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BASIC SURFACES FOR ENGINEERING

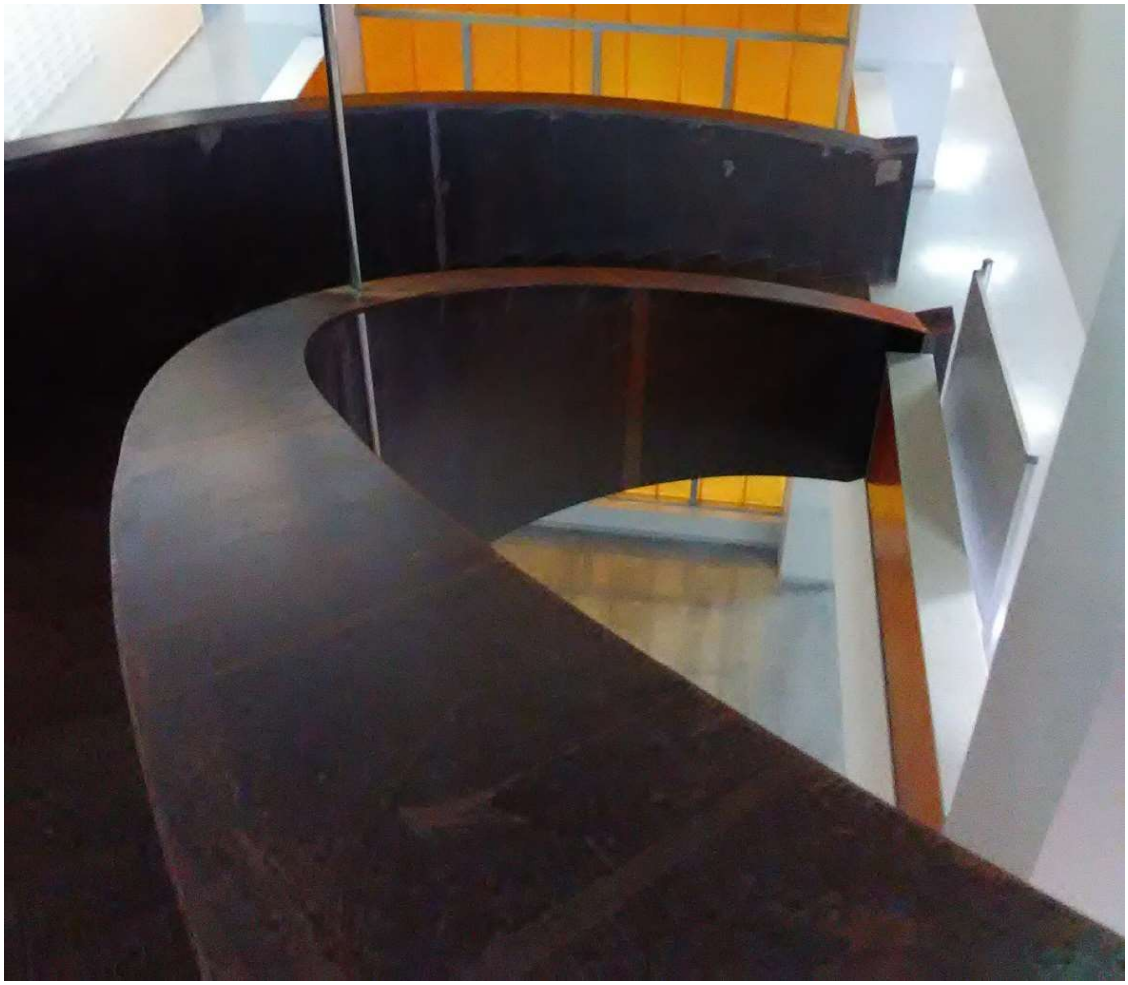

Figure 0. Central stairs of the 2nd building of the Faculty of Engineering in Bilbao. Photo by the authors, 2018.

Teaching Guide

Content

1. Teaching Guide

Next, the teaching guide of the subject "Basic Surfaces for Engineering" is detailed where the objectives of the subject are detailed, the competences that will be acquired, the prerequisites necessary to take it, the description of it and the syllabus and methodology to follow in it.

Surfaces are basic geometries in all areas of engineering; vessels, reactors, structures, etc. From the point of view of design, an engineer must not only know the different existing surfaces, but must have sufficient knowledge to generate and design them and to be able to transfer said information to other professionals in the area. This is a subject that is studied in the subject of Graphic Expression of 1st year of Industrial Engineering degrees. With this, the basic concepts of the surfaces are acquired and the spatial capacity is developed. This knowledge and skills are applied both in other subjects and in the exercise of the profession.

Traditionally in engineering studies, surfaces are studied in the subject of graphic expression taught in the first year of the degree. The traditional methodology used so far to impart this knowledge is centered on the teacher who is the one who imparts the information during the class period.

