ACADEMIC PROGRAM

ALGEBRA

B.F.A. IN **COMPUTER SCIENCE**

MODALITY: ON CAMPUS

ACADEMIC YEAR: 2022-2023

Name of the course:	**Algebra**
Degree :	Computer Science
Location:	Centro Universitario de Tecnología y Arte Digital
Area:	Science Fundamentals
Year:	1º
Teaching period:	2
Type:	B
ECTS credits:	6
Teaching modality:	On campus
Language:	English
Lecturer / Email	Christopher Hawkins /christopher.hawkins@u-tad.com
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SUBJECT DESCRIPTION

Area description

This subject is an integral part of the area of scientific fundamentals. This material provides the student with the mathematical base that enables them to acquire the degree of abstraction necessary to solve problems that arise in the world of software engineering.

Subject description

The objective of Algebra is to present the language and concepts of linear algebra, including complex numbers, vectors and matrices, including the application of these elementary operations to analytical and plane geometry; It is also intended to achieve familiarization with the resolution of systems of linear equations and the handling of vector spaces and linear applications. The final objective of the subject is that, on these concepts, the subsequent development of more advanced mathematical methods can be supported

COMPETENCIES AND LEARNING OUTCOMES

Competencies

BASIC AND GENERAL SKILLSs

CB1: Students demonstrate possession and understanding of knowledge in an area of study that is based on general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge arising from the forefront of their field of study.

CB2: Students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are typically demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

CB3: Students have the ability to gather and interpret relevant data (normally within their area of study) in order to make judgments that include a reflection on relevant issues of a social, scientific or ethical nature.

CB4: Students can transmit information, ideas, problems and solutions to both a specialized and non-specialized audience.

CB5: Students will have developed those learning skills necessary to undertake further studies with a high degree of autonomy

CG3 - Knowledge of the scientific foundations applicable to the resolution of problems in the area of computer science

CG11 – The ability to search for, analyze and manage information in order to extract knowledge from it

SPECIFIC SKILLS

CE24 – The Ability to solve mathematical problems that arise in computer engineering based on the knowledge acquired in linear algebra, differential and integral calculus and statistics

CE28 - Knowledge of the basic concepts of discrete mathematics, logic, algorithms and computational complexity and its application in solving problems in computer engineering

TRASVERSAL SKILLS

CT4 – The ability to update the knowledge acquired in the management of digital tools and technologies according to the current state of the sector and the technologies used

Learning outcomes

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- To understand and apply common demonstration strategies in mathematics (reductio ab absurdum, induction¿)

- To know and apply common numbering sets habituales (N, Z, Q, R y C).

- To know the basics of set theory.

- Basics of combinatorics in enumeration problems.

- To solve linear equation systems.

- To handle vectors, points, matrices, coordinates, distances, angles, conics, quadrics, movements, transformations, straight lines and planes in space

- To handle vector spaces and vector subspaces and linear applications.

- To apply the relation of linear applications and matrices to know the properties of a linear application according to its matrix representation.

- To apply real numbers, polynomials and expressions of inequality, absolute values, etc.

- To handle sequences and series of real number and to study their convergence.

- To understand and work intuitively and geometrically with the ideas of limits, derivative and integral.

- To know and handle common single variable functions and to find their properties (growth, maxima, minima, inflection points, concavity, convexity) and plot them.

- To be able to use elementary integration techniques of single variable functions and compute lengths, areas and volumes applying integral calculus.

