

## SUBJECT TEACHING GUIDE

G376 - Calculus

Degree in Energy Resources Engineering

Academic year 2022-2023

1. IDENTIFYING DATA					
Degree	Degree in Energy Resources Engineering			Type and Year	Core. Year 1
Faculty					
Discipline	Subject Area: Mathematics Basic Training Module				
Course unit title and code	G376 - Calculus				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICA APLICADA Y CIENCIAS DE LA COMPUTACION				
Name of lecturer	VERA EGOROVA				
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Other lecturers					

### 3.1 LEARNING OUTCOMES

- Knowledge and manipulation of elementary univariate functions. Comprehension and application of the concepts of limit and continuity of a function at a point. Differentiate real functions with ease and application to optimization problems. Differentiate an implicit function. Study the differentiability of functions at a point and within an interval. Deal with numerical series and power series. Use Taylor's polynomials to approximate real functions. Know how to numerically implement local approximations of a function using Taylor polynomials, providing an error estimate.
- Calculate partial and directional derivatives and gradients. Know how to apply formulas from variable change to polar and spherical coordinates. Determine the plane tangent to the graph of a function at a point. Calculate partial derivatives of higher order and Hessian matrices. Develop in Taylor series. Raise and solve optimizations problems using differential calculus.
- Applications of the most usual analytical integration techniques of univariate functions and calculation of arc lengths, areas and volumes using univariate integral calculus. Application of formulas for change of variable to polar coordinates. Learn to parametrize common curves.

### 4. OBJECTIVES

In the context of the curriculum of this Engineering, the subject of Calculus serves as an introduction to an important part of the main mathematical tools that students will need throughout their studies. The objectives are: to begin in the language and in the mathematical reasoning; acquire habits of intellectual work; start in the potentiality of calculation as a modeling tool; acquire operational management of mathematical functions and their main properties; know, understand and handle the basic elements of differential and integral calculus in one and several variables and their applications to problems of physics and engineering; recognition of specific software tools and programming as keys for learning and solving complex problems; instill in the student the form of continued study and autonomous work, both individually and in groups.

### 6. COURSE ORGANIZATION

#### CONTENTS

#### 1 THEMATIC BLOCK I: DIFFERENTIAL CALCULATION

##### UNIT 1. REAL FUNCTIONS OF ONE VARIABLE

- 1.1. Concept. Definitions. Operations with functions.
- 1.2. Limit of a function at a point. Continuity.
- 1.3. Theorems about continuous functions.
- 1.4. Derivation of functions of one variable.
- 1.5. Taylor's theorem and its applications.

##### UNIT 2. REAL FUNCTIONS OF SEVERAL VARIABLES

- 2.1. Concept. Definitions. Operations with functions.
- 2.2. Limit of a function at a point. Continuity.
- 2.3. Differential calculus in several variables.
- 2.4. Differentiation of functions with scalar values.
- 2.5. Applications to problems related to engineering.

#### 2 THEMATIC BLOCK II: INTEGRAL CALCULATION

##### UNIT 3. INTEGRAL CALCULATION

- 3.1. Integration of functions of one variable.
- 3.2. The Riemann integral.
- 3.3. Defined integral applications.
- 3.4. Multiple integration.
- 3.5. Applications of the double and triple integral to problems related to engineering.

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
<b>Partial Exam I</b> This individual written test will serve to assess the skills acquired in the contents corresponding to the Thematic Block I of the program.	Written exam	No	Yes	15,00
<b>Lab Practice</b> Continuous assessment during practical sessions. The students will practice autonomously following the script of the practice that is provided for each session.	Laboratory evaluation	No	No	15,00
<b>Partial Exam II</b> This individual written test will serve to assess the skills acquired in the contents corresponding to the Thematic Block II.	Written exam	No	Yes	15,00
<b>Final Exam</b> This individual written test will serve to evaluate the skills acquired throughout the course, so it will contain questions corresponding to all the Thematic Blocks.	Written exam	Yes	Yes	30,00
<b>Exercises to be done individually or in groups carried out throughout the semester</b>	Others	No	No	25,00
<b>TOTAL</b>				100,00
<b>Observations</b>				
<p>In the extraordinary period of examinations, students may only take those tests indicated as recoverable that have failed (qualification less than 5 out of 10).            Students who attend the extraordinary call, will take a single exam, corresponding to 60% recoverable, which will include all the thematic blocks, regardless of whether any of these were previously approved.</p> <p>In the tests will be penalized (among others):            - Answers that are not duly justified.            - Procedures that demonstrate the lack of acquisition of basic mathematical skills.</p> <p>Only for duly justified reasons (eg health restrictions) the assessment tests may be organized remotely, with prior authorization from the Center's Management.</p> <p>In the case of not exceeding the minimum grades, the global numerical grade will be the lowest value between 4.9 and the weighted average of all the evaluation tests, as indicated in the Regulation of the UC Evaluation Processes, in its article 35.</p>				
<b>Observations for part-time students</b>				
<p>The course can be followed from the Moodle platform. Part-time students must take the same assessment items as the rest of the students.</p>				

## 8. BIBLIOGRAPHY AND TEACHING MATERIALS

### BASIC

Larson, L. y Edwards, B. H. Cálculo I y II. 9ª ed. Mc Graw Hill. ISBN: 978-970-10-5710-0.  
<http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=263113>

Material puesto a disposición para clase (presentaciones, ejercicios, piezas audiovisuales y programas de software y código)