However, new teaching methodologies emerge where the work of certain learning processes is transferred outside the classroom and uses class time to enhance other processes of acquisition and practice of knowledge within the classroom.

This subject consists of a compilation of the basic and theoretical concepts about surfaces. It is a very graphic and visual compilation, from which students can acquire such knowledge outside the classroom.

1.1 Objectives

The main objective of the subject is to learn the basic concepts about surfaces in engineering, with which students can begin to solve problems in this area.

To do this, it is based on content in which the student can find all the basic concepts on the subject in particular. The concepts will be explained by videos or graphic schemes. In this way, concepts can be reviewed as many times as students need. The graphic or visual method will help to capture attention, understand and better fix those concepts.

In addition to the main objective mentioned, the course has the following general objectives:

• Use the scientific and normative basis of graphic representation in engineering, as a means of expression and communication, essential both for the graphic interpretation of technological projects, and in the development of scientific research processes.

• Develop a process methodology in the field of industrial design, based on the scientific knowledge of Graphic Expression in engineering in a constructive environment.

1.2 Competence development

Through this subject it is intended that students acquire the skills listed below:

• Consider the functions and importance that technical drawing has in the lives of individuals and societies in the field of technology, being aware that it is an objective and universal language.

• Effectively solve graphic constructions, being aware of the importance of precision, clarity and objectivity of graphic solutions for the proper communication, transmission and interpretation of ideas and information.

• Identify and understand the fundamentals of metric geometry using their resources in a timely manner to problematize situations, rework ideas and project reasoned and diverse solutions.

• Use graphic communication between technicians, specifically to carry out and interpret the standardized drawings of Industrial Engineering Technical Drawing, involving new technologies.

• Develop strategies and procedures in solving graphic problems as a channel to address engineering projects.

• Apply the spatial capacity for the development of the creativity necessary to face the ideas of industrial design.

1.3 Prerequisites

In order to complete the subject and successfully acquire the aforementioned competences, it is convenient that students have completed the subject of 'Technical Drawing 'in high school or an equivalent subject in other university access studies. The syllabus of this subject has been made taking as reference the skills acquired in the subjects of Technical Drawing of Baccalaureate.

Specifically, flat geometry will be used for the definition and representation of conical curves.

The Dihedral System will also be managed for the representation of lines and planes, as well as the methods of plane changes and turns.

1.4 Description

The subject proposed here aims to cover one of the basic aspects of industrial drawing: surfaces, geometries to address industrial engineering projects. Each topic, described in the next section, consists of a file. Each tab or file contains the following information:

• Requirements and objectives of the subject.

• Material equipped with visual examples. The available material includes the most basic concepts and cases in a visual mode, where explanatory notes or brief explanations in sandwich format are included to clarify the most relevant steps. As the agenda progresses, some of the cases are blank to be filled in by the students.

• Self-assessment test. Once the subject of each subject is finished, students will be able to assess the level of knowledge acquired. For this, test forms and their solutions are available.

• Exercises to practice knowledge. Once the basic knowledge is acquired, the students prepare to put them into practice. To do this you can perform a series of exercises available at the end of each topic. Solutions with explanatory notes are also available, for corrections and self-learning through the visualization of errors and the help of the notes.

• Practical exercises of global evaluation. After completing the course, there are some exercises that cover all subjects. The solutions with explanatory notes are also available here, for corrections and self-learning.

The full course is estimated to be completed in about 50 hours. This forecast has been made on the basis that the skills described in the prerequisite section have been previously acquired.

1.5 Syllabus

Next, the subject's agenda is detailed.

The Classification of curves and surfaces is treated, going on to study the developable ruled Surfaces, Revolution and Evolution Surfaces, making sections and their development. All this is distributed in five themes:

1. Basic concepts of surfaces. The course begins by looking at the basic concepts and definitions that will be used.

2. Surface representation. The projections identify the different surfaces and the properties that meet the projections.

3. Flat sections of surfaces. It deals with the sections that produce the planes on the different surfaces, it is analyzed from the preview of the solution to the obtaining of the resulting figure and its notable points.

4. Developments and transformed sections. As a practical application, it is described the obtaining of the surfaces extended in a plane, necessary step for the manufacture of the surfaces. In some cases of developments it is necessary to make a flat section previously.

5. Intersection of surfaces. Study the line of intersection between two surfaces. It is the most complex part due to the large number of cases that can occur. A general method based on the realization of several flat sections is used.

1.6 Methodology

Practices, exercises and activities

Each subject is accompanied by exercises, with which students can practice and put into practice the knowledge acquired. Some of the cases to be studied are given by the teaching staff and others must be completed by the students.

