Advanced Communications Circuit Design

Code: 42836  
ECTS Credits: 6

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<th>Degree</th>
<th>Type</th>
<th>Year</th>
<th>Semester</th>
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<td>4313797 Telecommunications Engineering</td>
<td>OB</td>
<td>1</td>
<td>2</td>
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</tbody>
</table>

**Contact**

Name: Ferran Martín  
Email: Ferran.Martin@uab.cat

**Teachers**

Jordi Bonache Albacete

**Use of languages**

Principal working language: english (eng)

**Prerequisites**

Good knowledge on the fundamentals of RF/microwave engineering

**Objectives and Contextualisation**

The main aim is the design of communication devices, focused on performance improvement, size and cost reduction, on the basis of advanced concepts, such as artificial transmission lines, and electromagnetic bandgaps, among others. It is also the aim of the module to know and use electromagnetic simulators for the design of RF/microwave components, as well as to establish specific experimental set-up for the characterization of RF/microwave components.

**Skills**

- Capacity for critical reasoning and thought as means for originality in the generation, development and/or application of ideas in a research or professional context.
- Capacity for developing electronic instrumentation as well as transducers, actuators and sensors.
- Capacity to apply advanced photonic and optoelectronic knowledge, as well as high frequency electronics.
- Demonstrate an entrepreneurial, creative and innovative spirit.
- Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context.
- Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent.
- Students should know how to apply the knowledge they have acquired and their capacity for problem solving in new or little known fields within wider (or multidisciplinary) contexts related to the area of study.
- Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously.

**Learning outcomes**
1. Apply miniaturisation strategies to the design of microwave components.
2. Capacity for critical reasoning and thought as means for originality in the generation, development and/or application of ideas in a research or professional context.
3. Demonstrate an entrepreneurial, creative and innovative spirit.
4. Design high performance and low cost communications circuits using periodic structures (electromagnetic and photonic crystals) and artificial transmission lines.
5. Design microwave components using equivalent circuits and simulation tools.
6. Design simple sensors based on RF techniques.
7. Develop advanced high frequency components using engineering techniques of dispersion and impedances.
8. Establish size and characterisation environments for communications circuits.
9. Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context.
10. Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent.
11. Students should know how to apply the knowledge they have acquired and their capacity for problem solving in new or little known fields within wider (or multidisciplinary) contexts related to the area of study.
12. Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously.

Content

- Miniaturization techniques. Slow-wave components, semilumped components.
- Artificial transmission lines. Dispersion and impedance engineering. Applications: broadband and multiband components, filters and diplexers, distributed amplifiers, microwave sensors, leaky wave antennas.
- Electromagnetic software tools.
- Instrumentation and characterization.

Methodology

The methodology will combine in-situ classes, problem resolution, work in the laboratory, the realization of supplemental works from recommended lectures and autonomous work as well. Virtual platforms will be used.

Activities

<table>
<thead>
<tr>
<th>Title</th>
<th>Hours</th>
<th>ECTS</th>
<th>Learning outcomes</th>
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<td><strong>Type: Directed</strong></td>
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<tr>
<td>presental classes</td>
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<td>1.2</td>
<td>1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12</td>
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<tr>
<td>problem resolution</td>
<td>15</td>
<td>0.6</td>
<td>1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12</td>
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<td></td>
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<tr>
<td>work at lab</td>
<td>15</td>
<td>0.6</td>
<td>1, 2, 4, 5, 6, 7, 8, 9, 11, 12</td>
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<tr>
<td><strong>Type: Autonomous</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>study by the student and preparation of lab exercises</td>
<td>70</td>
<td>2.8</td>
<td>1, 4, 5, 6, 7, 8</td>
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suplementary work 10 0.4 1, 2, 3, 4, 5, 6, 7, 8, 11, 12

**Evaluation**

Two exams each with a weight of 37.5% to evaluate the progress (representing a total of 75%)

Deliverables from lab. and exercises (25%)

The minimum to overcame the subject in regard to the two exams is an average of 4. If not, it is not possible to overcame the subject with the lab exercises.

If the continuos evaluation is not passed by the student, then there will be a final exam where, again, a minimumn of 4 is needed to overcome the subject.

Changes to this evaluation method are possible if considered by the Teacher. "No present" applies if the student does not make the exam. Moreover, at least one exam will be done before the final exam.

**Evaluation activities**

<table>
<thead>
<tr>
<th>Title</th>
<th>Weighting</th>
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<td>Exam</td>
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**Bibliography**