

SUBJECT TEACHING GUIDE

G321 - Further Calculus

Degree in Chemical Engineering

Academic year 2019-2020

1. IDENTIFYING DATA					
Degree	Degree in Chemical Engineering			Type and Year	Core. Year 1
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Mathematics Basic Training Module				
Course unit title and code	G321 - Further Calculus				
Number of ECTS credits allocated	6	Term	Semester based (2)		
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 TERESA HERRERO MARTINEZ
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Other lecturers	ANGEL BARON CALDERA

3.1 LEARNING OUTCOMES

- The student will learn the main concepts of multiple integration and will apply these concepts for solving practical problems.
- The student will learn the main concepts of vector calculus and will apply these concepts for solving practical problems.
- The student will learn how to solve line integrals and will know the most significant physical and geometric applications.
- The student will learn how to solve surface integrals and will know the most significant physical and geometric applications.
- The student will learn the basic concepts and resolution methods of first order differential equations.
- The student will learn the basic concepts and resolution methods of linear second order differential equations.
- The student will be able to modeling and solve some simple technical problems that involve differential equations.
- The student will learn Euler's methods for obtaining a numerical approximation of the solution to an initial value problem and will implement this methods using the computer.
- The student will learn the main concepts of Laplace Transforms and will used them to solve initial value problems for linear differential equations.
- the student will learn the main concepts of partial differential equations and will be able to solve some of them using numerical methods.

4. OBJECTIVES

- To introduce the student to some important basic concepts of Vector Calculus and Multiple Integration.
- To introduce the student to the role of ordinary differential equations in engineering, and their methods of solution.
- To introduce the student to the classical theory of Laplace Transforms and some of its applications to the analysis and design of engineering systems.
- To introduce the student to the basic concepts of partial differential equations.
- To be able to use mathematical software as an aid for solving problems.

6. COURSE ORGANIZATION

CONTENTS

1	Part One: Multivariate Calculus
1.1	Topic 1.- Multiple Integration: The concept of the double integral. Properties. Calculation of double integrals. Change of variable in double integrals: Jacobians. The concept of the triple integral. Properties. Calculation of triple integrals. Change of variable in triple integrals. Applications in physics and geometry.
1.2	Topic 2.- Vector Calculus and line integrals. 2.1 Basic concepts of vector calculus. Vector fields. Differential operators. Conservative fields and potential functions. 2.2 Line Integrals: Definition of line integral. Fundamental theorem of line integrals. Green's theorem. Line integrals and work. Line integrals and flow.
1.3	Topic 3.- Surface Integrals: The concept of surface integral. Flux of a vector field. Gauss' divergence theorem. Stokes' theorem.
2	Part two.- Ordinary Differential Equations and Laplace Transforms
2.1	Topic 4.- First Order Differential Equations. Applications to mathematical modeling. First order equations, basic concepts, general solution and particular solution. Analytical solution. Euler's methods. Higher-order numerical methods. Mathematical modeling involving first order differential equations.
2.2	Topic 5.- Linear Second-Order Equations. Introduction to Linear Systems. General solution of the homogeneous equation, homogeneous equations of constant coefficients, non-homogeneous equations of constant coefficients. General solution of first order linear systems with constant coefficients. Numerical solution to an initial value problem. Numerical solution to a boundary value problem. Introduction to modeling problems using systems of linear differential equations.
2.3	Topic 6.- Laplace Transforms: Definition of the Laplace Transform. Properties. Inverse Laplace Transform. Impulses and the Dirac Delta Function. Solving initial value problems with Laplace Transforms.
2.4	Topic 7.- An introduction to partial differential equations and boundary problems. Introduction to numerical solving techniques: Method of Lines.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Theory and problems exam: 30% of the total mark.	Written exam	No	Yes	30,00
Test laboratory practices: 20% of the total mark.	Laboratory evaluation	No	Yes	20,00
Questions assignment for virtual evaluation: 10% of the total mark.	Activity evaluation with Virtual Media	No	Yes	10,00
Final exam with theory and problems: 40% of the total mark.	Written exam	No	Yes	40,00
TOTAL				100,00
Observations				
<p>The evaluation method will be a continuous assessment along the semester. The final mark is obtained as follows:</p> <ul style="list-style-type: none"> -- 60% evaluation tests done throughout the semester -- 40% final exam. <p>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.</p>				
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, M^a T. y Ruiz, R. Colección Fundamentos Matemáticos. Tomos III, IV y V.

Gerald L. Bradley y Karl J. Smith. "Cálculo de varias variables". Volumen II. Editorial Prentice-Hall.

Nagle, R.K. y Staff, E. B. "Fundamentos de ecuaciones diferenciales". Editorial Addison -Wesley.

Kaplan, Wilfred. Advanced Calculus. Editorial Addison-Wesley. Pdf online version.