Self-Assessment Procedure

For each syllabus there will be a knowledge test that students can take once the study of these concepts has been completed. Also, solutions with explanatory notes will be available.

The solutions of the exercises proposed in each topic are also available and include explanatory notes. To this is added the rubric that collects the characteristics that the correctly executed plans must have. This rubric is available in this teaching guide in its entirety so that students become familiar with the standards and requirements of the Technical Drawing. However, for this subject, the concepts to be taken into account are those indicated with the following icon in the rubric: 

1.7 Schedule

The schedule of the subject is sequential, since first introductory topics are raised to acquire the basic concepts on surfaces and then more complicated concepts such as developments and intersections of surfaces are raised. Once each topic is finished, the valuation matrix will be used to assess the quality of work.

Topic 1					
Topic 2					
Topic 3					
Topic 4					
Topic 5					

Table 1.1. Timeline. Each column represents about 10 hours of dedication

Landmark 1: Knowledge of the basic concepts of surfaces and their representations.
Landmark 2: Knowledge of development and intersections of surfaces.

In each of the subjects it is estimated that the dedication to the study of the subject on the one hand and the dedication to the realization of the self-assessment tests and to the practical exercises on the other hand, is distributed to 50%.

The dedication to topic 5 includes the realization of the practical exercises of global evaluation that is estimated in about 5 hours.

1.8 Heading

HEADING FOR GRAPHIC EXPRESSION SHEETS

Sheet num.: *Delivery date:*

	SATISFACTORY	NOT SATISFACTORY
Window & texts	-Complete data, labeled in black ink and well presented. -Standard writing throughout the plane. -The sense of reading is respected. -Expanded tittle block/window ordered and with full standarized pieces names. (1)	-Incomplete, illegible, pen or ink data of another color or poorly presented. -Smaller than normalized, misaligned, or misguided writing. -Messy expanded title block with incomplete standard part names.
Scale	-Standardized and appropriate to the format. -All the scales used are shown in the tittle block/window and next to the views.	-Not standardized or inappropriate. -Poorly applied. -It is not on the sheet.
Solution & process	-Rigor in geometric constructions. Mark notable axes and points. -Correct measurements / proportions. -Logical development, clear, orderly and easy to follow. -Clear, defined and differentiated solutions of auxiliary constructions and data. -Use of the European Projection System. -Skill in sketched paths. Application of representation rules (1): a) Minimum and representative views. b) Suitable cuts, well executed, lined with uniform and differentiated spacing. c) Clear, concise and complete dimensioning. d) Tolerances and adjustments correctly indicated in the functional dimensions. e) Surface finishes correctly indicated differentiating types of surfaces. f) Material correctly indicated assigning it by the function of the piece.	-Methodless or imprecise geometric constructions. Notable axes or points are missing. -Incorrect or disproportionate measurements. -Illogical, confusing, messy or difficult to follow development. -Solutions without clearly marking or defining all your data. -Not respecting the European Projection System. -Undecided sketched, not very careful. Incorrect application of representation rules: a) Surplus or unrepresentative views. b) Inadequate cuts, poorly executed, uneven or uneven lines. c) Doubtful, repeated or incomplete dimensioning. d) Poorly indicated tolerances and adjustments or at non-functional levels. e) Poorly indicated surface finishes or without differentiating surface types f) Poorly indicated or inappropriate material for the function of the piece.

Lines	- Pencil trace (colored pencils can be used to mark the solution, except (1)). - Use of two different thicknesses. - Proper use of thicknesses and different types of lines. - Uniform paths, connected the vertices and tangencies.	- Traced in ink. - Use of a single thickness or two not differentiable. - Incorrect use of thicknesses or different types of lines. - Irregular paths, without connecting the vertices or tangencies.
Presen-tation	- Clean, clear and tidy layout. - Proper use of sheet space. - Neat sheet. - Uncoiled or folded delivery according to regulations. - There are no stains, smears, or marks that detract from its presentation.	-Undefined or messy plot. -Overlapping or out-of-range layouts. -Wrinkled, marked, folded, or torn sheet. -Delivery incorrectly rolled or folded. -There are stains or smears or marks.
Time	-Delivery of sheets on time. -Go with the sheets to class for the planned activities (correction, teamwork or individual ...).	-Late delivery of sheets. -Do not go with the sheets to class for the planned activities.
Attitude	-Know how to answer questions on the picture, using technical language. -Show interest in looking for information to solve the pictures. -Make an effort to solve them. -Use them as a learning method. -Collaborative attitude.	-Not answering questions about the picture, or not using technical language. -Do not seek information to solve the pictures. -Do not put effort into solving them. -Use them as a mere procedure. -Non-collaborative attitude.
In general	Overall, the quality of the drawing is excellent.	In general, the quality of the drawing is poor.

(1) In the sheets of sets and pieces