Self study: 8h

**Description:**
- GEO (Geostationary Orbit).
- MEO (Medium Earth Orbit).
- LEO (Low Earth Orbit).


**Learning time:** 37h
- Theory classes: 10h
- Laboratory classes: 5h
- Self study: 22h

**Description:**
- Topologies and advantages.
- Ad-hoc networks and mesh networks.
- Routing protocols.
- Application examples.
### Planning of activities

<table>
<thead>
<tr>
<th>LABORATORY</th>
<th>Hours: 7h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laboratory classes: 7h</td>
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</tbody>
</table>

**Description:**
- LoRa Networks analysis.
- Implementation and analysis of ad-hoc and mesh networks with linux embedded devices.

<table>
<thead>
<tr>
<th>EXERCISES</th>
<th>Hours: 6h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laboratory classes: 6h</td>
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</tbody>
</table>

**Description:**
- Design, dimensioning and evaluation exercises focused on the technologies studied during the course.

<table>
<thead>
<tr>
<th>SHORT ANSWER TEST (CONTROL)</th>
<th>Hours: 7h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 7h</td>
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</table>

**Description:**
1st Mid term control.
2nd Mid term control.
Final exam.

### Qualification system

Final exam: 60%
Midterm controls: 25%
Individual assessments: 15%

### Bibliography

**Basic:**