SUBJECT TEACHING GUIDE

G413 - Calculus I

Degree in Industrial Technologies Engineering
First Degree in Industrial Technologies Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Degree in Industrial Technologies Engineering First Degree in Industrial Technologies Engineering			Type and Year	Core. Year 1 Core. Year 1
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Mathematics Basic Training Module				
Course unit title and code	G413 - Calculus I				
Number of ECTS credits allocated	6	Term		Semester based (1)	
Web	https://www.giematic.unican.es/				
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICA APLICADA Y CIENCIAS DE LA COMPUTACION
Name of lecturer	MARIA REYES RUIZ COBO
E-mail	reyes.ruiz@unican.es
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 5. DESPACHO (S5015)
Other lecturers	ANGEL BARON CALDERA

3.1 LEARNING OUTCOMES
- The student will learn the properties and graphs for the elementary functions of a single real variable.
- The student will learn the definition, properties and differentiation techniques for functions of a single real variable.
- The student willl apply the Taylor polynomial local approximation for real functions of a single real variable.
- The student will learn the main concepts of infinite series and will get the Taylor series expansion of elementary functions.
- The student will learn the basic concepts and resolution methods to calculate integrals of functions of one real variable and will apply definite integrals to solve some physical and geometric problems.
- The student will learn the main concepts and differentiation techniques of functions of several variables.
- The student will be able to solve optimization problems about functions of one and several variables.
- The student will learn the main concepts of multiple integration and will apply these concepts for solving practical problems.
- The student will apply multiple integration techniques to solve some geometric and physical problems.

4. OBJECTIVES
--To learn and apply some important basic concepts of differential calculus in one and several variables . --To learn and apply some important basic concepts of single variable integral calculus . --To learn and apply some important basic concepts of Multiple Integration . --To be able to use mathematical software as an aid to troubleshooting .

6. COURSE ORGANIZATION

CONTENTS	
1	Part one
1.1	Topic 1.- Differential Calculus. 1.1 Review of real functions of a real variable. Definitions and properties. Graphs of elementary functions. 1.2 Derivative at a point: definition and geometric interpretation. The derivative as a rate of change. Differentiation techniques. Numerical differentiation. 1.3 Taylor polynomials. Definition. Taylor's formula. Approximation errors. Applications. Extreme values of a function.
1.2	Topic 2.- Integral Calculus 2.1 Primitives. Integration methods. 2.2 Integral of Riemann. Geometric interpretation. Integrability conditions. Properties. The Mean Value Theorem for integrals. Fundamental Theorem of integral calculus. Barrow's rule. Techniques of integration. 2.3 Improper Integrals. 2.4 Applications of the definite integral.
2	Part two
2.1	Topic 3.- Differential calculus of multivariable functions. 3.1 Definition. Domain and range. Traces, level curves, contour maps and graphs. Continuity. 3.2 Partial derivatives. Directional derivatives: definition and geometric interpretation. Higher order partial derivatives. 3.3 Differentiable function. The tangent plane and normal lines. Linear approximations. Gradients. 3.4 The chain rule. Implicit functions. 3.5 Taylor polynomial. Extremes.
2.2	Topic 4.- Multiple Integration. 4.1 The concept of the double integral. Properties. 4.2 Calculation of double integrals. Change of variable in double integrals: Jacobians. 4.3 The concept of the triple integral. Properties. 4.4 Calculation of triple integrals. Change of variable in triple integrals. 4.5 Applications in physics and geometry.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Written exams and computer based exams (Continuous evaluation)	Written exam	No	Yes	90,00
Homeworks: 10% of the total mark.	Activity evaluation with Virtual Media	No	Yes	10,00
Written theory and practice exam to retrieve de evaluation tests failed along the semester.	Written exam	No	Yes	0,00
TOTAL				100,00

Observations

The evaluation method will be a continuous assessment along the semester.
If students fail some of the evaluation tests taken during the semester, they can take the final exam in order to retrieve the part they failed during the semester.

Observations for part-time students

Part-time students will have a single final exam that will consist of theory and practice. The final grade will only be based on this final exam.

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
Álvarez, E., Herrero, Mª T. y Ruiz, R. Colección Fundamentos Matemáticos. Tomos I, II, III y IV.
Bradley, G.L. and Smith, K. Cálculo de una variable y Cálculo de varias varibles. Volúmenes I y II. Prentice Hall. ISBN: 84-89660-76-X
Larson, R. y Edwards, B. H. Cálculo de una variable. Ed. Mc Graw-Hill. ISBN: 978-607-15-0273-5. Cálculo de dos variables. Ed. Mc Graw-Hill. ISBN: 978-970-19-7134-2.
Strang, Gilbert. Calculus. Wellesley-Cambridge Press. Pdf online version .