VNIVERSITAT ᴅ VALÈNCIA

COURSE DATA

Data Subject

Code	34881
Name	Engineering graphics
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1403 - Degree in Telematics Engineering	School of Engineering	1	First term
1935 - PDG Matemàtiques-Telemàtica	Faculty of Mathematics	1	First term

Subject-matter

Degree	Subject-matter	Character
1403 - Degree in Telematics Engineering	7 - Graphic expression	Basic Training
1935 - PDG Matemàtiques-Telemàtica	1 - Primer curso	Basic Training

Coordination

Name	Department
CASAS YRURZUM, SERGIO	240 - Computer Science
PERIS DUO, NATALIA	240 - Computer Science

SUMMARY

This course is taught in the first semester of the first degree course in Telematics Engineering. It belongs to the basic training materials. This material is intended to give students an overview of graphic expression and its application in engineering. It provides the fundamental concepts of educating vision in space and technical drawing, with special emphasis on the use of common software

The course contents are:
Representation techniques. Spatial conception. Standardization. Computer Aided Design. Fundamentals of industrial design.

The general objectives of the course are:
• Improve education of vision in the space-plane:
• From a given object in 3 dimensions, draw the necessary views to build it.
• From the analysis of the views of an object, build a drawing in the axonometric system.
• Prepare 2- and 3-dimensional drawings with CAD tools
• Use the drawing as a tool to explain "what is" or ideas and intentions (graphic expression).
• Students will use their powers of observation and analysis, sensitivity, retention, intuitive thinking and deduction.
• Recognize the graphic meta-lenguage.
• Represent objects and mechanical parts by the use of drawing
• Describe the methodology to be used in industrial design.
• Promote and improve student research skills.
• Be able to meet deadlines.
• Encourage the student's critical ability.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

No prerequisites, although some previous knowledge of technical drawing may be highly beneficial to speed up the understanding of the concepts.

OUTCOMES

1403 - Degree in Telematics Engineering

- G3 - Acquisition of the knowledge of the basic and technological subjects that allows students to learn new methods and theories and endows them with the versatility to adapt to new situations.

- G5 - Knowledge to carry out measurements, calculations, assessments, evaluations, loss adjustments, studies, reports, task planning, and other analogous work in the specific field of telecommunications.

- G6 - Ability in the handling of specifications, regulations and norms of compulsory compliance.

LEARNING OUTCOMES

This course allows for the following learning outcomes:

• Know how to interpret technical plans and drawings in different systems of representation. (G6)

• Be able to represent on paper the 3-dimensional objects and to reconstruct and interpret by drawing the shape and position. (G6)

• Know and use different standards used in the technical representation. (G6) (G5)

• Understand the concepts of drawing and cutting set and its application in industrial design. (G6) (G3) (G5)

• Be able to use tools of computer aided design. (G3)

To complement the above results, this subject also to acquire the following skills:

• Manage effectively assisted drawing programs exposed. (G3)

• Compose and draw sheets. (G5)

• Know how to analyze and classify the exercises themselves critically. (G3)

• Know how to analyze and score a critical exercise of other groups. (G3)

• Find and select the information they require specialized bibliographic sources. (G6)

• Represent objects in three dimensions, to reconstruct and interpret through drawing its shape and position (spatial view). (G5)

• Know how to make charts and diagrams. (G5)

In addition to the specific objectives mentioned above, the course will encourage the development of several social and technical abilities, among which include:

• Ability to work as a team (including resolution of problems between them).

• Ability to solve exercises using the full application of the knowledge acquired by the student from the notebook.

• Ability to deliver a comprehensive and organized notebook.

DESCRIPTION OF CONTENTS

1. INTRODUCTION AND PREVIOUS CONCEPTS
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1.1. Introduction

1.2. Notation and Basic Geometric Concepts

1.3. Scale Drawing

2. DESIGN AND CAD/CAM/CAE SYSTEMS

2.1. The classic design process.

2.2. Types and Applications of CAD Systems

2.3. Brief History of CAD Applications

2.4. Elements of a CAD System

3. TWO-DIMENSIONAL CAD

3.1. Work environment: Coordinate systems. Entering orders. Selection of objects.

3.2. Layers

3.3. Basic drawing orders: Points. Lines.

3.4. Basic utilities: Grids and Limits. Drawing with resolution and orthogonal. Reference to objects.

3.5. Drawing orders: Circles. Bows. Polygons. Ellipses. Texts. Other orders.

3.6. Edition orders: Delete Order, Uy Order, Shift Order, Copy Order, Tour Order, Scale Order, Symmetry Order, Rectangle and Pole-Matrix Orders, Cut Order, Chamfer Order, Splice Order, Regen Order.

