Course guide
2500210 - GEA0210 - Mathematics II

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:** Catalan

LECTURER

Coordinating lecturer: ANTONIO RODRIGUEZ FERRAN

Others: IRENE ARIAS VICENTE, ANTONIO RODRIGUEZ FERRAN

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

Theoretical classes will be given, solving problems and practices.

Some practical classes may be taught in Spanish. 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.

LEARNING OBJECTIVES OF THE SUBJECT

Mathematical tools, such as vector fields and line and surface integrals, to study environmental phenomena are presented. For the practical application of these concepts, computer, programming and numerical simulation tools are also provided.

1. Relate EDOs and EDPs to engineering problems in continuous medium. Ability to solve them in simple geometric conditions that allow an analysis of these solutions, including a parametric study.
2. Program complex solutions using basic software and obtain numerical solutions under simple geometric conditions.
3. Develop solutions to these problems under simple geometric conditions that allow an analysis of these solutions, including a parametric study.

Mathematics II. Knowledge about ordinary differential equations and partial derivatives of physics-mathematics and ability to apply them to scientific-technological subjects and environmental engineering in general.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

Higher order linear ODEs

Description:
Introduction to ODEs
ODE systems
Numerical solution of systems
environmental applications

Full-or-part-time: 52h 48m
Theory classes: 16h
Laboratory classes: 6h
Self study : 30h 48m

Boundary value problems

Description:
Introduction. Balance problems. Shooting method
Environmental applications

Full-or-part-time: 19h 12m
Theory classes: 4h
Laboratory classes: 4h
Self study : 11h 12m

Approximation of functions

Description:
Introduction to interpolation
Environmental claims
Least squares
Applications

Full-or-part-time: 45h 36m
Theory classes: 8h
Practical classes: 11h
Self study : 26h 36m

Mathematical representation of wave phenomena

Description:
Complex numbers, concept and representation
Application to environmental phenomena

Full-or-part-time: 14h 23m
Theory classes: 2h
Practical classes: 4h
Self study : 8h 23m

Assessment

Full-or-part-time: 12h
Laboratory classes: 5h
Self study : 7h

GRADING SYSTEM

The grade for the course will consist of:

- Activities (NA).

- Two exams (NE1 and NE2).

1. Activities (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 subjects 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 = $0.25 * NA + 0.75 * NE$

EXAMINATION RULES.

Students who fail the ordinary 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:
- Burden R.L.; Faires, J.D. Análisis numérico. 10a ed. Mexico DF: Cengage Learning, 2017. ISBN 9786075264042.
- Zill, D.G. Ecuaciones diferenciales con aplicaciones de modelado. 10a ed. México: Cengage Learning Editores, 2018. ISBN 9786075266312.