Course guide
240012 - 240012 - Calculus I

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 749 - MAT - Department of Mathematics.
Degree: BACHELOR’S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).
Academic year: 2023 ECTS Credits: 6.0 Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: Joan Solà-Morales Rubió Carles Bonet Revés

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

TEACHING METHODOLOGY

In theory sessions the basic theoretical body of the subject is presented, together with illustrations and examples of the most important notions and results.

In the problem sessions, exercises are solved to consolidate the concepts introduced in the theory classes.

In the "Taller de Matemàtiques" practices, exercises will be carried out by means of the Matlab / Octave program that will reinforce the contents of the course, especially the graphical and numerical tools.

LEARNING OBJECTIVES OF THE SUBJECT

The Calculus 1 course intends to provide students with basic tools, analytic and numerical, to analyse single variable real functions, and at the same time show its use in modelling technical and science problems.

This course also intends to be an introduction in the degree's studying methodology, as well as a fundamental support to correctly understand the rest of subjects, this is the reason why the subject's instrumental character will be strongly emphasised.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>56,0</td>
<td>37.33</td>
</tr>
<tr>
<td>Hours small group</td>
<td>4,0</td>
<td>2.67</td>
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</tbody>
</table>

Total learning time: 150 h
## CONTENTS

### 1.- Continuity

**Description:**

**Related competencies:**
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

**Full-or-part-time:** 25h
Theory classes: 10h
Self study: 15h

### 2.- Derivation

**Description:**
Definition of derivative. Basic derivation rules. The chain rule. Implicit derivation and the derivative of the inverse function.

**Related competencies:**
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

**Full-or-part-time:** 35h
Theory classes: 14h
Self study: 21h

### 3.- Integration

**Description:**

**Related competencies:**
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

**Full-or-part-time:** 37h 30m
Theory classes: 15h
Self study: 22h 30m
### 4.- Series

**Description:**

**Related competencies:**
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

**Full-or-part-time:** 37h 30m  
Theory classes: 15h  
Self study: 22h 30m

### 5.- Mathematics workshop

**Description:**
Introduction to Matlab/Octave, graphic representation of functions, zeroes of functions. Integración numérica

**Related competencies:**
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

**Full-or-part-time:** 15h  
Laboratory classes: 6h  
Self study: 9h

### ACTIVITIES

**MATHEMATICS WORKSHOP**

**Description:**
Introduction to Matlab/Octave and graphical representation of functions (2h)  
Zeroes of functions: bisection, Newton,... (2h)  
Numerical Integration (2h)

**Full-or-part-time:** 15h  
Laboratory classes: 6h  
Self study: 9h
GRADING SYSTEM

The student will be evaluated in three tests:

- A partial test in midterm (EP), in a date set by the School.
- A laboratory test of the Mathematics Workshop (ET), which will take place during the semester.
- Final exam (EF), date determined by the School.

The final grade (NF) will be computed by the following formula:

\[ NF = \max(0.60*EF + 0.30*EP + 0.10*ET, 0.9*EF + 0.10*ET) \]

The grade corresponding to Mathematics Workshop will not be changed. Hence, in case of taking the reevaluation exam (ER), the final grade will be given by:

\[ NF = 0.9*ER + 0.1*ET \]

EXAMINATION RULES.

For the exams, it is permitted to use a handwritten personal collection of formulas in a DIN A4 a paper, no photocopies are allowed. The use of a scientific calculator is allowed as long as it cannot graph functions, save information, or transmit or receive data.

BIBLIOGRAPHY

Basic:

RESOURCES

Other resources:
The subject will have a website in which all the necessary material will be uploaded, such as problem lists or information on the laboratory sessions, and all that information that helps autonomous learning.