Course guides
2500208 - GECMATEMA1 - Mathematics I

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.
Degree: (ANG) GRAU EN ENGINYERIA AMBIENTAL (Syllabus 2020). (Compulsory subject).
Academic year: 2020
ECTS Credits: 6.0
Languages: Catalan

LECTURER

Coordinating lecturer: JAUME SOLER VILLANUEVA
Others: JAUME SOLER VILLANUEVA

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.

General:
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.
LEARNING OBJECTIVES OF THE SUBJECT

Mathematical resources are provided to understand natural environmental processes, with special emphasis on multiple 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

Introduction to Matlab

Description:
Loops, conditionals and functions
Practical programming cases

Full-or-part-time: 16h 48m
Theory classes: 4h
Laboratory classes: 3h
Self study: 9h 48m

Zero of functions

Description:
Bisection, secant and Newton
Problems in environmental applications

Full-or-part-time: 19h 12m
Theory classes: 4h
Practical classes: 4h
Self study: 11h 12m
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
Numerical resolution. Euler's method. Matlab ODE45 function
Problems in environmental applications

Full-or-part-time: 43h 12m
Theory classes: 10h
Practical classes: 5h
Laboratory classes: 3h
Self study : 25h 12m

assessment

Description:
Exam 1
Exam 2

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

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.
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:

Complementary: