Teaching Guide				
Identifying Data				2022/23
Subject (*)	Descriptive and Representation Geometry		Code	670G01102
Study programme	Grao en Arquitectura Técnica			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	Yearly	First	Basic training	9
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Expresión Gráfica Arquitectónica			
Coordinador	Fernández Álvarez, Ángel José	E-mail	angel.fernandez.alvarez@udc.es	
Lecturers	Fernández Álvarez, Ángel José	E-mail	angel.fernandez.alvarez@udc.es	
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General description	This subject aims geometric rationalization of space issues. In the academic field, this is the unit that serves as a base for other specialized graphics disciplines such as Architectural Graphic Expression, Topography and Technical Projects and the use of Computer Aided Design and Computer Graphics. In the professional field, being able to read and understand construction plans is a basic skill in order to execute the work properly. This implies a knowledge of of representation methodology, whose base is the Descriptive Geometry. In the field of writing technical projects, Descriptive Geometry provides the academic training of the necessary spatial vision for the creation of the three dimensional final solution. Through plans and sketches, this course provides the theoretical foundation basics of the different representation systems. This, as well as providing students with the capability to develop their creativity and imagination, are the reasons why this course is an essential pillar in the Degree in Engineering Building. Furthermore, the contribution to professional practice is clear, in terms of representation, resolution and restitution of any space or 3D-element in the field of construction.			

Study programme competences / results	
Code	Study programme competences / results
A38	A0.3 Ability to use spatial representation systems, sketching, dimensioning, and graphical representation language and techniques for building elements and processes.
B31	B1 Students will demonstrate knowledge and understanding of subjects that build upon the foundation of a general secondary education using advanced textbooks and ideas and analyses from the cutting edge of their field.
B32	B2 Students will be able to use their knowledge professionally and will possess the skills required to formulate and defend arguments and solve problems within their area of study.
B33	B3 Students will have the ability to gather and interpret relevant data (especially within their field of study) in order to make decisions and reflect on social, scientific and ethical matters.
B34	B4 Students will be able to communicate information, ideas, problems and solutions to specialist and non-specialist audiences alike.
B35	B5 Students will develop the learning skills and autonomy they need to continue their studies at postgraduate level.
C1	Adequate oral and written expression in the official languages.
C3	Using ICT in working contexts and lifelong learning.
C4	Acting as a respectful citizen according to democratic cultures and human rights and with a gender perspective.
C6	Acquiring skills for healthy lifestyles, and healthy habits and routines.
C7	Developing the ability to work in interdisciplinary or transdisciplinary teams in order to offer proposals that can contribute to a sustainable environmental, economic, political and social development.
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		
Understand geometry as a graphic model capable of establishing spatial relationships that allow the understanding, description and control of constructive and architectural forms.	A38	B31 B32 B33 B34 B35	C1 C3 C4 C6 C7 C8
Know and apply the theoretical foundations, terminology, concepts, conventions, methods and layouts of the different Graphic Representation Systems applicable in building and architecture for the resolution of practical problems.	A38	B31 B32 B33 B34 B35	C1 C3 C4 C6 C7 C8
Solve positional problems (intersections, parallelism, perpendicularity) and metric problems (distances and angle determination) between the various geometric elements.	A38	B31 B32 B33 B34 B35	C1 C3 C4 C6 C7 C8
Know and represent in the different systems the main bodies and geometric surfaces of constructive and architectural application, both at the level of mathematical concept and graphic analysis and representation.	A38	B31 B32 B33 B34 B35	C1 C3 C4 C6 C7 C8
Know the general foundations of the Theory of Shadows as a geometric rationalization of the luminous phenomenon in the different Representation Systems of architectural application.	A38	B31 B32 B33 B34 B35	C1 C3 C4 C7 C8
Applying the figured planes system (topographic projection) to the graphic resolution of roofs, to the representation of the terrain and to the resolution of modified topographies in the execution of esplanades and roads.	A38	B31 B32 B33 B34 B35	C1 C3 C4 C6 C7 C8
Apply the perspective spatial representation systems (Orthogonal Axonometry, Oblique Axonometry and Linear Perspective) to the graphic definition of architectural and construction elements.	A38	B31 B32 B33 B34 B35	C1 C3 C4 C6 C7 C8
Analyze and know the variations of the different elements of the linear perspective, the restitution of perspective images and their generation conditions.	A38	B31 B32 B33 B34 B35	C1 C3 C4 C6 C7 C8

