UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2020/21
Subject (*)	Algebra		Code	614G01010
Study programme	Grao en Enxeñaría Informática			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	First	Basic training	6
Language	SpanishEnglish			
Teaching method	Hybrid			
Prerequisites				
Department	Ciencias da Computación e Tecnoloxías da InformaciónComputación			
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Web	campusvirtual.udc.es/moodle			
General description	Algebra is a Q2-course of the basic training module of Computer Engineering Degree. It is intended for acquiring skills in formal and abstract thinking, which will be essential in the performance of the students' future professions. The main purpose of this subject is to introduce concepts that are needed for the development of more specific subjects such as Computer Security, Computer Graphics, Artificial Vision, Digital Image Processing, and Networks. We are concerned with a computational approach emerging from the interplay of Algebra and Computer Engineering. Therefore, special emphasis is given to the algorithmic approach of the methods that are explained in this course.			

Contingency plan	1. Modifications to the contents The contents will not be modified unless, due to time restrictions, they ought to be reduced; in that case students will be given notice via the University virtual platforms (Moodle, Teams). 2. Methodologies *Teaching methodologies that are maintained Guest lecture/keynote speech: elaborated notes of every chapter will continue to be delivered via the University virtual platforms (Moodle, Teams). Laboratory practice: using the University virtual platforms (Moodle and Teams), collections of exercises will be provided as well as their solutions. Seminar: due to the absence of face-to-face classes, students can make inquiries about theoretical concepts and/or exercises through the University virtual platforms (Moodle, Teams). *Teaching methodologies that are modified Guest lecture/keynote speech: face-to-face classes become asynchronous classes (in the Moodle platform, students will have explanatory videos about the most difficult parts of the theory followed by complementary exercises) and synchronous classes using Teams (the contents of those classes will be provided at the end of each class). Objective test: it will be maintained, although the requirement of a minimum score will be scrapped. It will take place via the University virtual platforms. Its value is 80% of the final grade, and if conditions allow to, the contents will be divided in two parts, each of which will be evaluated in 2 different tests (the second one will take place on the fixed date for the final exam). Laboratory practice: there will be asynchronous classes as well as synchronous through the Teams platform. The students will have access to collections of exercises with solutions detailed. 3. Mechanisms for personalized attention to students: Weekly support will be given to each group through the virtual platform Teams. Individual tutorial sessions can also be scheduled by the academic staff members in order to solve any particular questions related to the subject. 4. Modifications in the evaluation *Evaluation observations: As it consists in a summative evaluation, no minimum score is required. In the first opportunity, each of the 2 tests mentioned above will be a 40% of the final grade. The student needs to obtain 5 points or more as a final score to pass the subject. Students that fail to pass the subject during the first opportunity, will have a second chance which consists in a unique test where the student can obtain at most the score of the final face-to-face test (80%). 5. Modifications to the bibliography or webgraphy Since most of the suggested references of the basic bibliography can be found as a pdf online version, the bibliography will

not be modified.

Study programme competences	
Code	Study programme competences
A1	Capacidade para a resolución dos problemas matemáticos que se poden presentar na enxeñaría. Aptitude para aplicar os coñecementos sobre: álxebra linear; cálculo diferencial e integral; métodos numéricos; algorítmica numérica; estatística e optimización.
A3	Capacidade para comprender e dominar os conceptos básicos de matemática discreta, lóxica, algorítmica e complexidade computacional e a súa aplicación para a resolución de problemas propios da enxeñaría.
B3	Capacidade de análise e síntese
B6	Toma de decisións
C1	Expresarse correctamente, tanto de forma oral coma escrita, nas linguas oficiais da comunidade autónoma.
C6	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C7	Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.

