Course guide
2500208 - GECMATEMA1 - Mathematics I

Last modified: 01/10/2023

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

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

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: PABLO SAEZ VIÑAS

Others: FRANCISCO JAVIER OZON GORRIZ, PABLO SAEZ VIÑAS

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14446. Solve mathematical problems that may arise in engineering by applying knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, optimization, ordinary differential equations.
14447. Obtain basic knowledge about the use and programming of computers, operating systems, databases and basic numerical calculation and applied to engineering.
14448. Manage the basic concepts about the general laws of mechanics and thermodynamics, concept of field and heat transfer, and apply them to solve engineering problems.
14449. Apply the basic principles of general chemistry, organic and inorganic chemistry and their applications in engineering.
14450. Describe the global functioning of the planet: atmosphere, hydrosphere, lithosphere, biosphere, anthroposphere, biogeochemical cycles (C, N, P, S), soil morphology and apply it to problems related to geology, geotechnics, edaphology and climatology.

Generical:
14440. Identify, formulate and solve problems related to environmental engineering.
14441. Apply the functions of consulting, analysis, design, calculation, project, construction, maintenance, conservation and exploitation of any action in the territory in the field of environmental engineering.
14444. Apply business management techniques and labor legislation.

TEACHING METHODOLOGY

The course consists of 2 hours per week of classroom activity (large size group) and 1 hour 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 1 hour 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.

The rest of weekly hours devoted to laboratory practice.

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.

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.

LEARNING OBJECTIVES OF THE SUBJECT

Mathematical resources are provided to understand natural environmental processes, with special emphasis on mutiple variable functions, ordinary differential equations, and numerical methods for nonlinear equations, as well as some basic notions of programming.

1. Interpret vector spaces. 2. Solve systems of linear equations both manually and through a computer program. Ability to interpret geometrically vector calculation concepts.
3. Calculate with vectors and matrices. Ability to solve linear eigenvalues problems both manually and through some program of computer.

Mathematics I. Knowledge of linear algebra, methods of solving linear problems that appear in engineering, elements of analytical geometry and ability to apply to scientific-technological subjects and environmental engineering in general

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	15,0	10.00
Hours large group	30,0	20.00
Hours medium group	15,0	10.00

Total learning time: 150 h

CONTENTS

Introduction to Matlab

Description:
Loops, conditionals and functions
Practical programming cases

Full-or-part-time: 36h
Laboratory classes: 15h
Self study : 21h

Funcions de múltiples variables

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

Full-or-part-time: 52h 48m
Theory classes: 12h
Practical classes: 6h
Laboratory classes: 4h
Self study : 30h 48m

Ordinary differential equations

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

Full-or-part-time: 26h 24m
Theory classes: 8h
Laboratory classes: 3h
Self study : 15h 24m

assessment

Description:
Exam 1
Exam 2

Full-or-part-time: 9h 36m
Laboratory classes: 4h
Self study : 5h 36m

Approximation of functions

Description:
INterpolation
least squares
REsolution by numerical methods

Full-or-part-time: 19h 12m
Theory classes: 8h
Self study : 11h 12m

GRADING SYSTEM

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:

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.

EXAMINATION RULES.

Students who fail the regular assessment who have regularly taken the assessment tests of the failed subject will have the option of taking a re-assessment test in the period set in the academic calendar. Students who have already passed it or students who have qualified as not presented will not be able to take the re-assessment test for a subject. The maximum grade in the case of reassessment will be five (5.0). The non-attendance of a student summoned to the re-evaluation test, held in the fixed period, will not be able to give rise to the realization of another test with later date. Extraordinary assessments will be conducted for those students who due to accredited force majeure have not been able to complete some 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. Once each exam has been taken, there is the possibility that a student may be called to do an oral interview as a validation of their written exam, this interview being on the subject of the exam. In case of not obtaining a satisfactory assessment in the interview, the exam will be given as failed with a grade of zero.

BIBLIOGRAPHY

Basic:
- Larson, R.; Hostetler,R.; Edwards, B. Cálculo, Vol I, Vol II. 10a ed. Méxixo: Cengage, 2016. ISBN 9786075220154.
- Zill, D.G. Ecuaciones diferenciales con aplicaciones de modelado. 10a ed. México: Cengage Learning Editores, 2018. ISBN 9786075266312.
- Zill, D.G.; Wright, W.S.; Cullen, M.R. Matemáticas avanzadas para ingeniería [on line]. 4a ed. México: McGraw Hill, 2012 [Consultation: 23/11/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4315. ISBN 9786071507723.
- Herman E; Strang,G. Calculus [on line]. Open Stax, Rice University, 2016 [Consultation: 19/12/2022]. Available on: https://d3bxy9euw4e147.cloudfront.net/oscms-prodcms/media/documents/CalculusVolume1-OP.pdf. ISBN 9781947172135.
- Rorres, 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.