Course guide
270201 - CAL - Calculus

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

Degree: BACHELOR'S DEGREE IN DATA SCIENCE AND ENGINEERING (Syllabus 2017). (Compulsory subject).

Academic year: 2022 ECTS Credits: 7.5 Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: RAFAEL RAMIREZ ROS

Others: Primer quadrimestre:
RAFAEL RAMIREZ ROS - 11, 12
JORDI VILLANUEVA CASTELLTORT - 11, 12

PRIOR SKILLS

Knowledge on basic calculus theory at level 2n Batxillerat

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE1. Skillfully use mathematical concepts and methods that underlie the problems of science and data engineering.

Generical:
CG2. Choose and apply the most appropriate methods and techniques to a problem defined by data that represents a challenge for its volume, speed, variety or heterogeneity, including computer, mathematical, statistical and signal processing methods.

Transversal:
CT5. Solvent use of information resources. Manage the acquisition, structuring, analysis and visualization of data and information in the field of specialty and critically evaluate the results of such management.
CT6. Autonomous Learning. Detect deficiencies in one’s own knowledge and overcome them through critical reflection and the choice of the best action to extend this knowledge.

Basic:
CB1. That students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply Knowledge from the vanguard of their field of study.

TEACHING METHODOLOGY

Lectures introduce the concepts, results and algorithms needed to achieve the required level of understanding

These concepts are put into practice in problem and laboratory sessions.
The teacher poses problems related to the current topic prior to each problem session.

LEARNING OBJECTIVES OF THE SUBJECT

1. Grasp the concept of real and complex number
2. Ability to cope with interval calculus and inequalities
3. Modeling of problems of numerical optimization
## STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>45,0</td>
<td>24.00</td>
</tr>
<tr>
<td>Self study</td>
<td>112,5</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>30,0</td>
<td>16.00</td>
</tr>
</tbody>
</table>

**Total learning time:** 187.5 h

## CONTENTS

### Numbers

**Description:** Rational, and real numbers. Absolute value. Operations and expressions.

### Functions

**Description:** Qualitative study of the most common functions and their inverses. Limits and continuity.

### Derivation


### Integration


### Sequences and series

# ACTIVITIES

## Midterm exam

**Specific objectives:**
1, 2

**Related competencies:**
CE1. Skillfully use mathematical concepts and methods that underlie the problems of science and data engineering.
CT5. Solvent use of information resources. Manage the acquisition, structuring, analysis and visualization of data and information in the field of specialty and critically evaluate the results of such management.
CT6. Autonomous Learning. Detect deficiencies in one's own knowledge and overcome them through critical reflection and the choice of the best action to extend this knowledge.
CB1. That students have demonstrated to possess and understand knowledge in an area of ??study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge from the vanguard of their field of study.

**Full-or-part-time:** 7h
Guided activities: 2h
Self study: 5h

## Final exam

**Specific objectives:**
2, 3

**Related competencies:**
CG2. Choose and apply the most appropriate methods and techniques to a problem defined by data that represents a challenge for its volume, speed, variety or heterogeneity, including computer, mathematical, statistical and signal processing methods.
CE1. Skillfully use mathematical concepts and methods that underlie the problems of science and data engineering.
CT5. Solvent use of information resources. Manage the acquisition, structuring, analysis and visualization of data and information in the field of specialty and critically evaluate the results of such management.
CT6. Autonomous Learning. Detect deficiencies in one's own knowledge and overcome them through critical reflection and the choice of the best action to extend this knowledge.
CB1. That students have demonstrated to possess and understand knowledge in an area of ??study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge from the vanguard of their field of study.

**Full-or-part-time:** 12h 30m
Guided activities: 2h 30m
Self study: 10h

## Numbers

**Full-or-part-time:** 25h
Theory classes: 3h
Practical classes: 4h
Self study: 18h

## Functions study

**Full-or-part-time:** 31h
Theory classes: 8h
Practical classes: 5h
Self study: 18h
Differentiability

**Full-or-part-time:** 38h  
Theory classes: 12h  
Practical classes: 8h  
Self study: 18h

Integrability

**Full-or-part-time:** 38h  
Theory classes: 12h  
Practical classes: 8h  
Self study: 18h

Sequences and series

**Full-or-part-time:** 33h  
Theory classes: 10h  
Practical classes: 5h  
Self study: 18h

**GRADING SYSTEM**

Final grade = max(0.1*NPract + 0.9*NExFinal, 0.1*NPract + 0.3*NExParcial + 0.6*NExFinal)

where:
- \(NPract\): numerical methods exam
- \(NExParcial\): midterm exam
- \(NExFinal\): final examen grade

In case of reevaluation, the new grade will replace the previous.

**BIBLIOGRAPHY**

**Basic:**

**Complementary:**
- Thompson, Silvanus Phillips; Gardner, Martin. Calculus made easy : being a very-simplest introduction to those beautiful methods of reckoning which are generally called by the terrifying names of the differential calculus and the integral calculus. 2nd ed. Macmillan and co., limited, 1998. ISBN 9781514779545.

**RESOURCES**

**Hyperlink:**
- [https://openstax.org/details/books/calculus-volume-1](https://openstax.org/details/books/calculus-volume-1)  
- [https://openstax.org/details/books/calculus-volume-2](https://openstax.org/details/books/calculus-volume-2)  
- [https://openstax.org/details/books/calculus-volume-3](https://openstax.org/details/books/calculus-volume-3)  
- [https://web.mat.upc.edu/rafael.ramirez/ACcY/index.html](https://web.mat.upc.edu/rafael.ramirez/ACcY/index.html)