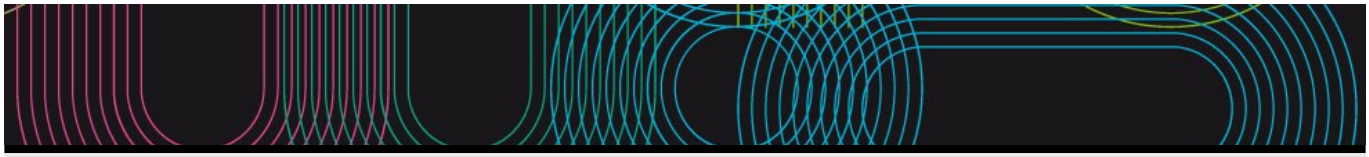

IDENTIFYING DATA				
Graphic expression: Graphic expression				
Subject	Graphic expression: Graphic expression			
Code	P52G382V01101			
Study programme	Grado en Ingeniería Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Basic education	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Feijoo Conde, Jorge			
Lecturers	Feijoo Conde, Jorge Garrido González, Iván Pérez Collazo, Carlos			
E-mail	jfeijoo@cud.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	This course aims to train the students in different aspects of the Graphic Expression in order to give them adequate skills for the management and interpretation of the representation systems most commonly used in the industrial field and its basic techniques to introduce them to the knowledge of the geometric shapes, generation and properties of the most frequent geometric entities, including the acquisition of spatial vision and comprehension to introduce them into the study of technological aspects of Graphic Expression in Engineering as well as into the knowledge and application of Standardization, in both basic and specific aspects. The subject will be developed aiming to enable the student to handle traditional techniques as well as new information and communication technologies.			

Training and Learning Results	
Code	
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B4	Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of Industrial Engineering in Mechanical specialty.
B6	Capacity for handling specifications, regulations and mandatory standards.
C5	Capacity for spatial vision and knowledge of the techniques of graphic representation, using traditional methods of metric geometry and descriptive geometry, and through the application of computer-aided design.
D2	Problems resolution.
D6	Application of computer science in the field of study.
D9	Apply knowledge.
D17	Team working.

Expected results from this subject	Training and Learning Results		
Get to know apply and understand the basic concepts and normalisation of the engineering design, on its broaden concept, allowing at the same time the development of the space ability.	B3 B4	C5	D2 D6
To acquire the capacity for abstract reasoning, and the establishment of efficient strategies and procedures for the resolution of graphic problems within the context of engineering projects.	B3 B4	C5	D2
Use of a graphic communication between technicians, by means of the realisation and interpretation of plans according to the Technical Drawing Standards, involving the use of new technologies.	B6	C5	D6 D9
To assume a favorable attitude for a permanent learning in the profession, being proactive and with a collaborative and committed spirit.	B4		D9

Work as a team, developing knowledge based on a critical and responsible technical-cultural exchange.	B4 B6		D9 D17
ENAEE learning outcome: KNOWLEDGE AND UNDERSTANDING: LO1.1.- knowledge and understanding of the mathematics and other basic sciences underlying their engineering specialisation, at a level necessary to achieve the other programme outcomes [level of achievement (basic (1), intermediate (2) and advanced (3)) for this learning outcome: Intermediate (2)].	B3	C5	
ENAEE learning outcome: ENGINEERING ANALYSIS: LO2.2.- ability to identify, formulate and solve engineering problems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to recognise the importance of non-technical societal, health and safety, environmental, economic and industrial constraints [Intermediate (2)].	B4	C5	D2 D9
ENAEE learning outcome: INVESTIGATION AND INNOVATIONS: LO4.1.- ability to conduct searches of literature, to consult and to critically use scientific databases and other appropriate sources of information, to carry out simulation and analysis in order to pursue detailed investigations and research of technical issues in their field of study [Basic (1)].	B6		
ENAEE learning outcome: INVESTIGATION AND INNOVATIONS: LO4.2.- ability to consult and apply codes of practice and safety regulations in their field of study [Intermediate (2)].	B6		
ENAEE learning outcome: ENGINEERING PRACTICE: LO5.3.- understanding of applicable materials, equipment and tools, engineering technologies and processes, and of their limitations in their field of study [Basic (1)].			D6 D9
ENAEE learning outcome: ENGINEERING PRACTICE: LO5.4.- ability to apply norms of engineering practice in their field of study [Intermediate (2)].	B6		D9
ENAEE learning outcome: COMMUNICATION AND TEAM-WORKING: LO7.1.- ability to communicate effectively information, ideas, problems and solutions with engineering community and society at large [Intermediate (2)].	B4		
ENAEE learning outcome: COMMUNICATION AND TEAM-WORKING: LO7.2.- ability to function effectively in a national and international context, as an individual and as a member of a team and to cooperate effectively with engineers and non-engineers [Intermediate (2)].			D17

