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: 2023  
ECTS Credits: 7.5  
Languages: Catalan, Spanish  

LECTURER  

Coordinating lecturer:  
Others:  

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.  

General:  
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, algorithms and results needed to reach the required level of understanding. These concepts are put into practice in the problem classes in which, due to its structure, it is easier to encourage the active participation of students. The practice note is aimed at encouraging the most creative and transversal aspects of the subject since it involves the completion of problems that involve the understanding of concepts and the use of tools that we could hardly fit into the regulated exhibition.  

LEARNING OBJECTIVES OF THE SUBJECT  
1. Elementary functions, continuity, limit and associated concepts  
2. The derivative and its use as a basic calculation tool.  
3. Calculation of primitives and definite integrals.  
4. Discussion of the convergence of improper integrals, sequences and series and calculation of their limit in simple cases where it is approachable.
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>Hours small group</td>
<td>30,0</td>
<td>16.00</td>
</tr>
<tr>
<td>Self study</td>
<td>112,5</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 187.5 h

CONTENTS

Functions

**Description:**
Rational and real numbers. Absolute value. Qualitative study of the most usual functions and their inverses. Limit and continuity. Theorem of Bolzano and theorem of the intermediate value.

Derivation

**Description:**

Integration

**Description:**

Sequences and series

**Description:**
### ACTIVITIES

#### Midterm exam

**Specific objectives:**
1, 2

**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:** 7h  
Guided activities: 2h  
Self study: 5h

#### Final exam

**Specific objectives:**
1, 2, 3, 4

**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

#### Functions

**Full-or-part-time:** 38h  
Theory classes: 9h  
Practical classes: 7h  
Self study: 22h
**Differentiability**

**Full-or-part-time:** 53h 30m  
Theory classes: 12h 30m  
Practical classes: 10h  
Self study: 31h

**Integrability**

**Full-or-part-time:** 45h 30m  
Theory classes: 11h  
Practical classes: 8h  
Self study: 26h 30m

**Sequences and series**

**Full-or-part-time:** 31h  
Theory classes: 8h  
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)  

on  
[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)