Learning outcomes			
Learning outcomes	Study programme competences		
Acquire basic concepts from Elementary Number Theory.	A1 A3		
Interpret and apply the acquired knowledge from Elementary Number Theory to Cryptography.	A1 A3	B3	
Know some basic concepts of Linear Algebra: systems of linear equations, vectorial spaces, matrices and linear maps.	A1		
Use Linear Algebra as a tool for modeling and solving processes related to computer science.	A1	B6	C6
Know the definitions and basic principles from Coding Theory related to Linear Algebra.	A1		
Simulate coding and decoding processes using matricial techniques.	A1	B6	C6
Learn how to use mathematical language in a proper way to express ideas.	A1		C1
Develop the capacities of abstraction, concretion, concision, imagination, intuition, reasoning, criticism, objectivity, synthesis and accuracy; put all of them in practice either in the academic or the professional life for solving problems successfully.		B3	C7
Apply basic concepts from the subject and relate to algorithmic and computational concepts in the light of the mathematical ones.	A1		C6
Acquire tools and skills for solving problems in a proper way. Express and interprete results in a rigorous way. Check the result and, in case of any incongruence, revise the process to detect the error.	A1	B6	C1 C7

Contents	
Topic	Sub-topic
Chapter 1: Modular arithmetic: application to Cryptography.	Basic concepts from elementary number theory. Euclides' algorithm. Prime numbers. Linear diophantine equations. Congruences. Modular arithmetic. Definition of cryptosystem. Classical cryptography. Symmetrical and asymmetrical cryptography. Examples of cryptosystems. Numeration systems. Divisibility criteria.
Chapter 2: Systems of Linear Equations, Matrices and Determinants.	Definition and properties of systems of linear equations. Echelon row form of system. Gauss method. Matrices. Operations with matrices. Invertible matrix. Determinant of a square matrix, properties. Cramer's rule.
Chapter 3: Vector Spaces.	Definition and properties of a vector space. Bases and coordinates. Dimension. Rank of a set of vectors and matrix rank. Computation of the rank. Change of basis. Rouché-Frobenius theorem.
Chapter 4. Linear maps.	Definición e propiedades das aplicacions lineais. Núcleo e imaxe de unha aplicación lineal. Matriz asociada a unha aplicación lineal. Teorema da dimensión. Definition and properties of linear maps. Kernel and image of a linear map. Matrix associated to a linear map. Dimension theorem.

Chapter 5. Linear Codes	Definition of linear codes. Parameters of a linear code. Hamming distance and Hamming weight. Generator matrix and parity-check matrix of a code. Error correction in linear codes. Binary Hamming codes.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 A3 C6 C7	30	45	75
Laboratory practice	A1 B3 B6 C1 C6	20	30	50
Objective test	A1 B3 C1	3	0	3
Collaborative learning	A1 B3 C1 C7	6	11	17
Personalized attention		5	0	5
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	The chief means of communication for this course will be the platform Moodle. Students are expected to check this for up-to-date assignments-including material separate from the given at the blackboard-and announcements. Over the semester we will study many topics that form a central part of the language of modern science. Weekly problem sets with a mix of exercices will be given. These include problems requiring abstraction, understanding and/or synthesis of various concepts. In many ways, these constitue the heart of the course; rigor in their completion often yields the greatest understanding. We want the student to leave the course not only with computational ability, but with the ability to use these notions in their natural scientific contexts, and with an appreciation of their mathematical power.
Laboratory practice	The laboratory work is the focal point of learning. A series of exercises related to the theoretical contents explained in the theoretical classes will be given to students at the beginning of every chapter. It ensures that: I) students work closely with the teacher helping them to grow in confidence, to develop their skills in analysis, and to encourage them to reinforce the learning of theoretical concepts through the resolution of the exercises. II) students gain capacity of abstraction and understanding. A typical laboratory practice is a 2-hour class, with small groups of students, discussing the resolution of the exercises. It gives students the chance to interact directly with teachers, to exchange ideas and argue between them, to ask questions, and of course, to learn through the discussion. Technology can play an important role in the learning of mathematics, and as such, graphing and scientific calculators are permitted for class and homework, though they will not be permitted on tests and quizzes, and thus it is emphasized that students learn not to rely on them. Subject to availability, some exercises may be designed to be solved with computers.
Objective test	Realizarase un exame escrito que consistirá nunha colección de cuestións teóricas e/ou de problemas (do mesmo tipo que os propostos nos seminarios(TGR) e nos boletíns de exercicios).
Collaborative learning	Collaboration is encouraged, for home and class assignments; however, all submitted assignments must be written up independently and represent the student?s own work and understanding.

