

**Planar Antennas for Wireless Systems**

Code: 42834  
ECTS Credits: 6

| Degree                                 | Type | Year | Semester |
|----------------------------------------|------|------|----------|
| 4313797 Telecommunications Engineering | OB   | 1    | 2        |

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

## Contact

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## Use of Languages

Principal working language: english (eng)

## Prerequisites

The student is supposed to have knowledge about radiation, guided waves, fundamental parameters of antenna and the transmission equation

## Objectives and Contextualisation

Once completed the course the student should be able to:

1. Understand and describe the structures that are commonly used in the design of planar antennas.
2. Apply different techniques to adjust the antennas to the requirements of a particular application.
3. Use simulation tools to predict the behavior of these antennas.
4. Carry out measurements of different parameters of antennas.

## Competences

- Capacity for developing radio communications systems: design of antennas, equipment and subsystems, channel modelling, calculation of links and planning.
- 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. Analyze antennas assessing whether they meet the requirements of an application.
2. Carry out measurements of different parameters of antennas.
3. Design antennas according to the requirements of a particular application.
4. 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
5. 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
6. Use electromagnetic simulation tools for the analysis and design of antennas

## Content

1. Introduction
2. Fundamental parameters of antennas
3. Fundamentals of radiation
4. Dipole antennas
5. Loop antennas
6. Slot antennas
7. Microstrip antennas
8. Simulations Tools
9. Measurement Techniques

## Methodology

Guided activities:

- Lectures: explanation of theoretical contents with application examples
- In the lab: develop a planned activity using simulation tools and measurement techniques

Autonomous activities:

- Individual study of the subject
- Solving exercises, preparation of lab activities and reports

Supervised activities:

- Individual or Small group meetings to clarify concepts, to advise on the development of the course or to attend other specific issues.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Activities

| Title                | Hours | ECTS | Learning Outcomes |
|----------------------|-------|------|-------------------|
| Type: Directed       |       |      |                   |
| Lab classes          | 15    | 0.6  | 4, 6              |
| Lectures             | 30    | 1.2  | 4, 5, 6           |
| Type: Supervised     |       |      |                   |
| Supervision meetings | 15    | 0.6  | 4, 5, 6           |
| Type: Autonomous     |       |      |                   |
| Personal work        | 56    | 2.24 | 4, 5, 6           |

## Assessment

a) Evaluation activities

- Final exam (FEx): 50%. Short questions and problems. It is compulsory to obtain FEx  $\geq 4$  to pass the course.
- Solving exercises (EX): 20%. Short questions and problems will be proposed throughout the course.
- Lab activities (LR): 30% reports on the activities developed in the lab (25%) and lab exam (short questions 5%).

Any evaluation activity delivered after the deadline will be qualified with zero.

#### b) Evaluation activities schedule

- FEx: final exam dates will be public the first day of the course in the Campus Virtual and the web page of the Engineering School.
- EX and LR: schedule of lab sessions and deliverables will be made public in Campus Virtual.

The schedule can be modified due to unexpected events. Please, check Campus Virtual often since any modification will be published there.

#### c) Second chance procedure

- FEx: according to UAB regulations there will be one second chance exam for those students with FEx  $< 4$  that have participated in, at least, 2/3 of the evaluation activities of the course.
- EX and LR: these evaluation activities do not have second chance procedure.

#### d) Grades revision procedure

For every evaluation activity it will be scheduled a place, date and time for reviewing the grade together with the teacher. The grade of the activity will not be modified after the scheduled date.

#### e) Final grade

- If FEx  $< 4$ , Final grade = FEx
- Si FEx  $\geq 4$ , Final grade =  $\max(0.5 \cdot \text{FEx} + 0.2 \cdot \text{EX} + 0.3 \cdot \text{LR}, 0.7 \cdot \text{FEx} + 0.3 \cdot \text{LR})$
- It is mandatory a final grade  $\geq 5$  to pass the course
- Matricules d'honor (MH): the highest grade available can only be awarded by the coordinator of the course to those students with the top final grades. According to UAB regulations final grade should be  $\geq 9$  and the number of MH is restricted to the 5% of the students enrolled in the course.
- "Not evaluated" will be only granted with the student participates in less than 10% of the evaluation activities.

#### f) Irregularities by the student, copy and plagiarism

Without prejudice to other disciplinary measures considered appropriate, the irregularities committed by the student that can lead to a variation of the grade of an evaluation activity (such as copying plagiarizing, cheating ...) will be qualified with zero.

#### g) Students repeating the course

There is no differential treatment for students repeating the course. No grades of the previous course will be kept.

### Assessment Activities

| Title             | Weighting | Hours | ECTS | Learning Outcomes |
|-------------------|-----------|-------|------|-------------------|
| Final exam        | 50%       | 3     | 0.12 | 4, 5, 6           |
| Lab activities    | 30%       | 15    | 0.6  | 1, 3, 2, 4, 5, 6  |
| Solving exercises | 20%       | 16    | 0.64 | 4, 5, 6           |

## **Bibliography**

C.A Balanis, Antenna Theory, 3rd edition, John Wiley & Sons, 2005

J.L. Volakis, C. Chen, K. Fujimoto, Small Antennas: Miniaturization techniques and applications, McGraw-Hill, 2010

K.L. Wong, Planar antennas for Wireless Communications, John Wiley & Sons, 2003

## **Software**

FEKO from Altair: electromagnetic solver. <https://altairuniversity.com/feko-student-edition/>