Course guide
230450 - CAL1 - Calculus 1

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR’S DEGREE IN ENGINEERING PHYSICS (Syllabus 2011). (Compulsory subject).

Academic year: 2022 ECTS Credits: 6.0 Languages: Catalan

LECTURER

Coordinating lecturer: Consultar aquí / See here:
https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura

Others: Consultar aquí / See here:
https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Ability to solve math problems that may arise in engineering. Ability to apply knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, ordinary and partial differential equations, probability and statistics.
2. Ability to select numerical and optimization methods suitable for solving physical and engineering problems. Ability to apply the knowledge of numerical algorithms and optimization.

Generical:
3. ABILITY TO IDENTIFY, FORMULATE, AND SOLVE PHYSICAL ENGINEERING PROBLEMS. Planning and solving physical engineering problems with initiative, making decisions and with creativity. Developing methods of analysis and problem solving in a systematic and creative way.

Transversal:
1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

TEACHING METHODOLOGY

There will be two classes of sessions: the main lectures will be devoted to a careful presentation of the basic concepts and results of Calculus in one variable, developing complete proofs when possible, while the lab sessions will be devoted to the solution of a variety of exercises and problems.

LEARNING OBJECTIVES OF THE SUBJECT

The main objective is that the student know the basic concepts, techniques and results from the Calculus of one variable in order to be able to apply them in other scientific contexts. Moreover, this course serves also as a basic background for future courses.
### STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>65.0</td>
<td>43.33</td>
</tr>
<tr>
<td>Self study</td>
<td>85.0</td>
<td>56.67</td>
</tr>
</tbody>
</table>

**Total learning time:** 150 h

### CONTENTS

#### 1. Numbers and functions

**Description:**
Real functions of one variable. Domain of a function. The elementary function: polynomials, rational fractions, exponentials, trigonometric and hyperbolic functions.

**Full-or-part-time:** 10h 50m
- Theory classes: 3h
- Practical classes: 2h
- Guided activities: 3h 20m
- Self study : 2h 30m

#### 2. Limits and continuity

**Description:**

**Full-or-part-time:** 10h 50m
- Theory classes: 3h
- Practical classes: 4h 30m
- Guided activities: 1h 40m
- Self study : 1h 40m

#### 3. Derivatives and approximation of functions

**Description:**

**Full-or-part-time:** 46h 40m
- Theory classes: 12h
- Practical classes: 8h
- Guided activities: 2h 30m
- Self study : 24h 10m
4. Integration

**Description:**

**Full-or-part-time:** 45h 50m
- Theory classes: 12h
- Practical classes: 8h
- Guided activities: 2h 30m
- Self study: 23h 20m

5. Numerical series and power series

**Description:**
Power series. Radius of convergence, function defined by a powwr series., its derivability and integrability. Taylor series, examples: exponential, trigonometric and binomial series.

**Full-or-part-time:** 35h 50m
- Theory classes: 9h
- Practical classes: 6h
- Guided activities: 2h 30m
- Self study: 18h 20m

**GRADING SYSTEM**
There will be a final exam (EF) and a partial exam (EP). The students participation in practical sessions will also be taken into account (P). The final score will follow from

\[
\text{max}(EF, 0.65*EF+0.30*EP+0.05*P)
\]

**EXAMINATION RULES.**
The exams will consist a some theoretical questions and some exercices and problems.

**BIBLIOGRAPHY**

**Basic:**
- Marsden, J.; Weinstein, A. Calculus. 2nd ed. New York: Springer Verlag, 1986. ISBN 0387909745 (V.1); 0383909753 (V.2); 0387909850 (V.3).