Course guides  
2500005 - GECCALCUL - Calculus

Unit in charge: Barcelona School of Civil Engineering  
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2020). (Compulsory subject).

Academic year: 2021  
ECTS Credits: 6.0  
Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: M. ROSA ESTELA CARBONELL  
Others: M. ROSA ESTELA CARBONELL, FRANCISCO JAVIER MARCOTE ORDAX, MARCOS PEDRO TERÉS PERNICHI

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14392. Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculation; differential equations and partial derivatives; numerical methods; numerical algorithmic; Statistics and optimization. (Basic training module)

TEACHING METHODOLOGY

The course consists of 2 hours per week of classroom activity (large size group) and 2 hours weekly with half the students (medium size group).

The 2 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 2 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.
LEARNING OBJECTIVES OF THE SUBJECT

Knowledge of differential calculus of functions of several variables; Riemann multiple Integral; Successions and series of functions; and ordinary differential equations

1. Ability to relate ordinary differential equations to engineering problems. Ability to solve ODEs in simple conditions and conduct analysis such as parametric studies.
2. Ability to solve engineering problems that require minimization, integration and analysis of functions of several variables.


STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.00</td>
</tr>
</tbody>
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**Total learning time:** 150 h
**Contents**

**Differential calculus of functions of several variables**

**Description:**
- Limits of functions of several variables
- Problem limits of functions of several variables
- Continuity of functions of several variables
- Problem limits of functions of several variables
- Partial derivatives
- Partial derivatives
- Differentiability
- Differentiability
- Chain rule
- Chain rule
- Inverse function theorem
- Implicit function theorem
- Implicit function theorem
- Taylor's formula
- Free ends
- Conditioned extremes
- Conditioned extremes

**Full-or-part-time:** 55h 12m
- Theory classes: 11h
- Practical classes: 10h
- Laboratory classes: 2h
- Self study: 32h 12m

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**Riemann multiple integrals**

**Description:**
- Definition. Construction
- Implicit function theorem
- Problem limits of functions of several variables
- Variable change theorem
- Multiple integration problems

**Full-or-part-time:** 21h 36m
- Theory classes: 3h
- Practical classes: 4h
- Laboratory classes: 2h
- Self study: 12h 36m
**Sequences and functional series**

**Description:**
Sequences of functions. Punctual and uniform convergence
Sequences of functions
Series of functions
Series of functions
Power series
Power series
Fourier series

**Full-or-part-time:** 26h 24m
Theory classes: 4h
Practical classes: 5h
Laboratory classes: 2h
Self study: 15h 24m

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**Ordinary differential equations**

**Description:**
Introduction to ordinary differential equations
Separable variables
Separable variables
First-order linear EDOS
First-order linear EDOS
Second-order linear EDOS
Second-order linear EDOS
Linear EDOS systems at constant coefficients
Linear EDOS systems at constant coefficients

**Full-or-part-time:** 40h 48m
Theory classes: 7h
Practical classes: 8h
Laboratory classes: 2h
Self study: 23h 48m

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**GRADING SYSTEM**

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.
BIBLIOGRAPHY

Basic: