Course guide
2500005 - GECCALCUL - Calculus

Last modified: 22/05/2025

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: 2025 **ECTS Credits:** 6.0 **Languages:** Catalan, English

LECTURER

Coordinating lecturer: M. ROSA ESTELA CARBONELL

Others: NAPOLEON ANENTO MORENO, M. ROSA ESTELA CARBONELL, FRANCISCO JAVIER MARCOTE ORDAX, ESTHER SALA LARDIES

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 subject consists of 4 hours a week of face-to-face classes in the classroom and 2 hours a week of voluntary workshop.

In face-to-face classes, the teaching staff presents the basic concepts and materials of the subject, presents examples and carries out exercises.

The volunteer workshop hours are mostly devoted to consolidating concepts previous to entering university and solving problems, always having a great deal of interaction with the students.

Support material is used in the form of a detailed teaching plan through the ATENEA virtual campus: contents, schedule of assessment and directed learning activities and bibliography.

Although the majority of sessions will be held in the language indicated in the guide, sessions supported by other guest experts from time to time may be held in another language.

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.

Knowledge of differential calculation of functions of various variables. Knowledge of integral calculation of various variables, including representation integral of functions, integral dependent on parameters. Directional derivatives. Gradient vector. Chain rule. Tangent plane. Inverse function theorem. Implicit functions. Higher order partial derivatives. Taylor's formula. Free extrema. Conditional extrema. Knowledge of the existence of serial development and its application to problems in civil engineering.

STUDY LOAD

Type	Hours	Percentage
Hours large group	20,0	13.33
Hours medium group	30,0	20.00
Hours small group	10,0	6.67
Self study	90,0	60.00

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

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 funcional series

Description:
Sequences of functions. Punctual and uniform convergence
Sequences of functions. Punctual and uniform convergence
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

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

GRADING SYSTEM

The subject's grade is obtained from the continuous assessment grades and the corresponding laboratory and/or computer lab grades. There will be a global test with 50% of the weight of the assessment and the remaining 50% will be continuous assessment tests.

The continuous assessment consists of doing different activities, both individual and group, of an additive and formative nature, carried out during the course (inside and outside the classroom).

The assessment tests consist of a part with questions about concepts associated with the learning objectives of the subject in terms of knowledge or understanding, and a set of application exercises.

Criteria for qualification and admission to the re-evaluation: Students suspended from the ordinary evaluation who have appeared regularly in the evaluation tests of the suspended subject will have the option to take a re-evaluation test in the period set in the academic calendar Students who have already passed it, or students classified as not present, will not be able to take the revaluation test of a subject. The maximum grade in the case of taking the reassessment exam will be five (5.0). The non-attendance of a student called to the re-evaluation test, held in the fixed period, cannot give rise to the completion of another test with a later date. Extraordinary assessments will be carried out for those students who, due to accredited force, have not been able to take any of the continuous assessment tests.

These tests must be authorized by the corresponding head of studies, at the request of the teacher responsible for the subject, and will be carried out within the corresponding teaching period.

BIBLIOGRAPHY

Basic:
- Estela, M.R.; Saà, J. Cálculo con soporte interactivo en Moodle [on line]. Madrid: Pearson Educación, 2008 [Consultation: 27/09/2024]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4668. ISBN 9788483224809.
- Estela, M. R.; Serra, A. Cálculo: ejercicios resueltos. Madrid: Pearson Educación, 2008. ISBN 9788483224816.
- Edwards, C.H.; Penney, D.E. Ecuaciones diferenciales y problemas con valores en la frontera: cómputo y modelado [on line]. 4a ed. México: Prentice Hall Hispanoamericana, 2009 [Consultation: 27/09/2024]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1281. ISBN 9789702612858.