ANEXO I

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA

GENERAL SPECIFICATIONS

COURSE 2022/23

Subject Data

Name:	
Matemáticas II – Ingeniería Informática	
English name:	
Mathematics II – Computer Science	
Code:	**Type:**
606010106	Basic

Hours:

	Total	**In class**	**Out class**
Time distribution	150	60	90

ECTS:

Standard group	**Small groups**			
	Classroom	**Lab**	**Practices**	**Computer classroom**
4.5	0	0	0	1.5

Departments:	**Knowledge areas:**
Integral Sciences	Applied Mathematics
Year:	**Semester**
1st - First Year	Second Semester

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TEACHING STAFF

Name:	E-mail:	Telephone
Irene García Selfa	irene.garcia@dmat.uhu.es	959219930

Others Data (Tutoring, schedule...)

Office: Campus de El Carmen, Facultad de Ciencias Experimentales, 3rd floor, door P3-N3-D10
(please, arrange the appointment in advance via e-mail)

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SPECIFIC INFORMATION OF THE COURSE

1. Contents description:

1.1 In English:

- Linear Algebra: matrices and determinants. Systems of linear equations. Vector spaces and linear maps. Diagonalization. Inner product and applications.

- Discrete Mathematics: Modular arithmetic. Algorithms. Introduction to Graph Theory.

1.2 In Spanish:

- Álgebra Lineal: Matrices y determinantes. Sistemas de Ecuaciones Lineales. Espacios vectoriales y aplicaciones lineales. Diagonalización. Producto escalar, ortogonalización y aplicaciones.

- Matemática Discreta: Aritmética entera y modular. Combinatoria. Algoritmos. Introducción a la teoría de grafos.

2. Background:

2.1 Situation within the Degree:

Foundational subject, second semester course.

2.2 Recommendations

Students should have a basic understanding of mathematics studied in secondary school. Specially they should have basic knowledge about matrices, vectors and systems of linear equations.

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3. Objectives (as result of teaching):

General:

- Introduction to abstract reasoning and development of fundamental mathematical skills.
- Capacity to express mathematically scientific problems, solve them using the correct mathematical techniques and correctly interpret the results.
- Appreciation for mathematics as an essential tool for deeper scientific understanding.

Methodology:

- Introduce the student to mathematical notation and the mathematical way of thinking and solving problems.
- Capacity to solve basic, real-world mathematical problems.

4. Skills to be acquired

4.1 Specific Skills:

CB01: Capacity to solve mathematical problems typical in engineering. Ability to apply knowledge of: linear algebra, differential and integral calculus, numerical methods, numerical algorithms, statistics and optimization.
CB03: Ability to understand and make use of basic concepts of discrete mathematics, logic, algorithmic and computational complexity, and their application to resolution of engineering problems.

4.2 General, Basic or Transversal Skills:

CG0: Capacity for analysis and synthesis: Finding, analysing, criticising (critical reasoning), relate, structure and synthesise information from different sources, as well as integrate ideas and knowledge.
CG01: Organisational and planning skills, as well as information management skills.
CG03: Problem solving.
CG04: Objective decision-making, based on experimental or simulated data. Ability to debate and defend logically these decisions and accept other points of view.
CG05: Ability to work in teams.
CG06: Ability to work independently and take the initiative.
CT2: Develop critical-thinking skills with the ability to analyze and synthesize.
CT3: Develop research skills that permit the continual reflection and advancement of knowledge.

5. Training Activities and Teaching Methods

5.1 Training Activities:

- Lectures on theoretical material.
- Problem-solving sessions.
- Programming sessions.
- Individual student work.

5.2 Teaching Methods::

- Lectures.
- Problem-solving in computer labs.
- Practice problems.
- Office hours.
- Planning, completing, tutoring and presentation of individual work.
- Exams.

5.3 Development and Justification:

Lectures on theory and problem-solving:
Precisely develop theoretical concepts, omitting most of the proofs. This way not only facilitates learning, but also leaves more time for solving examples and answering questions.

Small-group sessions / Computer lab sessions:
Introduction to MATLAB and how to use it to solve problems.

6. Detailed Contents

Part I: Algebra and Geometry.

- Theme 1. Matrices and Systems of Linear Equations: Determinants. Matrices. Basic operations. Reduced form. Gauss-Jordan algorithm. Systems of linear equations. Rank. Inverse matrix. Determinants.
- Theme 2. Vector spaces: Vector subspace. Linear combination. Linear dependence and Independence. Bases. Dimension. Change of basis equations. Parametric and implicit equations. Intersection and sum of subspaces.
- Theme 3. Linear maps. Diagonalisation. Matrix of a linear map. Change of basis. Image and kernel of a linear map. Endomorphisms. Similar matrices. Eigenvalues and eigenvectors. Characteristic Polynomial. Algebraic and geometric multiplicity. Diagonalisation. Applications.
- Theme 4. Inner Product. Orthogonality. Orthonormal bases. Gram-Schmidt. Projections. Least Squares Approximations.

