

Fundamentals of Mathematics for Environmental Science 1 (250559)

General Information

School	ETSECCPB
Departments	Departament d'Enginyeria Civil i Ambiental (DECA)
Credits	6.0 ECTS
Programs	GRAU EN CIÈNCIES I TECNOLOGIES DEL MAR (pla 2018)
Course	2024/25

Main teaching language at each group

- Group 11 Spanish (Q2)
- Group 12 Spanish (Q2)

Faculty

Responsible Faculty: Pablo Saez Viñas
Faculty: Francisco Javier Ozon Gorriz, Pablo Saez Viñas

Objectives of Education

In this course, some mathematical aspects will be provided to understand natural environmental processes. Emphasis will be placed on the development of series (power, Fourier, etc.), functions that describe curves in 2 and 3 dimensions, and the introduction of numerical methods for the solution of systems of nonlinear equations.

- 1.- Relate the ordinary differential equations (ODEs) with environmental processes. Ability to solve ODEs in simple conditions, allowing an analysis of these solutions, including a parametric study.
- 2.- Problem solving of environmental processes that involve the minimization of multivariable functions, including their integration and analysis.
- 3.- Use the Fourier series in the resolution of environmental process problems.

This subject deepens the topics covered in Fundamentals for the Environment and introduces some new ones. In general, there is a lot of emphasis on the applications of mathematics to real problems. The theory that is explained is sufficient to understand the process of building models of the various problems that later require the use of numerical calculation software (Matlab) for its effective resolution. The essential objective is to integrate within the subject the modeling and numerical resolution processes necessary for the treatment of real problems. At the end of the course the student must be able to formulate the problem, write a small Matlab code to solve it (using the Matlab functions), interpret the results and be able to represent them graphically.

Competencies

Especific

To know and apply the lexicon and concepts of the Marine Sciences and Technologies and other related fields.

Establish a good practice in the integration of common numerical, laboratory and field techniques in the analysis of any problem related to the marine environment.

Generic

Develop a professional activity in the field of Marine Sciences and Technologies.
Address in a comprehensive manner the analysis and preservation of the marine environment with sustainability criteria.

Total hours of student work

		Hours	Percentage
Supervised Learning	Large group	30.0 h	50.00 %
	Medium group	30.0 h	50.00 %
	Laboratory classes	0.0 h	0.00 %
	Guided Activities	0.0 h	0.00 %
Self Study		90.0 h	

Contents

Introduction to Matlab

Loops, conditionals and functions
Practical cases of programming

Functions of multiple variables

Representation of functions in Matlab
Partial and directional derivatives. Gradient. Chain rule
Parametric representation of surfaces
Problems in environmental applications

Ordinary differential equations

Introduction. Separation of variables
Linear equations with constant coefficients
Problems in environmental applications

Evaluation

Functional approximation

Functional approximation
Least squares
Resolution by numerical methods

Zero de functions

Obtaining the zero of a function through numerical methods

Teaching Methodology

Theoretical classes will be given, solving problems and practices. The subject is face-to-face and the work in class will be evaluated, in addition to the exams proposed for the course. The participation in class will be very positive. Class attendance will not be enough to pass the subject, which means that the student must spend about 4 hours a week on a regular basis outside the classroom. Support material is used in the format of a detailed teaching plan through the ATENEA virtual campus: contents, programming of assessment activities and directed learning and bibliography.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

Grading Rules

() The evaluation calendar and grading rules will be approved before the start of the course.*

The grade for the course will consist of:

- Practical works (NA).
- Two exams (NE1 and NE2).

1. The practical work (NA) will include, among others, the resolution of problems and the performance of directed work.

2. The contents of the NE1 and NE2 exams will be in accordance with all the subject taught from the beginning of the course.

- The NE1 exam will be taken approximately halfway through the semester and the subject taught so far will enter.

- The NE2 exam will be a final exam, where the complete subject taught throughout the course will enter.

The note of the exams will be calculated as:

$$NE = \max(0.3 * NE1 + 0.7 * NE2, NE2)$$

The final grade for the course will be:

$$\text{Final Note} = 0.25 * NA + 0.75 * NE$$

Criteria for re-evaluation qualification and eligibility: students that failed the ordinary evaluation and have regularly attended all evaluation tests will have the opportunity of carrying out a re-evaluation test during the period specified in the academic calendar. Students who have already passed the test or were qualified as non-attending will not be admitted to the re-evaluation test. The maximum mark for the re-evaluation exam will be five over ten (5.0). The non-attendance of a student to the re-evaluation test, in the date specified will not grant access to further re-evaluation tests. Students unable to attend any of the continuous assessment tests due to certifiable force majeure will be ensured extraordinary evaluation periods.

These tests must be authorized by the corresponding Head of Studies, at the request of the professor responsible for the course, and will be carried out within the corresponding academic period.

Test Rules

. Students suspended to the ordinary assessment that have been submitted regularly to the evaluation tests of the suspended subject will have the option to carry out a reassessment test in the period set in the academic calendar. Students who have already passed the qualification as not yet submitted may not be submitted to the re-evaluation test of a subject. The maximum qualification in the case of re-evaluation will be five (5.0). The non-attendance of a student summoned to the test of re-evaluation, celebrated in the fixed period, will not be able to give rise to the accomplishment of another test with later date. Extraordinary assessments will be made for students who have not been able to complete some of the continuous assessment tests because of their proven accreditation. These tests must be authorized by the corresponding head of studies, at the request of the professor responsible for the subject, and will be carried out within the corresponding teaching period.

Office Hours

The timetable must be agreed with the teacher at the beginning of the course

Bibliography

Basic

- Larson, R.; Hostetler, R.; Edwards, B. [Cálculo, Vol I, Vol II](#). 9a ed. México: Mc. Graw Hill, 2010. ISBN 9786071502735.
- Larson, R.; Edwards, B.H. [Cálculo](#). 10a ed. México, D.F.: Cengage, 2016. ISBN 9786075220154.
- Zill, D.G. [Ecuaciones diferenciales con aplicaciones de modelado](#). 9a ed. México, D.F.: International Thomson, 2009. ISBN 9789708300551.
- Zill, D.G.; Wright, W.S.; Cullen, M.R. [Matemáticas avanzadas para ingeniería](#). 4a ed. México: McGraw Hill, 2012. ISBN 9786071507723.
- Herman, E.; Strang, G. [Calculus](#). Houston, Texas: OpenStax, Rice University, 2016. ISBN 9781947172135.
- Dorronsoro, C.; Anton, H. [Aplicaciones de álgebra lineal](#). México: Limusa, 1979. ISBN 9681801792.

Complementary

- Boyce, W.E.; DiPrima, R.C. [Ecuaciones diferenciales y problemas con valores en la frontera](#). 5a ed. México: Limusa Wiley, 2010. ISBN 9786070501517.