- To be able to use software for symbolic computation and plotting

- To describe analytically and geometrically datasets

- To compute probabilities

- To solve elementary problems of regression, estimation and hypothesis testing

- To be able to use statistical software

CONTENTS

Modular and integer arithmetics

Linear systems of equations

Vectorial spaces, linear transforms and matrices

Euclidean geometry

SUBJECT SYLLABUS

Topic 1. Complex numbers

1.1. complex number

1.2. Binomial and polar forms of a complex number.

1.3. Operations

1.4. Integer roots of a complex number.

1.5. Logarithm and exponential of a complex number.

Topic 2. Vectors

2.1. Basic operations on vectors. Module.

2.2. Rule. Distances.

23. Scalar, vector and mixed product. Applications

2.4. Straight. Blueprints

Topic 3. Matrices and determinants

3.1. Operations with matrices. Range.

3.2. Square matrices.

3.3. Equivalent, congruent and similar matrices.

3.4. Determinants and properties.

3.5. Minor complementary, adjunct of an element. Inverse.

Topic 4. Systems of linear equations

4.1. Substitution, equalization and reduction method.

4.2. Rouché-Frobenius theorem.

4.3. Gaussian resolution method

4.4. Cramer's rule

Topic 5. Vector Spaces

5.1. Introduction to group theory.

5.2. Vectorial space. Vector subspaces.

5.3. Linear independence. Generator system. Base. Dimension.

5.4. Sum and intersection of subspaces. Direct sum.

5.5. Coordinates of a vector in a base. Base change.

5.6. Product vector space. Quotient vector space.

Topic 6. Linear applications

6.1. Definition

6.2. Core and image.

6.3. Composition.

6.4. Isomorphy theorems.

6.5. Base changes

6.6. Diagonalization

TRAINING ACTIVITIES AND TEACHING METHODOLOGIES

TRAINING ACTIVITIES

LEARNING ACTIVITIES	Total hours	Hours of presence

Theoretical / Expository classes	30,00	30,00
Practical classes	24,00	24,00
Tutorials	4,00	2,00
Independent study and autonomous work of the student	57,50	0,00
Elaboration of work (group or individual)	28,50	0,00
Evaluation Activities	6,00	6,00
TOTAL	150	62

Teaching methodologies

Expository method or master lesson

Case learning

Learning based on problem solving

Cooperative or collaborative learning

inquiry learning

Flipped classroom methodology

Gamification

Expository method or master lesson

Case method

Learning based on problem solving

Cooperative or collaborative learning

inquiry learning

Flipped classroom methodology

Gamification

TEMPORAL DEVELOPMENT

DIDACTIC UNITS / TOPICS TIME PERIOD

Complex numbers Weeks 1 and 2

Vectors Week 3, 4 and 5

Matrices and determinants Weeks 6 and 7

Systems of linear equations Weeks 8 and 9

Vector spaces Weeks 10, 11 and 12

Linear applications Weeks 13, 14 and 15

EVALUATION SYSTEM

ASSESSMENT SYSTEM	MINIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)	MAXIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)
Assessment of participation in class, exercises or projects of the course	0	30
Assessment of assignments, projects, reports, memos	30	60
Objective test	30	60

GRADING CRITERIA

ASSESSMENT SYSTEM	ORDINARY EVALUATION	EXTRAORDINARY EVALUATION
Assessment of participation in class, exercises or projects of the course	10	10
Assessment of assignments, projects, reports, memos	30	30
Objective test	60	60

General comments on the evaluations/assessments

The evaluation of participation will be carried out based on attendance and active participation in class and in the rest of the activities carried out during the course. This aspect will represent 10% of the final grade for the subject in the ordinary call.

- Throughout the course, activities, exercises and problems will be proposed that must be delivered before the indicated date through the virtual platform. This work will be evaluated through the virtual platform itself and will account for 30% of the final grade for the subject in the ordinary call.

- In the middle of the semester, the first partial exam will be taken, which will be liberatory if the student so wishes, with the condition of obtaining at least a grade of 4.0 in said exam. Those students who do not pass this grade or who decide to voluntarily discard it must take separate exams corresponding to the two partial exams on the date assigned for the ordinary June session. The two partial exams will represent 70% of the final grade in the ordinary call.

- To pass the subject in the ordinary call, it is essential that the final grade (including the partial exams, the problems and activities to be delivered and the participation) is at least 5.0 (out of 10). In addition to this requirement, it is necessary that the average of the partial exams be at least 5.0 (out of 10), where the grade of each partial exam must necessarily be greater than or equal to 4.0 (out of 10). If any of these requirements are not met, the subject will be automatically considered failed regardless of the rest of the grades.

- If the student does not get the pass in the ordinary call, the student may take the extraordinary call, where he/she will take a final exam that will represent 100% of his/her grade in said call, and in which it will be part of the subject required for the exam. student all the content of the subject seen in class (including the activities delivered through the virtual classroom).

- The use of notes or programmable scientific calculators is not allowed in the exams, for which the student must refer to the teacher's specific instructions on this topic.

- No grades of any kind will be kept between different academic years, nor between different calls.

LIST OF REFERENCES (BOOKS, PUBLICATIONS, WEBSITES):

Basic Bibliography:

Seymour Lipschutz. Linear algebra. McGraw-Hill. ISBN: 978-84-7615-758-9

Jose Manuel Gamboa and Mª Belén Rodríguez Rodríguez. Matrix algebra. University Base. Anaya. ISBN: 978-84-667-2606-1B

Recommended ibliography:

José F. Fernando, J. Manuel Gamboa and Jesús M. Ruiz. Linear algebra and geometry. Fascicle I. Systems of linear equations and matrices. Sanz and Torres. ISBN: 978-84-96808-03-4

José F. Fernando, J. Manuel Gamboa and Jesús M. Ruiz. Linear algebra and geometry. Fascicle II. Vector spaces and linear applications. Sanz and Torres. ISBN:978-84-96808-06-0

REQUIRED MATERIALS, SOFTWARE AND TOOLS

Type of classroom

Theory classroom

Board and projection system

Materials:

Personal computer.

Notebook or tablet for taking notes

Software:

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