Learning objectives of the subject:

To present advanced antenna concepts based on a modern time-space formulation, system oriented CAD design techniques and wireless antenna optimization and measurements. In addition, the course develops appreciation for research issues of antennas for mobile wireless and advanced communications systems.
Learning results of the subject:

- Ability to specify, design antennas of telecommunications in both a fixed, mobile, personal, local or long distance, with different bandwidths.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group:</th>
<th>26h</th>
<th>20.80%</th>
</tr>
</thead>
<tbody>
<tr>
<td></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>
</tr>
<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>
## Content

1. **Channel modeling. LOS, NLOS. MIMO channel.**  
   
   **Learning time:** 16h  
   - Theory classes: 3h  
   - Laboratory classes: 1h  
   - Self study: 12h

2. **Antenna modeling: time-frequency radiation parameters, impedance and matching.**  
   
   **Learning time:** 17h  
   - Theory classes: 3h  
   - Laboratory classes: 2h  
   - Self study: 12h

3. **Compact antennas: wire and slot antennas, small antennas, ground planes.**  
   
   **Learning time:** 18h  
   - Theory classes: 4h  
   - Laboratory classes: 2h  
   - Self study: 12h

4. **Broadband antennas: principles of broadbanding, fractal antennas, UWB antennas.**  
   
   **Learning time:** 18h  
   - Theory classes: 4h  
   - Laboratory classes: 2h  
   - Self study: 12h

5. **Multielement antennas: Arrays, MIMO, smart and reconfigurable antennas.**  
   
   **Learning time:** 18h  
   - Theory classes: 4h  
   - Laboratory classes: 2h  
   - Self study: 12h

6. **Antennas in systems: wireless systems, active antennas, EMC topics, technology**  
   
   **Learning time:** 10h  
   - Theory classes: 2h  
   - Laboratory classes: 1h  
   - Self study: 7h
### 7. Antenna measurements: ranges, radiation pattern and impedance measurements

**Learning time:** 10h  
- Theory classes: 2h  
- Laboratory classes: 1h  
- Self study: 7h

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### 8. Application to radar and radionavigation systems

**Learning time:** 18h  
- Theory classes: 4h  
- Laboratory classes: 2h  
- Self study: 12h

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### Planning of activities

#### LABORATORY

**Description:**  
Antenna design.

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#### EXERCISES

**Description:**  
Exercises to strengthen the theoretical knowledge.

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#### ORAL PRESENTATION

**Description:**  
Presentation of a work group.

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#### SHORT ANSWER TEST (CONTROL):

**Description:**  
Mid term control.

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#### EXTENDED ANSWER TEST (FINAL EXAMINATION):

**Description:**  
Final examination.
230648 - WLA - Wireless Communication Links and Antennas

Qualification system

Final examination: from 20% to 70%
Partial examinations and controls: from 0% to 50%
Individual assessments: from 0% to 40%
Laboratory assessments: from 0% to 70%

Bibliography

Basic:


