390104 - FM1 - Mathematics I

Coordinating unit: 390 - ESAB - Barcelona School of Agricultural Engineering
Teaching unit: 749 - MAT - Department of Mathematics
Academic year: 2018
Degree: BACHELOR'S DEGREE IN FOOD ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN AGRICULTURAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN FOOD ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN AGRICULTURAL, ENVIRONMENTAL AND LANDSCAPE ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN BIOSYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Fabregat Fillet, Jaime
Others: Fabregat Fillet, Jaime

Degree competences to which the subject contributes

Specific:
2. Fundamentals of computer use and programming, operating systems, data bases, software for engineering applications.
3. Ability to solve mathematic problems in an engineering context. Ability to apply the knowledge of linear algebra, geometry, differential geometry, differential and integral calculus.

General:
1. Ability to solve problems.

Teaching methodology

The lecture and the participatory expositive class will be used, in particular, in sessions of two hours and one hour. The structured topics will be presented through the lecture, in order to facilitate the information organized according to the criteria that are appropriate for the objectives. By using the participatory expositive class, spaces will be incorporated for the intervention of students with short-term actions in the classroom (direct questions, student's exhibitions on specific topics, performance of exercises, problem solving linked to the theoretical approaches).

The resolution of exercises and problems with active involvement of students will be applied fundamentally in small groups and computer laboratories. Students will be asked during these sessions to seek appropriate solutions through the exercise of routines and the application of formulas or algorithms (although without losing the use of personal wits), the application of procedures for transforming the available information and the interpretation of the results, as well as the use of appropriate software, to be developed in a framework of computer lab practices.

Autonomus learning will focus on actions basically aimed at solving exercises and problems. For personal learning some questionnaires, related to various contents, will be proposed using the virtual campus.

Learning objectives of the subject

The subject Mathematics 1 will attend general training purposes, focusing the objectives on the generation of capacities for the learning and to foment attitudes of valuation of the power and utility of the mathematical models and procedures to understand, and to make decisions, inside the techno-scientific field. Mathematics will play an instrument role for a better approach to the technological and scientific environment and to be able to move on to it in a more autonomous
and creative way. The systematic and ordered work, perseverance, deepening in interpretations, precision in reasoning, abstraction - which are some of the common characters of work in the area of mathematics - will impregnate the teaching process. From a general point of view, the student must be able, within the framework of the contents of the subject, to exercise logical reasoning, develop analytical thinking, apply a critical spirit, methodically argue, communicate with rigor.

When studying the subject, in the area of linear algebra, the student will achieve fundamental concepts related to linear relationships between variables, will use tools and basic methods to solve exercises related to the relationships that have been mentioned; and will work on concepts that refer to the sets on which basically optimize linear functions when the variables are subject to linear constraints. It will deal with basic aspects of analytic and differential geometry. In the area of differential calculus, the student will generalize to several variables the concepts previously studied in the case of a single variable, will delimit properties, will approximate functions through polynomial functions, and will determine extremes. These competencies will basically be applied to sets $\mathbb{R}^n$ (especially $n = 1, 2, 3$), in parts of those $\mathbb{R}^n$, and in associable sets, and above all with functions that in their domain (or in the interior of their domain) are infinitely derivable with continuity. Regarding the introduction of computing, the student will know powerful software as a basic tool for work and as an indisputable resource in the resolution of the problems posed in the mathematical fields developed in the subject.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 40h</th>
<th>26.67%</th>
</tr>
</thead>
<tbody>
<tr>
<td>---</td>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>---</td>
<td>Hours small group: 20h</td>
<td>13.33%</td>
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<tr>
<td>---</td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>---</td>
<td>Self study: 90h</td>
<td>60.00%</td>
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</table>
### Content

#### REAL FUNCTIONS OF VECTOR VARIABLE

**Description:**
Generalities (basic definitions, domains ...). Explicit and implicit functions. Functions of an elementary nature (polynomials and combinations with roots, exponential, logarithmic, trigonometric, cyclometric). Functions defined in sections. Limits (iterated, directional ...). Continuity (at one point, in a set, domain). Derivation. Level curves. Tangency.

**Learning time:** 18h 45m
- Theory classes: 5h
- Practical classes: 2h 30m
- Self study: 11h 15m

#### VECTOR FUNCTIONS OF REAL VARIABLE

**Description:**
Generalities (basic definitions, domains ...). Derivation of functions. Cases of two components (examples, parametric and Cartesian equations of curves). Cases of two and three components (scalar product, module - case of the constant module - and vector product). Derivation of products. Vectors that are tangent to curves. Kinematics of the point in the plane (position, trajectory, speed, acceleration). Kinematics of the point in space (position, trajectory, speed, acceleration).

**Learning time:** 18h 45m
- Theory classes: 7h 30m
- Self study: 11h 15m

#### VECTOR LINEAR FUNCTIONS OF VECTOR VARIABLE

**Description:**

**Learning time:** 18h 45m
- Theory classes: 5h
- Practical classes: 2h 30m
- Self study: 11h 15m

#### VECTOR NONLINEAR FUNCTIONS OF VECTOR VARIABLE

**Description:**

**Learning time:** 18h 45m
- Theory classes: 7h 30m
- Self study: 11h 15m
### Generalities about Extremes

**Description:**

**Learning time:** 18h 45m
- Theory classes: 5h
- Practical classes: 2h 30m
- Self study: 11h 15m

### Extremes of Real Functions of Real Variable

**Description:**

**Learning time:** 18h 45m
- Theory classes: 5h
- Practical classes: 2h 30m
- Self study: 11h 15m

### Extremes of Real Functions of Vector Variable

**Description:**

**Learning time:** 18h 45m
- Theory classes: 5h
- Practical classes: 2h 30m
- Self study: 11h 15m

### Linear Programming

**Description:**

**Learning time:** 18h 45m
- Theory classes: 5h
- Practical classes: 2h 30m
- Self study: 11h 15m
Qualification system

N1: A continuous assessment by teachers will be deployed mainly in the context of small groups.
N2: There will be one action of assessment inside the semester.
N3: There will be one action of assessment at the end of the semester.

Regarding the assessment of certificates character, this will lead finally to an evaluation report, which is based on the pondered consideration of the previous notes (N).

\[ N_{\text{final}} = 0.20 \times N_1 + 0.32 \times N_2 + 0.48 \times N_3 \]

If the average of the numbers N2 of the group of students is strictly less than 5, the personal number N2 will be replaced by the personal number N3 if this last number (N3) is higher than the previous one (N2).

For students who do not have the subject approved, except for students "not presented" there is the possibility of a re-assessment in the special period of reassessment exams. The re-assessment mark will substitute marks N2 and N3.

Bibliography

Basic:


Others resources:

Hyperlink

WIRIS, La solución global para la enseñanza de matemáticas
http://www.wiris.com/

WolframAlpha: Computational Knowledge Engine
http://www.wolframalpha.com/