Contents	
Topic	Sub-topic
Lesson 1.- DIHEDRAL REPRESENTATION SYSTEM: FUNDAMENTALS AND POSITIONAL PROBLEMS	Introduction. Basics. Fundamentals. Representation of point, line and plane. Spatial basic geometric relations. Parallelism. Intersections. Perpendicularity
Lesson 2.- DIHEDRAL REPRESENTATION SYSTEM: GRAPHICS METHODS AND METRIC PROBLEMS.	Geometric Procedures: Change of planes of projection. Rotations. Plans' Abatment (rotated planes method). Distances. Angles.
Lesson 3.- DIHEDRAL REPRESENTATION SYSTEM: ANALYSIS AND REPRESENTATION OF SURFACES	Representation of surfaces. Regular polyhedra. Radiating polyhedra: Pyramid and Prism. Radiated Quadrics: Cone and Cylinder. Representation of the Sphere.
Lesson 4. DIHEDRAL REPRESENTATION SYSTEM: INTERSECTION OF SURFACES AND THEORY OF SHADOWS	Intersection of surfaces. Methods. Architectural applications: vaults, domes and lunettes. Shadow Theory applied to Diedral System.
Lesson 5.- FIGURED PLANS SYSTEM (TOPOGRAPHICAL PROJECTION): FUNDAMENTALS	Introduction. Fundamentals. Representation of the plane. Positional Problems: parallelism, perpendicularity, intersections. Abatments. Metrical problems: distances and angles. Representation of geometric surfaces.
Lesson 6.- FIGURED PLANS SYSTEM (TOPOGRAPHICAL PROJECTION): APPLICATIONS IN BUILDING. ROOFS. LAND REPRESENTATION.	Graphical resolution of roofs. Topographical surfaces and interventions on the ground: dirt moving and road layout.
Lesson 7.- ORTHOGONAL AXONOMETRY. Fundamentals and implementation.	Orthogonal axonometry. Overview. Axonometry classes. Tri-rectangle triangle. Axonometric axes. Axonometric scales. Schlömilch-Waisbach theorem. Representation of the fundamental geometric elements: point, line and plane. Positional problems. Intersections. Parallelism and perpendicularity. Implementation in orthogonal axonometry: representation of plane figures, geometric bodies and shadow theory.
Lesson 8.- OBLIQUE AXONOMETRIES: Cavalier (cabinet) and Military Perspective. Fundamentals and implementation.	Oblique Axonometry. Overview. Pohlke's theorem. Cavalier (cabinet) and Military perspective. Projection direction. Reduction coefficients. Representation of the fundamental geometric elements: point, line and plane. Positional problems. Intersections. Parallelism and perpendicularity. Implementation in oblique axonometry: representation of plane figures, geometric bodies and Shadow Theory.
Lesson 9.LINEAR PERSPECTIVE. Fundamentals.	Generalities and conventions. Representation of the fundamental geometric elements: point, line and plane. Positional problems. Intersections. Parallelism. Perpendicularity. Rotated plane method. Metric problems.
Tema 10. LINEAR PERSPECTIVE. Implementation.	Visual perception and representation. Influence of the relative position of the elements of the linear perspective. Vision angle. Classification of linear perspectives according to the position of the Point of View and the Plane of the Picture. Perspective restitution and Shadow Theory.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A38 B31 B32 B33 B34 B35 C1 C3 C4 C6 C7 C8	45	60	105
Problem solving	A38 B31 B32 B33 B34 B35 C1 C3 C4 C6 C7 C8	45	65	110
Objective test	A38 B31 B32 B33 B34 B35 C1 C3 C4 C6 C7 C8	6	0	6

Personalized attention		4	0	4
(*)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	Oral and graphic presentation in the classroom supplemented by the optional use of audiovisual media and ICT as well as the introduction of questions to students in order to transmit knowledge and facilitate learning.
Problem solving	Students will face situation where they will solve a particular problem with multiple solutions using the knowledge we have worked in the lecture. Within this dynamic, interactive personalized attention will take place.
Objective test	Graphic test for the assessment of learning, whose distinctive feature is the ability to determine whether the answers are correct or not. It is a measuring element that allows to assess knowledge, abilities, skills, performance, attitudes, intelligence, etc. It is applicable for both diagnostic, formative and summative evaluation.

Personalized attention	
Methodologies	**Description**
Problem solving	The needs and questions of the students related to the study or similar topics with the course will be adressed, while giving them orientation, support and motivation throughout the learning process.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Objective test	A38 B31 B32 B33 B34 B35 C1 C3 C4 C6 C7 C8	Objective tests will be carried out during the course on the contents of the different Representation Systems. These tests will have characteristics similar to the exercises developed in the interactive classes and will serve to articulate a continuous evaluation process.s applicable for both diagnostic, formative and summative evaluation.	100

Assessment comments

Attendance at both expository classes (THEORY) and interactive classes (PRACTICE) is considered mandatory, so students must meet minimum attendance requirements to be able to take the objective tests. This minimum attendance will be 80%.
The objective scoring tests will be scored on 10 points each. The overall final grade of these tests will be obtained by adding the scores of each of them and dividing this sum by the number of tests carried out. In order for this average to be made, a minimum score of 4 points must be obtained in the test that includes all the contents of the corresponding system. In order to pass the course, it will be compulsory to take ALL the objective tests.
The schedule and content of the objective tests will be communicated to the students at the beginning of the teaching activities.
In addition to the assistance, participation and performance of supervised works, the tests deemed necessary may be carried out in order to adequately assess the degree of assimilation of the conceptual and procedural contents of the subject.
The student who achieves a global average grade of 5 points or higher in the sum of the objective scoring tests developed during the course will pass the subject.
Students who do not reach the minimum global grade of 5 points must sit the official Final Exam of the subject to be held at the end of the 2nd semester (First Chance) according to the official calendar approved by the School Board.
Those approved will be saved in the objective scoring tests carried out during the annual teaching period but by complete systems (DIÉDRICO, BOXED, AXONOMETRY, PERSPECTIVE). This condition is considered linked to the corresponding academic year and therefore these passes will be kept for the First Chance (May / June) and Second Chance (July) but exclusively during the current course and this reservation will not be maintained for subsequent courses. Nor will the partial passes approved by the system that could be produced in the final exam corresponding to the First Opportunity (MAY / JUNE) be saved for the Second Chance.
IMPORTANT NOTE. In order for the student to have a passing grade in the final exams, they must obtain an overall average grade of 5 points or higher in the sum of the proposed exercises, but it will be mandatory to score in all the exercises corresponding to the different Representation Systems. A grade of 0 in any of them would give rise to a failure grade in the subject.
Implications of plagiarism: Fraudulent performance of the tests or evaluation activities, once verified, will directly imply the failing grade "0" in the subject in the corresponding call, thus invalidating any grade obtained in all the evaluation activities with a view to extraordinary call.

Sources of information

Basic	- BARDÉS FAURA, Lluis; GIMÉNEZ RIBERA, José Manuel (1999). Geometría Descriptiva. Sistema Dièdric. Exercicis. Edicións UPC - BARDÉS FAURA, Lluis; GIMÉNEZ RIBERA, José Manuel (2001). Geometría Descriptiva. Plans acotats i perspectives. Exercicis. Edicións UPC - COBOS GUTIERREZ, Carlos (2001). Geometría para Ingenieros. Tomo I: Representación Diédrica. Tébar - FERNÁNDEZ SAN ELÍAS, Gaspar (1999). Fundamentos del Sistema Diédrico. Universidad de León - FERNÁNDEZ SAN ELÍAS, Gaspar (2004). Sistema Acotado. Problemas y Aplicaciones. Asociación de Investigación Instituto Automática y Fabricación - FRANCO TABOADA, José Antonio (2011). Geometría Descriptiva para la representación arquitectónica. Vol. 1. Fundamentos. Santiago de Compostela: Andavira Editora - FRANCO TABOADA, José Antonio (2011). Geometría Descriptiva para la representación arquitectónica. Vol. 2. Geometría de la forma. Santiago de Compostela: Andavira Editora - GENTIL BALDRICH, José María (1998). Método y aplicación de representación acotada y del terreno. Bellisco - GIMÉNEZ PERIS, Vicente (2007). Diédrico Directo. Tomo I. Teoría y 190 ejercicios de aplicación. Edición del autor - GIMÉNEZ PERIS, Vicente (2014). Diédrico Directo. Tomo II. Superficies, Intersecciones, CAD, Sombras. Edición del autor - IZQUIERDO ASENSI, Fernando (Varias ediciones). Geometría Descriptiva. - MARTÍN MOREJÓN, Luís (1978-80). Geometría Descriptiva. Sistema Diédrico (2 vol). Sevilla - RODRÍGUEZ DE ABAJO, F. J. (Varias ediciones). Geometría Descriptiva. Tomo I. Sistema Diédrico. Donostiarra - RODRÍGUEZ DE ABAJO, F. J. (Varias ediciones). Geometría Descriptiva. Tomo II. Sistema de Planos Acotados. Donostiarra - SÁNCHEZ GALLEGO, Juan Antonio (1997). Geometría Descriptiva. Sistemas de Proyección Cilíndrica. Edicións UPC - TAIBO FERNÁNDEZ, Ángel (2010). Geometría Descriptiva y sus aplicaciones. Tomo I. Punto, Recta y Plano. Tébar - TAIBO FERNÁNDEZ, Ángel (2007). Geometría descriptiva y sus aplicaciones. Tomo II. Curvas y Superficies. Tébar - FERRER MUÑOZ (1996). Axonometrías. Sistema de representación axonométrico. Paraninfo - IZQUIERDO ASENSI, Fernando (). Ejercicios de Geometría Descriptiva Tomo II. Sistema Acotado y Axonométrico. F. Izquierdo - IZQUIERDO ASENSI, Fernando (). Ejercicios de Geometría descriptiva. Tomo IV. Sistema Cónico. - PALANCAR PENELLA (1985). Geometría descriptiva. Sistemas de representación axonométrica. Caballera. Planos Acotados. Madrid: M. Palancar - RODRIGUEZ DE ABAJO (). Geometría Descriptiva. Tomo III: Sistema de Perspectiva Caballera.. - RODRÍ•GUEZ DE ABAJO (). Geometría Descriptiva. Tomo IV: Sistema Axonométrico.. - RODRÍGUEZ DE ABAJO (). Geometría Descriptiva. Tomo V. Sistema Cónico.. - VILLANUEVA BARTRINA (2001). Perspectiva lineal. Su relación con la fotografía. Edicións UPC - BARTOLOMÉ RAMÍREZ (2011). Perspectiva: fundamentos y aplicaciones. Universidad de La Rioja. Servivio de publicaciones - RENDÓN GÓMEZ, Álvaro (2001). Geometría paso a paso. Geometría Proyectiva y Sistemas de Representación. Vol. I. (1ª parte). Madrid: Editorial Tébar
Complementary	- IZQUIERDO ASENSI, F. (2002). Construcciones Geométricas. - IZQUIERDO ASENSI, F. (2005). Fórmulas y Propiedades Geométricas. - IZQUIERDO ASENSI, F. (Varias ediciones). Geometría Descriptiva Superior y Aplicada. - RENDÓN GÓMEZ, Álvaro (2016). Geometría paso a paso. Vol. I. Elementos de Geometría Métrica y sus aplicaciones en Arte, Ingeniería y Construcción. Editorial Tébar Flores - ÁLVAREZ BENGOA; RODRÍGUEZ DE ABAJO (). Curso de Dibujo Geométrico y Croquización.

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Digital Graphic Tools for Building/670G01109 Architectural Graphic Expression I/670G01103
Subjects that continue the syllabus
Architectural Graphic Expression II/670G01117 Topography and Setting out/670G01119
Other comments
By addressing the basics of graphical representation, it is recommended to study the subject of Descriptive Geometry prior or simultaneous to other subjects in the area of Architectural Graphic Expression.PrerequisitesIt is recommended to have studied the subject of Technical Drawing in high school or equivalent training as it is considered that the student must be accustomed to using conventional instruments of graphical representation. They also should know the most basic aspects of the different systems of representation, especially Diedric System and basic planar geometry layouts (angles, polygons, conic sections, elementary trigonometry, etc.).