Analytic and Descriptive Geometry

DESCRIPTION OF THE SUBJECT

The subject "Analytic and Descriptive Geometry" is set out as a self-learning process in which the student is able to relate elementary knowledge of two basic subjects taught in the majority of the engineering degrees: Algebra and Graphical expression. The fields included inside geometry are the ones that are common to the descriptive geometry and to the affine geometry. It is expected that students, once having understood and assimilated the theoretical concepts, in which theoretical and practical questions are included, are going to be able to solve a set of geometric problems analytically and graphically, being also able to compare results.

PRE-REQUISITES

The pre-requisites to follow this subject are the knowledge of Mathematics and Technical Drawing acquired in the baccalaureate.

OBJECTIVES

The objectives of the subject are the following:

- To obtain the essential theoretical concepts of geometric to approach possible questions and problems.
- To go in depth into the knowledge of the subjects Analytic Geometry and Descriptive Geometry.
- To acquire skills to solve questions related to the subject using adequate procedures.
- To obtain a more global vision of the knowledge by solving exercises using different approaches and procedures from the typical ones in each of the subjects.
- To apply the knowledge about geometry from an interdisciplinary perspective.

COMPETENCES

The competences of the subject are:

1- To acquire basic knowledge about problem solving skills in linear algebra and graphical expression related to the geometry.

2- To develop the spatial visualization ability not only from the point of view of the linear algebra but also from the point of view of the technical drawing.

3- To join and to interpret relevant information for solving problems from the point of view of the linear algebra and of the technical drawing.

4- To increase the ability to relate basic knowledge of graphical representation and linear algebra, so that depending on the presented problem the most suitable procedure of resolution is chosen.

5- To develop strategies of solving graphical and algebraic problems when approaching problematic situations related to engineering.

STRUCTURE OF THE SUBJECT

The subject is designed in the following way:

- **Study materials**: This material contains the theoretical contents of the subject with application examples. The methods used in each of the subjects will be presented (Algebra and Graphical Expression), comparing the procedures for each common matter.

- **Solved exercises:** The resolution of several exercises of both subjects will be included. Students could verify similarities in the resolution of the set out problems.

- **Self-assessment exercises**: Resolution of practical exercises will be included, which could be used by students as self-assessment. In some cases the solutions will be given and in other cases, the students will be asked to solve them from the point of view of the descriptive geometry and the affine geometry. Students will check if the obtained results are correct.

- **Self-assessment questions**: A list of theoretical and practical questions will be set out, so that students can study what they have seen in the subject. Its solution will be given.

The following is suggested in order to progress appropriately during the course:

1. In each lesson:
    a. It is necessary to read critically and analytically the study materials. The recommended bibliography should be read.
    b. It is necessary to solve the recommended exercises and to check the obtained results with the provided solutions.
    c. Once all the lessons have been studied, the self-assessment questions and exercises should be done.

LIST OF TOPICS

Lesson 1: Elements of the affine space: definition and representation.

In the first lesson, the main geometrical, analytical and graphical elements are presented and their most important characteristics are described.

Lesson 2: Relative positions among elements.

Once the main elements and their representation are known, the different relative positions of these elements in the space are analysed and the associated procedures are described: parallel elements, intersections, …

Lesson 3: Orthogonality.

In this lesson the condition of perpendicularity between the different elements studied on the first lesson and how this perpendicularity affects their representation is described.

Lesson 4: Distance between elements.

The analytical and graphical procedures to determine the distance between elements in the space are explained.

Lesson 5: Symmetries.

In this lesson, symmetries are presented as an application of the third and fourth lessons.

Lesson 6: Angles between elements.

The concept of angle is defined and the procedures to compute it analytically and graphically are explained.

Application problems.

In this section applied exercises that cover all the concepts previously studied are proposed. It is expected that these problems will help to consolidate the acquired knowledge. Results are provided.

TIMELINE

The subject "Analytic and Descriptive Geometry" is set out as a course of 120 hours. Students will learn the theoretical contents with examples of application, using methods from the graphical and algebraic point of views.

In the next table the timeline of the subject is presented, showing the number of hours estimated for each lesson. The time required for understanding the lectures, and for the accomplishment of the exercises and the self-assessment exercises is specified.

LESSONS	Hours	Reading	Exercises solving	Self-assessment exercises
Lesson 1: Elements of the affine space: definition and representation	28	13	14	1
Lesson 2: Relative positions among elements	28	12	10	6
Lesson 3: Orthogonality	13	5	4	4
Lesson 4: Distance between elements	20	10	5	5
Lesson 5: Symmetries	6	2	2	2
Lesson 6: Angles between elements	10	4	3	3
Application problems	15			