Contents

Topic	
Section I. Descriptive geometry. Unit 1. Introduction to the representation systems.	1.1. Projective geometry. projective invariants. 1.2. Orthogonal projection system. 1.3. Dihedral system. 1.4. Axonometric system. 1.5. Conic system.
Section I. Descriptive geometry. Unit 2. Dihedral system.	2.1. General principles. 2.2. Representation of point, line, plane and volume. 2.3. Distances and true magnitude. 2.4. Intersections. 2.5. Relative positions: Parallelism, Perpendicularity.
Section I. Descriptive geometry. Unit 3. Orthogonal projection system.	3.1. Point, straight line and plane. Line of maximum slope on a plane. 3.2. Intersections. Application to covers and roofs. 3.3. Straight lines, surfaces and lands. Generalities and applications.
Section I. Descriptive geometry. Unit 4. Curves of Engineering.	4.1. Involute and evolute. Tracing and applications. 4.2. Rolling curves: cycloid, epicycloid and hypocycloid. Tracing and applications.
Section II. Standardised representation. Unit 5. Introduction - The technical drawing and the standardisation.	5.1. The Graphic Expression. 5.2. Standardization in Technical Drawing. 5.3. Regulation, specification and standard. 5.4. Types of standards. 5.5. Basic standards of Technical Drawing.
Block II. Standardised representation. Unit 6. Technical drawing basis.	6.1. Visualisation and representation of body shapes. 6.2. Methods of arrangements of views. 6.3. Types of views. 6.4. Cuts and sections. 6.5. Other conventionalisms: intersections, symmetrical pieces, interrupted views, repetitive elements, details, etc.
Section II. Standardised representation. Unit 7. Elements and ways of dimensioning.	7.1. General principles and basic standards. 7.2. Types of dimensioning. 7.3. Dimensioning elements. 7.4. Symbols. 7.5. Arrangement of dimensions. 7.6. Special indications (radii, equidistant elements, etc.). 7.7. Dimensioning systems. 7.8. Other indications (missing dimensions, particular specifications, etc.).