Personalized attention	
Methodologies	Description

Guest lecture / keynote speech Laboratory practice Collaborative learning	The studens have the possibility to revise the qualification obtained in the written final test, proving that this is adjusted to the criteria of evaluation established. Likewise, the evaluations of the answers to the questions and exercises formulated during the course, with the indications adequate in order to correct the errors and/or improve the answers with a view to a more solid formation, will justify. In the sessions in reduced groups, the doubts formulated by the students are solved in an individualized way, especially when they are common to several of them or illustrate an interesting case. If the question is more particular or does completely not remain solved for some pupil, it would be treated in the hours of individualized tuition. Students registered to partial time: Depending on the particularities of every specific case and the possibilities of the teaching staff put in charge of the group to the that it is a pupil registered in time partial assigned, the tests of the continuous evaluation will be adjusted so that this pupil can obtain the same qualification as a pupil of ordinary registration.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Laboratory practice	A1 B3 B6 C1 C6	This section will consist of, at least, 2 structured or problem-solving questions based on the different topics, similar to exercises from the weekly 2-hour session classes. Correct answers as well as the presentation and clarity of the exposition will be valued. A participative attitude of the student in the resolution of the proposed exercises during the sessions will also be positively valued.	20
Objective test	A1 B3 C1	Ó final do cuatrimestre realizarase unha proba escrita que inclúe: - Preguntas curtas que permitan valorar se o alumno comprendeu os conceptos teóricos básicos. - Problemas cun grao de dificultade semellante aos realizados na aula e aos presentados nas coleccións de exercicios propostos. Avaliarase o dominio dos conceptos teóricos da materia, a comprensión dos mesmos e a súa aplicación na resolución de exercicios. Asimesmo, valorarase a claridade, a orde e a presentación dos resultados expostos. A presentación á proba final do curso supón que o estudante completou o proceso de avaliación continua. Hai que obter máis de 3 puntos, dos 8 posibles, na proba obxectiva para sumar a ésta a cualificación de evaluación continua (a cualificación final, neste caso, obténse sumando a cualificación da proba obxectiva e a da avaliación continua). Noutro caso, a cualificación final do alumno é, soamente, a nota da proba obxectiva.	80
Others			

Assessment comments

Evaluation of the student registered in time partial: Depending on the particularities of every specific case and the possibilities of the teaching staff put in charge of the group to the that it is a student registered in time partial assigned, the tests of the continuous evaluation will be adjusted so that this student can obtain the same qualification as a student of ordinary registration.In the opportunity advanced to December, the examination will be qualified on ten points, being necessary to obtain at least one five to approve the matter.

Sources of information	
Basic	- Grossman, S. I. (1996). Álgebra lineal con aplicaciones. McGraw-Hill Interamericana México. - Grossman, S. I. (1994). Elementary Linear Algebra with Applications. Wiley - Merino, L. y Santos, E. (2006). Álgebra Lineal con Métodos Elementales. Thomson. - Cameron, P. J. (1998). Introduction to Algebra. Oxford University Press, Oxford. - Rosen, K. H. (2004). Matemática Discreta y sus aplicaciones. McGraw-Hill Interamericana. - Rosen, K. H. (2003). Discrete Mathematics and Its Applications. McGraw-Hill - Biggs, N. L. (1994). Matemática Discreta. Madrid, Vicens Vives. - Lay, D. C. (2011). Linear Algebra and Its Applications. Pearson - Lay, D. C. (2007). Algebra Lineal y sus Aplicaciones. Prentice Hall
Complementary	- Hernández, E. (1994). Álgebra y Geometría. Addison-Wesley. - Rojo, J. y Martín, I. (2005). Ejercicios y problemas de Álgebra Lineal. McGraw-Hill. - Lidl, R. y Pilz, G. (1998). Applied Abstract Algebra. Nueva York, Springer. - Torrecilla Jover, B. (1999). Fermat. El Mago de los Números. Nivola. - Van Lint, J. H. (1999). Introduction to Coding Theory. Berlín, Springer. - Singh, S. (2000). Los Códigos Secretos. Debate - Nakos, G. y Joyner, D. (1999). Álgebra lineal con aplicaciones. Thomson. - Nakos, G. y Joyner, D. (1998). Linear Algebra with Applications. Brooks Cole Publising

Recommendations
Subjects that it is recommended to have taken before
Discrete Mathematics/614G01004
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.