Part II: Discrete mathematics

- Theme 5. Modular arithmetic: Divisibility. Prime Numbers. Greatest Common Divisor and Least Common Multiple. The Euclidean Algorithm. Diophantine equations. Congruences. Chinese remainder theorem. Fermat's Theorem. RSA.
- Theme 6. Combinatorics. Permutations and combinations. Inclusion–exclusion principle.
- Theme 7. Introduction to Graph Theory: Definitions and representation. Graph isomorphism. Subgraphs. Eulerian trails and circuits. Hamiltonian paths and cycles. Components. Planarity. Trees.

7. Bibliography

7.1 Basic Bibliography:

Part I:

- ***Linear Algebra***. Jörg Liesen, Volker Mehrmann.
Springer (2015)
ISBN: 978-3-319-24346-7

- ***Introduction to Linear Algebra***, (Fifth Edition), Gilbert Strang
Wellesley-Cambridge Press (2016)
ISBN : 978-09802327-7-6

Part II:

- ***Discrete Mathematics. Elementary and Beyond***. L. Lovasz, J. Pelikan, K. Vesztergombi.
Springer (2003)
ISBN 978-0-387-95585-8
ISBN 978-0-387-21777-2 (eBook)

- ***A First Course in Discrete Mathematics.***Ian Anderson.
Springer (2003)
ISBN: 978-0-85729-315-2

7.2 Additional Bibliography:

- *Álgebra lineal y sus aplicaciones* (5ª Edición)
David C. Lay
Pearson Educación (México 2016)
ISBN 978-607-32-3745-1

- *Elementos de matemática discret.*
José Manuel Gutiérz Jiménez y Víctor Lanchares Barrasa
Servicio de Publicaciones de la Universidad de La Rioja (2010)
ISBN 978-84-693-6451-2

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8. Systems and Assessment Criteria

8.1 System for Assessment:

- Theoretical and problems Exam
- Practical Exam
- Individual progress activities

8.2 Assessment Criteria and Marks:

8.2.1 Examinations Convocatory I

- There will be an exam on theory and problems (T) on the date specified by the ETSI.
- The grade for practices (P) will be provided by the grade of one practical exam using MATLAB in the computer lab.
- Students who choose continuous evaluation, will be required to submit an assignment which grade (R) will count as 10% of the final grade.
- If the student obtains a minimum grade of 4 in the exam on theory and problems (T), and also in the practical exam (P), then the final grade will be 0.7*T+0.2*P+0.1*R. Otherwise, the final grade will be the minimum between 4 and 0.7*T+0.2*P+0.1*R.
- In order to obtain the qualification “Matricula of Honor” it will be necessary for the student to obtain a final grade of 9 or higher, and also to have shown constant interest, capacity for work and participation during the course. If there were a number of candidates with these conditions greater than the maximum number of “Matrículas of Honor” that can be granted, it will be used the final grade to establish an order of priority (in case of a tie, a tiebreaker exam will be done).

8.2.2 Examinations Convocatory II

- Unless the student wishes otherwise, a grade of 5 or more in any of the exams (T) or (P) in the 1st round of examination will be valid during the 2nd round of examination. The student will only have to take the exams (theory-problems or practical) which grade was less than 5 in the 1st round of examination.
- If the student obtains a minimum grade of 4 in the exam on theory and problems (T), and also in the practical exam (P), then the final grade will be 0.8*T+0.2*P. Otherwise, the final grade will be the minimum between 4 and 0.8*T+0.2*P.
- After the 2nd round of examination the student must retake all exams (theory and practical) in future rounds of examination.

8.2.3 Examinations Convocatory III

- There will be one exam on theory and problems, and a practical exam using MATLAB.
- If the student obtains a minimum grade of 4 in the exam on theory-problems (T), and a minimum grade of 4 in the practical exam (P), then the final grade will be 0.8*T+0.2*P. Otherwise, the final grade will be the minimum between 4 and 0.8*T+0.2*P.

8.2.4 Extraordinary Convocatory

- Same rules than convocatory III.

8.3 Single Final Evaluation:

- There will be one exam on theory and problems, and a practical exam using MATLAB.
- If the student obtains a minimum grade of 4 in the exam on theory-problems (T), and a minimum grade of 4 in the practical exam (P), then the final grade will be 0.8*T+0.2*P. Otherwise, the final grade will be the minimum between 4 and 0.8*T+0.2*P.

- Unless the student wishes otherwise, a grade of 5 or more in any of the exams (T) or (P) in the 1st round of examination will be valid during the 2nd round of examination. The student will only have to take the exams (theory-problems or practical) which grade was less than 5 in the 1st round of examination. After the 2nd round of examination the student must retake all exams (theory and practical) in future rounds of examination.