Section II. Standardised representation. Unit 8. Representation of standardised elements.	8.1. Standardized elements. 8.2. Representation of mechanical connections. - Definition of threaded joints. - Types of threads. - Conventional representation of threads. - Representation of riveted connections. 8.3. Representation of welded joints. 8.4. Representation of standard mechanical elements. - Springs. - Shafts. - Keyways and grooves. - Bearings. - Gears, chains and pulleys.
Section II. Standardised representation. Unit 9. Representation of groups.	9.1. Representation of mechanical groups. 9.2. Rules for the preparation of group drawings. 9.3. Reference of elements. 9.4. List of pieces. 9.5. Designation standardised materials. 9.6. Breakdown drawing. 9.7. Numbering of planes.
Section II. Standardised representation. Unit 10. Tolerances systems and surface finishes.	10.1. Basics and need of tolerances. 10.2. Dimensional tolerances and adjustment. 10.3. Standardized tolerances: UNE-ISO notation. 10.4. Geometrical tolerances. 10.5. Finishings and surface quality treatments.
Section II. Standardised representation. Unit 11. Symbology and schematic representations.	11.1. Introduction and standards of application. 11.2. Characteristic of the symbols. 11.3. Classes of symbols and codes. 11.4. Standardised symbols. 11.5. Graphic symbols for diagrams. 11.6. Typology of diagrams according to their nature and application. 11.7. Practical applications of schematic representations in Engineering. - Electrical system. - Pneumatic system. - Hydraulic system.
Practical Activity 1 (CAD 3D)	Basic design procedure: from sketch to solid.
Practical Activity 2 (CAD 3D)	Sketching and modeling tools (I).
Practical Activity 3 (CAD 3D)	Sketching and modeling tools (II).
Practical Activity 4 (CAD 3D)	Sketching and modeling tools (III).
Practical Activity 5 (CAD 3D)	Assembly drawings
Practical Activity 6 (CAD 3D)	Generation of views and plans.
Practical Activity 7 (CAD 3D)	Resolution of a case study
Practical Activity 8 (CAD 2D)	File formats and management. Setting. Drawing and modification tools (I). Line drawing by coordinates.
Practical Activity 9 (CAD 2D)	Drawing and modification tools (II). Object snap and trace.
Practical Activity 10 (CAD 2D)	Drawing and modification tools (III). Point and line formats.
Practical Activity 11 (CAD 2D)	Layer editing. Text and dimension formats. Scaling.
Practical Activity 12 (CAD 2D)	Presentation and drawing of plans. 2D sketching.
Practical Activity 13 (CAD 2D)	Blocks, attributes and external references.
Practical Activity 14 (CAD 2D)	Resolution of a case study

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	42	48	90
Practices through ICT	28	28	56
Problem solving	14	10	24
Project based learning	0	10	10
Seminars	25	7	32
Essay questions exam	13	0	13

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

Methodologies

	Description
Lecturing	Lecture session. Each thematic unit will be presented by the lecturer, and complemented with the comments of the students based on the assigned bibliography or other relevant information.

Practices through ICT	Computer exercises will be carried out focused on the use of CAD software for the generation of technical drawings and plans.
Problem solving	Exercises and / or study cases will be raised and solved individually or in groups.
Project based learning	Throughout the semester, a group project will be carried out in which each and every member of the group must collaborate, contributing and complementing the knowledge necessary for its achievement.
Seminars	Intensive course (25 hours) for those students who have failed the subject at first call, prior to the exam in second call. Group tutoring with the lecturer.

Personalized assistance

Methodologies	Description
Problem solving	In the personalized tutoring, each student, individually, can discuss with the lecturer any problem related to their learning achievements in the subject. The lecturer will solve the questions of the students both in person, according to the tutoring schedule published on the web page of the CUD, as well as through telematic means (email, videoconference, Moovi forums, etc.) with previous appointment.
Seminars	Group tutoring with the lecturer. The lecturer will solve the questions of the students both in person, according to the tutoring schedule published on the web page of the CUD, as well as through telematic means (email, videoconference, Moovi forums, etc.) with previous appointment.
Project based learning	The students will have at their disposal hours of tutoring in which they can consult any doubt related to the contents, organization and planning of the subject, with the development of the project, etc. The tutoring can be individualized, but group tutoring will be encouraged for the resolution of problems related to the activities to be carried out in group, or simply to inform the lecturer of the evolution of the collaborative project.

