820008 - ACM - Algebra and Multivariable Calculus

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 749 - MAT - Department of Mathematics
Academic year: 2019

Degree:
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
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BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)

ECTS credits: 6

Teaching languages: Catalan, Spanish, English

Teaching staff
Coordinator: FAYÇAL IKHOUANE EL MOUSTACHIR - MARGARIDA MITJANA RIERA
Others: Primer quadrimestre:
ANGÉLES CARMONA MEJÍAS - M30
FAYÇAL IKHOUANE EL MOUSTACHIR - T10, T20
MARGARIDA MITJANA RIERA - M10
JUAN TRIAS PAIRO - M20

Opening hours
Timetable: Each teacher will determine the timetable when the course start.

Degree competences to which the subject contributes

Specific:
1. Solve mathematical problems that may arise in engineering. Apply knowledge of linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial differential equations; numerical methods; numerical algorithms; statistics and optimisation.

Transversal:
3. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Teaching methodology

Teaching methodology is a combination of lectures in the classroom and homeworks, along with a midterm and a final exam.
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Learning objectives of the subject

To present the fundamental concepts of differential and integral calculus of several variables, and linear algebra. To develop the ability to applying them to engineering problems.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>60h</th>
<th>40.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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</tbody>
</table>
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## Content

<table>
<thead>
<tr>
<th>(ENG) Linear algebra and geometry</th>
<th>Learning time: 40h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 16h</td>
</tr>
<tr>
<td></td>
<td>Self study: 24h</td>
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</tbody>
</table>

**Description:**

**Specific objectives:**
Identify and characterize vector spaces and subspaces, and manipulate vectors. Identify diagonalizable endomorphisms.

<table>
<thead>
<tr>
<th>(ENG) Functions of several variables</th>
<th>Learning time: 30h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 12h</td>
</tr>
<tr>
<td></td>
<td>Self study: 18h</td>
</tr>
</tbody>
</table>

**Description:**

**Specific objectives:**
Study of functions of several variables with emphasis on the concepts and methods of differential calculus of several variables.

<table>
<thead>
<tr>
<th>(ENG) - Extrema of real functions of several variable</th>
<th>Learning time: 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Self study: 9h</td>
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</tbody>
</table>

**Description:**
Local and global extrema. Test for local extrema. Constrained extrema. Lagrange multiplier method.

**Specific objectives:**
To acquire the basic tools for analyzing extrema problems, both free and constrained extrema problems.
### (ENG) -Multiple integration and applications

<table>
<thead>
<tr>
<th>Learning time: 30h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 12h</td>
</tr>
<tr>
<td>Self study: 18h</td>
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</tbody>
</table>

**Description:**

**Specific objectives:**
Ability for solving problems of multiple integration and its application to problems of science and engineering.

### (ENG) Differential geometry and field theory

<table>
<thead>
<tr>
<th>Learning time: 35h</th>
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<tbody>
<tr>
<td>Theory classes: 14h</td>
</tr>
<tr>
<td>Self study: 21h</td>
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</tbody>
</table>

**Description:**

**Specific objectives:**
Ability to provide analytical descriptions of curves and surfaces, calculate their properties and perform differential and integral calculus operations on them. Applications in field theory.

### Qualification system

The grading will be carried out by means of the assessment by the teacher. The students should pass the subject with the continuous assessment based on the controls and the realization of exercises that will be common for all students.

Examens:
- Exam 1 (20%) (Test plus a problem)
- Exam 2 (20%) (Exam by pairs. The use of a calculator/computer/tablet... is allowed)
- Exam 3 (20%) (Test plus a problem)
- Exam 4 (40%) (Test plus two problems)

The subject DOES NOT HAVE a resit test.


### Regulations for carrying out activities

During the exams, the use of calculators, mobiles, PC's or tablets is not allowed, except for Exam 2. Students will be provided with a form that will be the only material that can be used during exams.
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Bibliography

**Basic:**


**Complementary:**

