Course guide
240721 - 240721 - Calculus II

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR’S DEGREE IN INDUSTRIAL TECHNOLOGIES AND ECONOMIC ANALYSIS (Syllabus 2018).
(Compulsory subject).

Academic year: 2022 ECTS Credits: 6.0 Languages: English

LECTURER
Coordinating lecturer: AMADEU DELSHAMS I VALDES
Others:

PRIOR SKILLS
Ability to solve the mathematical problems that can be posed in Industrial Technologies and Economic Analysis. Aptitude to apply the knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; numerical methods; numerical algorithm; Statistics and optimization.

TEACHING METHODOLOGY
The most conceptual contents of the course will be introduced in the theoretical classes, as well as basic examples in relation to these contents. In addition to some proofs (few), the emphasis will be put on making the student to understand the "What" and the "Why" of these concepts. The chosen examples will rely on a most "practical" formulation to help the student to see all these mathematical concepts as natural in problems that are easy to understand.

The most practical contents of the course will be developed in the practical classes and also in the laboratory sessions. On the one hand more elaborate examples will be presented. On the other hand the most practical methods and calculation tools will be practised. The exercises will be developed mainly by the teacher, but also stimulating the active participation of the student. To do this, the student will know beforehand the exercises to be develop in the next class, and some of them will be solved by the student, individually or inside a group, during the development of the class and under the supervision of the teacher.

The collections of exercises are thought to be sufficiently extensive so that the student has enough material to practise. In this way the students will be able to complete their learning in an autonomous way. In the laboratory sessions Teamwork will be encouraged and Matlab will be used as a programming tool.

LEARNING OBJECTIVES OF THE SUBJECT
The main goal of the course is that the student reaches a sufficient solvency in the use of the tools of the differential calculus and the vector calculus. In particular, of the derivation and the integration in several variables, and the calculus with curves and surfaces. Likewise, the aim of the subject is that this solvency is not only manifested in the conceptual understanding of the contents and in the ability to identify which methods are suitable for each of the Problems treated, but also in the acquisition of a certain "fluidity" of calculus and in a good understanding of the interaction between these theoretical contents and the mathematical modeling of the problems of Science and Technology.
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>60.0</td>
<td>40.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90.0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

1.- Continuity and derivability of functions of several variables

Description:

Full-or-part-time: 55h
Theory classes: 11h
Practical classes: 11h
Self study: 33h

2.- Integration of functions of several variables

Description:

Full-or-part-time: 35h
Theory classes: 7h
Practical classes: 7h
Self study: 21h

3. Vector Calculus

Description:
Integral of functions and vector fields on curves and surfaces. Theorems of Green, Stokes and Gauss. Extreme values and method of Lagrange Multipliers

Full-or-part-time: 45h
Theory classes: 9h
Practical classes: 9h
Self study: 27h

4. Numerical calculus: optimization

Description:
Linear optimization, the simplex method. Nonlinear optimization problems. Unconstrained and Constrained optimization, Overdetermined nonlinear systems

Full-or-part-time: 15h
Theory classes: 3h
Practical classes: 3h
Self study: 9h
GRADING SYSTEM

During the semester there will be two:
- One midterm exam (ME), on the date determined by the School.
- One test about the Matlab Workshop (WE), that will take place during a workshop session and will be notified in advance.
- The final exam (FE), on the date determined by the School.

Exams will contain a mixture of computational and conceptual problems. Some of them will resemble problems from the list, while some will be brand new to you. The final exam is likely to be a mixture of multiple choice and free response problems.

The final mark (FM) will be computed according to this formula:
$$FM = \max(0.6*FE + 0.1*WE + 0.3*ME, 0.9*FE+0.1*WE)$$

The part corresponding to the Matlab Workshop will not be re-evaluated. Therefore, those students that take the re-evaluation exam (RE), the final mark will be computed according to this formula:
$$FM = 0.9*RE+0.1*WE$$

EXAMINATION RULES.

The students can bring a manuscript sheet DINA4 with formulas for the exams. Calculator is not allowed.

BIBLIOGRAPHY

Basic: