



## Teaching Guide

| Identifying Data    |  |        |   |         | 2024/25 |
|---------------------|--|--------|---|---------|---------|
| Subject (*)         | Mathematics for Architecture 1   | Code   | 630G02004   |         |         |
| Study programme     | Grao en Estudos de Arquitectura  |        |   |         |         |
| Descriptors         |  |        |   |         |         |
| Cycle               | Period   | Year   | Type  | Credits |         |
| Graduate            | 1st four-month period  | First  | Basic training  | 6       |         |
| Language            | Spanish  |        |   |         |         |
| Teaching method     | Face-to-face   |        |   |         |         |
| Prerequisites       |  |        |   |         |         |
| Department          | Matemáticas  |        |   |         |         |
| Coordinador         | Rodríguez Seijo, Jose Manuel   | E-mail | jose.rodriguez.seijo@udc.es   |         |         |
| Lecturers           | Arós Rodríguez, Angel Daniel<br>Cuellar Cerrillo, Nuria<br>Otero Piñeiro, Maria Victoria<br>Rodríguez Seijo, Jose Manuel   | E-mail | angel.aros@udc.es<br>nuria.cuellar@udc.es<br>victoria.otero@udc.es<br>jose.rodriguez.seijo@udc.es |         |         |
| Web                 | campusvirtual.udc.gal  |        |   |         |         |
| General description | The objective of this subject is to offer the basic knowledge of Mathematics required in a first year of the Degree in Architecture Studies, covering a whole range of geometric, algebraic and analytical concepts, which are considered essential for all students with a view to solving problems of later courses, mathematical or not, as well as presenting methods that solve scientific and technical problems of architectural work and whose knowledge will facilitate the future architect the dialogue with other specialists, who can collaborate with him in carrying out a complex project. |        |   |         |         |

## Study programme competences / results

| Code | Study programme competences / results   |
|------|---|
| A5   | "Knowledge of the metric and projective geometry adapted and applied to architecture and urbanism ";  |
| A11  | Applied knowledge of numerical calculus, analytic and differential geometry and algebraic methods   |
| A63  | Development, presentation and public review before a university jury of an original academic work individually elaborated and linked to any of the subjects previously studied  |
| B1   | Students have demonstrated knowledge and understanding in a field of study that is based on the general secondary education, and is usually at a level which, although it is supported by advanced textbooks, includes some aspects that imply knowledge of the forefront of their field of study |
| B2   | Students can apply their knowledge to their work or vocation in a professional way and have competences that can be displayed by means of elaborating and sustaining arguments and solving problems in their field of study   |
| B3   | Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgements that include reflection on relevant social, scientific or ethical issues   |
| B4   | Students can communicate information, ideas, problems and solutions to both specialist and non-specialist public  |
| B5   | Students have developed those learning skills necessary to undertake further studies with a high level of autonomy  |
| B6   | Knowing the history and theories of architecture and the arts, technologies and human sciences related to architecture  |
| B9   | Understanding the problems of the structural design, construction and engineering associated with building design and technical solutions   |
| C1   | Adequate oral and written expression in the official languages.   |
| C3   | Using ICT in working contexts and lifelong learning.  |
| C6   | Critically evaluate the knowledge, technology and information available to solve the problems they must face  |
| C7   | Assuming as professionals and citizens the importance of learning throughout life   |
| C8   | Valuing the importance of research, innovation and technological development for the socioeconomic and cultural progress of society.  |

## Learning outcomes

| Learning outcomes | Study programme competences / results |
|-------------------|---------------------------------------|
|                   |                                       |



|   |                  |  |                            |
|---|------------------|--|----------------------------|
| Know and apply algebraic methods and analytical geometry: Know the basic concepts of matrix and vector algebra. Know how to calculate eigenvalues and eigenvectors of a matrix, and know the diagonalization process of a matrix.   | A11<br>A63       | B1<br>B2<br>B3<br>B4<br>B5<br>B6<br>B9 | C1<br>C3<br>C6<br>C7<br>C8 |
| Know and apply metric and analytical geometry: Know isometries in the plane and in space.   | A5<br>A11<br>A63 | B1<br>B2<br>B3<br>B4<br>B5<br>B6<br>B9 | C1<br>C3<br>C6<br>C7<br>C8 |
| Know and apply numerical calculus and differential and integral calculus: Know the simplest numerical methods for solving linear systems. Know and manage the differential calculus of one and several variables. Know and properly apply the integration methods of functions of one variable. Establish the basic concepts of numerical integration. Understand the fundamental concepts related to differential equations. Recognize and integrate equations of first order and higher order. Know how to apply the integration methods of linear differential equations. Know the initial value problem for first order ordinary differential equations. Know and know how to apply approximate methods for solving first-order differential equations. Know the initial value problem for systems of first-order ordinary differential equations. Know and be able to apply approximate methods for solving systems of first-order differential equations. | A11<br>A63       | B1<br>B2<br>B3<br>B4<br>B5<br>B6<br>B9 | C1<br>C3<br>C6<br>C7<br>C8 |

| Contents   |   |
|--|---|
| Topic  | Sub-topic   |
| Vector spaces. Linear applications.                            | Vectorial space. Subspaces. Bases. Dimension. Basis change. Orthogonality. Orthonormal bases.<br>Linear application. Associated matrix.   |
| Diagonalization of matrices.                                   | Eigenvalues and eigenvectors of a square matrix. Characteristic polynomial.<br>Diagonalizable matrices. Orthogonal diagonalization.   |
| Geometric transformations.                                     | Orthogonal transformations. Classification in R2 and R3. Isometries.  |
| Numerical methods for solving systems of linear equations.     | Direct methods for solving linear systems: LU factorization, Cholesky factorization.<br>Iterative methods for solving linear systems: Gauss-Seidel.   |
| Real functions and vector functions.                           | Real valued functions. Vector functions. Limit and continuity.<br>Derivation: Partial derivatives. Total derivative. Successive derivatives.<br>Derivation of composite functions. Derivation of implicit functions.<br>Derivation of vector functions. |
| Integration. Numerical integration.                            | Continuation of integration methods.<br>Numerical integration.  |
| Introduction to ordinary differential equations.               | Introduction to differential equations. First order ordinary differential equation. Higher order ordinary differential equation. Systems of ordinary differential equations.<br>Differential equation in partial derivatives.                           |
| Methods for solving ordinary differential equations (I).       | Analytical methods for solving first-order ordinary differential equations.<br>Analytical methods for solving higher order ordinary differential equations.   |
| Methods for solving ordinary differential equations (II).      | Linear differential equations of order n.<br>Analytical methods for solving linear differential equations.  |
| Numerical methods for solving ordinary differential equations. | Need for numerical methods.<br>Numerical methods for solving first order ordinary differential equations.<br>Numerical methods for solving systems of first order ordinary differential equations.  |



| Planning                       |  |                                      |                               |             |
|--------------------------------|--|--------------------------------------|-------------------------------|-------------|
| Methodologies / tests          | Competencies / Results                               | Teaching hours (in-person & virtual) | Student?s personal work hours | Total hours |
| Introductory activities        | A63 B1 B2 B3 B4 B5<br>B6 B9 C1 C3 C6 C7<br>C8        | 1                                    | 0                             | 1           |
| Guest lecture / keynote speech | A5 A11 A63 B1 B2 B3<br>B4 B5 B6 B9 C1 C3<br>C6 C7 C8 | 25                                   | 30                            | 55          |
| Objective test                 | A5 A11 A63 B1 B2 B3<br>B4 B5 B6 B9 C1 C3<br>C6 C7 C8 | 4                                    | 0                             | 4           |
| Workshop                       | A5 A11 A63 B1 B2 B3<br>B4 B5 B6 B9 C1 C3<br>C6 C7 C8 | 29                                   | 60                            | 89          |
| Personalized attention         |  | 1                                    | 0                             | 1           |

(\* )The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

| Methodologies                  |   |
|--------------------------------|---|
| Methodologies                  | Description   |
| Introductory activities        | In the first class of the course there will be a presentation of the contents, skills and objectives to be achieved with this subject.  |
| Guest lecture / keynote speech | Oral presentation complemented by the use of audiovisual media, in which the teacher will present the different topics of the subject as well as the problems that the student must learn to solve. Throughout it, the student may intervene by asking questions that facilitate his/her instruction and the teacher will ask questions addressed to the students in order to transmit knowledge and facilitate learning. |
| Objective test                 | Theoretical-practical exam of the subject.  |
| Workshop                       | As the subject develops, the teacher will hand out problem sets that the students will have to solve and/or will propose assignments. The problem sets are not exams and it is recommended that each student discuss difficult problems with other students, after having tried to solve them and discover where their difficulty lies, although each one must develop their own solutions.                               |

| Personalized attention                     |  |
|--|--|
| Methodologies                              | Description  |
| Guest lecture / keynote speech<br>Workshop | Throughout the course, each student should carry out at least two sessions of 30 minutes each with the teacher. In them the teacher will solve the doubts that the student presents. |

| Assessment     |  |   |               |
|----------------|--|---|---------------|
| Methodologies  | Competencies / Results                               | Description   | Qualification |
| Objective test | A5 A11 A63 B1 B2 B3<br>B4 B5 B6 B9 C1 C3<br>C6 C7 C8 | The evaluation of the student will be carried out as explained in the observations. | 100           |

| Assessment comments |
|---------------------|
|                     |



First opportunity (January): The subject matter is divided into two blocks. At the end of each block, there will be a partial liberatory exam of the corresponding subject. Those students who have attended at least 70% of the classes may take the partial exams. Those students with recognition of part-time dedication and/or academic exemption from attendance (which must be communicated to the subject teacher), may take these partial exams without having to achieve the minimum attendance requirement.