3.7. Dimensions.

3.8. Drawing of planes.

3.9. CAD customization.

4. BASIC GEOMETRIC CONSTRUCTION

4.1. Operations with segments and angles: Thales theorems. Fourth, third and average proportional. Geometric calculation of the square root. Construction of perpendicular bisectors and bisectors. Construction of perpendiculars.

4.2. Circumference and arches: Definitions. Angles with respect to the circumference. Capable bow. Power of a point with respect to a circumference. Rectification of the circumference (Kochanski and Mascheroni).

4.3. Triangles: Classification (according to its sides and angles). Cevianas and notable points. Arctic triangle, Nagel's theorem, Euler's line. Properties. Basic theorems on right triangles (Pythagorean Theorem, Height Theorem, Leg Theorem).

4.4. Quadrilaterals. Classification. Properties.

4.5. Polygons. Regular polygons inscribed in a circle. Regular polygons given the side. Starry regular polygons. Non-regular polygons.

4.6. Tangencies: Tangency Theorems.

4.7. Links

4.8. Technical Curves

4.9. Conical Curves or Sections. The circumference. The ellipse. The hyperbola. The parable. Construction of conical curves.

5. TRANSFORMATIONS, PROPORTION AND SCALES

5.1. Geometric transformations: Types of geometric transformations. Isometric transformations (translation, rotation, central symmetry, axial symmetry). Isomorphic transformations (homotecia, scaling). Anamorphic transformations (of equivalence, equicomposition).

5.2. Proportionality, equality and similarity: Proportionality. Direct similarity and inverse similarity.

5.3. Scales. Types of scales. Graphic scales. Standard scales.

6. PROJECTIONS AND REPRESENTATION SYSTEMS

6.1. Descriptive geometry

6.2. Projections and their types: Types of projections. Non-flat projections. Flat projections.

6.3. The Orthogonal Parallel Flat Projection: Types of Orthogonal Parallel Flat Projections.

6.4. The flat plane orthogonal axonometric projection: axonometric coefficients and projection scales. Fundamental or trace triangle. Relationship between axonometric reduction coefficients. Schlömilch - Weisbach theorem.

6.5. The oblique parallel flat projection: Analytical calculation of reduction coefficients.

6.6. Representation systems: dihedral system. Dimensional drawing system. Orthogonal axonometric system. Other systems. Comparison of representation systems.

7. REPRESENTATION MODELS IN THREE DIMENSIONS

7.1. Representation Models: The model of polygonal surfaces.

7.2. The real-time perspective projection: the vision pyramid.

7.3. Related 3D transformations: Translation. Turn / Rotation. Scaling. Combined Matrix Representation.

7.4. The graphic pipeline.

7.5. Practical example of 3D modeling: Sketch Up: Basic interface and commands. Push / pull and follow me. Object transformations. Details of the objects.

8. STANDARDIZATION AND SYMBOLOGY

8.1. Origins and standardization bodies

8.2. Normalization in graphic expression.

8.3. Symbology: Mathematical symbols. Symbology on units and quantities International unit system (SI).

8.4. Specific symbology in Telematics.

9. DIMENSIONS AND TOLERANCES

9.1. Introduction and definitions

9.2. Dimensioning criteria: Dimensioning based on functionality criteria. Dimensioning by manufacturing criteria. Limitation by the verification criteria.

9.3. Elements of a dimension.

9.4. Dimensioning rules: Scale invariance. Placement of dimension lines. Dimension arrows. Rate repetition. Choice of dimension plans. Dimensions of angles, arches and strings. Position of the dimension figures. Chamfer and joint dimensioning. Dimensions in holes. Dimensioning in tangencies. Other standards of dimensioning.

9.5. Tolerances and adjustments: Concepts. Sèrie and parallel dimensioning.

10. DIAGRAM REPRESENTATION MODELS

10.1. Introduction and definition

10.2. Flowcharts.

10.3. Block diagrams.

10.4. Electrical diagrams.

10.5. The Unified Modeling Language (UML)

11. FUNDAMENTALS OF INDUSTRIAL DESIGN

11.1. Analysis

11.2. Synthesis.

11.3. Evaluation.

11.4. Creativity: Phases of the creative process. The creative product.

11.5. Techniques to promote creativity: Mind maps. Art of asking. Forced relationships. SCAMPER. Attribute listing. Analogies. Bionics. Delphi method (Delphi). Morphological analysis. IDEART. 4x4x4. Da Vinci technique. Brainstorming.