Assessment

	Description	Qualification	Training and Learning Results
Lecturing	Two evaluation tests/questionaries, in a continuous assessment, of short duration will be carried out throughout the semester. The tests will be carried out, proposed by the lecturer, at the most appropriate times within the classroom sessions of the subject. These two tests will be mandatory and required to pass the subject (percentage in the final qualification: 20%, 10% each assessment).	20	B3 C5 D2 B4 D9 B6
Practices through ICT	The evaluation of the abilities for using the CAD 2D/3D software is included in the 20% corresponding to the methodology of problems and/or exercises resolution, more specifically for the elaboration of plans and partial drawings of assembly mechanisms.	0	B4 C5 D2 D6 D9
Problem solving	During the semester, different assembly mechanisms will be proposed for their representation in the computer sessions through the use of the CAD 2D/3D software. It will be assessed through two tests within the classroom sessions of the subject (percentage in the final qualification: 20%, 10% each assessment).	20	B4 C5 D2 D6 D9
Project based learning	Throughout the semester, students will carry out a project related to the subject. The project will be developed in parallel to the syllabus of the course and will cover most of the aspects reflected in it. The project will be carried out in small groups of students that will be fixed during the first three weeks of class. The project grade will have two elements: 1) Delivery of the report (75%): Same score for all members of the group. 2) Final presentation / oral presentation (25%): individual score (according to the defense of each one).	20	B3 C5 D2 B4 D6 B6 D9 D17
Essay questions exam	A final exam will be carried out covering all the contents of the subject, both theoretical and practical, and that may include tests, reasoning questions, exercise solving and development of practical cases. It is required to achieve a minimum score of 4.0 points over 10 possible to pass the subject (percentage in the final qualification: 40%).	40	B3 C5 D2 B4 D9 B6

Other comments on the Evaluation

The final qualification will be determined based on the scores obtained in:

1. Final evaluation, through the assessments carried out in the calls and dates proposed by the University and the Center.

2. Continuous evaluation, through the assessment of the practical works and activities proposed throughout the semester.

A numerical rating system with values from 0.0 to 10.0 points will be used according to current legislation (R.D. 1125/2003 of September 5, B.O.E. No. 224 of September 18). The subject will be considered passed when the student achieves a

minimum qualification of 5.0 points.

Those students who have not reached the minimum mark in the final exam of continuous assessment will obtain a maximum score of 4.5 points in continuous assessment.

All the students who have not passed the subject during the first call will have the possibility to recover the subject. The recovery plan consists of the right, already acquired, to perform a new exam, called extraordinary or second call, on the official dates, whose qualification will replace the previously obtained and, if it is higher, will be used for the calculation of the final marks.

ACADEMIC INTEGRITY: Students are expected to show adequate ethical behaviour, committing to act honestly. Based on article 42.1 of the *Regulation on the evaluation, qualification and quality of teaching and the student learning process of the University of Vigo*, as well as point 6 of the fifth rule of *Order DEF/711/2022, of July 18th, which establishes the requirements for evaluation, progress, and ongoing enrolment in military educational training centres for incorporation into the ranks of the Armed Forces,* **any violation of academic integrity in the assessment process, as well as the cooperation in it will result in the assignment of a failing grade to the student (zero) for the entire course in the corresponding assessment opportunity,** regardless of the percentage of importance that the test in question had in the overall continuous assessment and independently of other disciplinary actions that may be applied.

Sources of information

Basic Bibliography

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AURIA J.M., IBÁÑEZ P. Y UBIETO P., **Dibujo Industrial. Conjuntos y despieces**, Thompson, 2000

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CRESPO GAMUZA J.J. Y USTARROZ IRIZAR I., **Esquemas de instalaciones eléctricas en baja tensión: Problemas resueltos**, Ustarroz Irizar, 2003

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Recommendations

Subjects that continue the syllabus

Graphic engineering/P52G381V01304

Other comments

There are no prerequisites to follow the course, although it is recommended that the student has some knowledge in technical drawing and geometry fundamentals at the level required in high school.

For the appropriate development of the practical classes and seminars, it is recommended that the student has the basic technical drawing tools: 45º and 60º setsquares, scale, compass and pencils or with different hardness.
It would also be advisable for the student to have a computer, with access to the Internet and software applications.