Those students who obtain an average grade between the two partials, greater than or equal to 5, will have passed the subject, and will not have to take the final exam.

The final exam will consist of two tests corresponding to the subject of each block. Those students who have not passed the subject through the partial exams will be examined in the block, or blocks, that they have not passed (\*). The presentation to the exam of a block supposes the express resignation to the previous qualification, if there was it. To pass the subject it will be necessary to obtain an average grade, between the two blocks, greater than or equal to 5.

(\*) Those students who, having to examine the two blocks, only examine one of them, will be graded as failed on the first opportunity and will obtain the smallest value between 4.5 and the resulting average between the highest recent qualification obtained in each of the blocks.

Second opportunity (July): The students who have not passed the subject in the first opportunity have a second opportunity to pass it. The evaluation of the student in this second opportunity will be carried out by means of a global exam of the entire subject, whose qualification will provide the final mark.

Both opportunities: The fraudulent performance of the tests or evaluation activities, once verified, will directly imply the qualification of suspense in the call in which it is committed, in accordance with the valid rule of the UDC.

### Sources of information

|                      |   |
|----------------------|---|
| <b>Basic</b>         | Lay, D. (2007). Álgebra Lineal y sus aplicaciones. México, Prentice-HallLarson, R.; Hostetler, R. P.; Edwards, B. H. (2006). Cálculo, volúmenes 1 y 2. Madrid, McGraw-HillAyres, F. (1991). Ecuaciones Diferenciales. México, McGraw-HillZill, D. G. (2007). Ecuaciones diferenciales con aplicaciones de modelado. México, Ed. ThomsonFaires, J. D.; Burden, R. (2004). Métodos Numéricos. Madrid, Thomson   |
| <b>Complementary</b> | Alsina, C.; Trillas, E. (1992). Lecciones de Álgebra y Geometría. Editorial Gustavo Gili, S. A. Ayres, F. (1992). Cálculo Diferencial e Integral. Madrid, McGraw-HillBradley, G. L.; Smith, K. J. (1997). Cálculo de una variable, volúmenes 1 y 2. Madrid, Prentice-HallBurgos, J. (1994). Álgebra Lineal. Madrid, McGraw-HillBurgos, J. (1994). Cálculo infinitesimal de una variable. Madrid, McGraw-HillBurgos, J. (1995). Cálculo infinitesimal de varias variables. Madrid, McGraw-HillDemidovich, B. (1998). 5.000 problemas de Análisis Matemático. Madrid, ParaninfoGranero, F. (2001). Cálculo integral y aplicaciones. Madrid, Prentice-HallGranero, F. (1995). Cálculo infinitesimal de una y varias variables. Madrid, McGraw-HillGrossman, S. (1995). Álgebra lineal con aplicaciones. México, McGraw-HillHernández, E. (1998). Álgebra y Geometría. Madrid, Addison-WesleyMarsden, J.; Tromba, A. (2004). Cálculo Vectorial. Madrid, Pearson EducaciónRojo, J.; Martín, I. (2005). Ejercicios y problemas de Álgebra Lineal. Madrid, McGraw-HillSpiegel, M. R. (1991). Cálculo Superior. México, McGraw-HillSpiegel, M. R.; Moyer, R. E. (2007). Álgebra Superior. México, McGraw-HillNagle, R. K.; Saff, E. B. (1992). Fundamentos de Ecuaciones Diferenciales. E. U. A., Addison-Wesley IberoamericanaMartínez Sagarzazu, E. (1996). Ecuaciones diferenciales y cálculo integral. Servicio Editorial Univ. del País VascoBerman, G. N. (1983). Problemas y ejercicios de análisis matemático. Moscú, Ed. MirSimmons, G. F.; Krantz, S. G. (2007). Ecuaciones diferenciales. Teoría, técnica y práctica. México, McGraw-HillDemidovich, B. (1993). Problemas y ejercicios de análisis matemático. Madrid, ParaninfoSimmons, G. F. (2002). Cálculo y Geometría Analítica. Madrid, McGraw-HillGarcía, A. y otros (1998). Cálculo I. Madrid, CLAGSAGarcía, A. y otros (1996). Cálculo II. Madrid, CLAGSARogawski, J. (2012). Cálculo. Varias variables.. Barcelona, Editorial RevertéRogawski, J. (2012). Cálculo. Una variable. Barcelona, Editorial RevertéInformación adicional en: <a href="https://campusvirtual.udc.gal/">https://campusvirtual.udc.gal/</a> |

### Recommendations

Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus



Mathematics for Architecture 2/630G02009

Mathematical Techniques for Architecture/630G02047

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.