11.6. The assembly drawing and the exploded view drawing

12. GRAPHIC EXPRESSION LABORATORY

Will undertake the following practices:

geometric designs.

Diagrams

2D representation

3D Rendering

Standardization and dimensioning

VNIVERSITAT ÖID VALÈNCIA

WORKLOAD

ACTIVITY	Hours	% To be attended
Laboratory practices	30,00	100
Theory classes	15,00	100
Classroom practices	15,00	100
Development of group work	5,00	0
Development of individual work	10,00	0
Study and independent work	10,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	30,00	0
Resolution of case studies	5,00	0
Resolution of online questionnaires	5,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

• • Classroom work: theory classes, practical classes and laboratory classes. (G3) (G5) (G6)

• Student's home work: preparation of classes, solving of exercises and problems, job preparation and presentation of results. (G3) (G5) (G6)

• Individual and group tutorials. (G3) (G5) (G6)

EVALUATION

Students have two opportunities to pass this course: January and June.

The evaluation of the course will be carried out using the following scheme:

In the **first examination opportunity (January call)**, whenever the student accredits class attendance, the final note of the course shall be calculated as follows:

FinalGrade = 0.3*LabGrade + 0.2*PartialGrade + 0.35*FinalExamGrade + 0.15*ExerGrade

LabGrade is obtained from the evaluation of laboratory practices. For such evaluation, the amount of preparation, the work delivered and the effort devoted by each student during the lab sessions will be taken into account. In addition, the practices may be evaluated with additional exercises during the laboratory session, with individual practice sessions exams, or a with a final laboratory exam. Although group work will be encouraged in the form of couple teams, evaluation will remain in individual terms.

PartialGrade will be obtained by carrying out a theoretical-practical test of minimum knowledge on the subject matter.

FinalExamGrade will be get through the final examination of the course. The students who get a grade greater or equal than 8 in the average grade of the two minimum knowledge tests, will have the option to skip the final exam. If so, the final exam grade will be equal to the aforementioned average grade of the minimum knowledge tests.

ExerGrade will be get through the realization of exercises and activities throughout the year. This grade will be based on the participation and involvement in the process of teaching and learning, taking into account the resolution of issues and problems proposed during classes. Activities must be delivered in time and in the way proposed by teachers to be able to be evaluated.

All grades are considered in the range of 0 to 10 points.

Students will need to get at least **5 out of 10** points in both **LabGrade** and **FinalExamGrade** to overcome the course.

It will be necessary to obtain at least **3.5 out of 10** in the **PartialGrade** in order to pass the subject in the **first examination opportunity (January call)**.

VNIVERSITAT ĞİD VALÈNCIA

Class attendance is defined as the situation in which the student has not missed more than 20% of the theory/exercise classes nor more than 20% of laboratory sessions. Class attendance implies the permanence in the classroom for at least 80% of the duration of the lesson.

All students who fail to overcome the course in January, are eligible to be evaluated in a **second call in June**. The grades obtained in each one of the parts of the January call will not be saved to the June call. In this call, evaluation shall be calculated in the following way:

FinalGrade = 0.3*LabGrade + 0.7*FinalExamGrade

LabGrade will be get through a final laboratory exam.

FinalExamGrade will be get through the final examination of the course.

All grades are in the range from 0 to 10 points.

Students will need to get at least **5 out of 10** points in both **LabGrade** and **FinalExamGrade** to overcome the course.

Partial minimum grades (for both examination opportunities) could be slightly reduced to favor students, always keeping the same minimum grades for everyone.

Examination Ahead of Schedule:

Given the practical and in-person approach of the course, to opt for the possibility of an examination ahead of schedule, the student must have officially signed up for the course before the start of the course.

Important note:

The detection of any kind of copy in any of the proposed activities to students during the course, laboratory practice, tests or exams, either from another student or any other source, will mean the fail of the current course evaluation of all students involved in the copy, including all the members of the group in case of a group activity, being indifferent if the students are the source or the destination of the copy, notwithstanding the possible disciplinary proceedings that may arise by the University to those students.

The assessment procedure follows the guidelines of the Reglament de Avaluació i Qualificació de la Universitat de València (https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639)

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