1. Teaching guide

In this document the teaching guide for the lecture entitled "CAD using Solid Edge. Resolution of assemblies based on PBL methodology" is described. The objectives of the present lecture, the skills that will be acquired, the prerequisites, as well as the description of the subject are included in this teaching guide. The subjects and the methodology used will be presented.

Computer Aided Design (CAD) is an essential tool in the education of an engineer. Therefore, for this lecture CAD, using Solid Edge Software (SE) is proposed to solve an assembly. An assembly is formed by parts that altogether generate a mechanism. Each part has to be represented in the correct position so that the mechanism functions correctly.

Following the process of industrial design, the learning proposed herein will be focused on the resolution of assemblies. Therefore, the learning is based on a Project Based Learning (PBL) methodology. In PBL methodologies the learning is done with a case that needs to be solved. Consequently and, in order to solve the project presented for the lecture, CAD tools are presented and their functionalities are introduced.

1.1. Objectives

The main goal of this lecture is to improve the skills on CAD. For this purpose and, to present all the possibilities and functionalities of the SE software, resolution of assemblies based on a PBL methodology will be used.

Besides this main goal, the lecture also pretends to achieve other intermediate objectives which are described below:

- The use on scientific and regulatory basis of the engineering technical drawing for communicating, expressing and understanding of technological projects.
- To develop a methodology in the area of the industrial design based on the knowledge technical drawing.
- To applicate CAD tools to generate technical drawings and virtual prototypes.

1.2. Skills

By performing this subject, the student will acquire the following skills:

- Performing and interpreting standardised technical drawings to communicate among professional.
- Applying spatial intelligence to solve problems in the industrial design with creativity.
- Development strategies to face graphical problems present in the engineering projects.
- Using computers and CAD tools as quick and accurate instruments, based on the basis of the engineering technical drawing.
- Using CAD tools for modelling of 3D objects, assemblies and technical drawings.

1.3. Prerequisites

In order to follow the lecture and acquire all the skills described above, the student previously must have knowledge of the basis of engineering technical drawing and standars. In fact, this knowledge is essential for an appropriate use of CAD tools. However, it is not necessary previous knowledge about other CAD software packages, although it would be very interesting in order to increase the use of these techniques.

1.4. Description

The lecture proposed herein aims to deal with a key aspect of the industrial design: the use of software tools to solve relevant graphical problems present in industrial engineering projects. Due to the high potential of SE software it was selected to carry out this lecture. SE is an accurate and quick software, very useful to generate objects from the point of view of the industrial engineering.

The use of programs for the 3D parametric modelling, compared to the traditional design, induces changes in the processes of the design. Those changes are basically based on virtual prototypes. CAD tools not only modify the strategy of the design but also the teamwork, for instance CAD tools promote cooperation.

Lately, CAD programs are being integrated into CAE and CAM systems, becoming part of the automation of industrial processes. Therefore, for an engineer it is essential to have good skills in CAD software packages.

The bibliography available to learn how to use SE is organized in two parts. The first part presents and explains all the capacities and functionalities of the software and, in a second one, exercises to practice the theoretical concepts presented in the first part are included. Besides the bibliography, SE tutorials also have the same organization: first the operation is explained and then a clarifying example is provided.

Compared to the existing methodology available in the bibliography, in this lecture, CAD and SE learning are focused differently. In fact, the learning is carried out by solving an assembly based in PBL methodology. The aim of a PBL methodology is to analyse and understand the problem under study and then, depending on the needs, to select the most suitable functions available in SE. The main goal of using this methodology is to offer the student a practical point of view and to present the different functionalities of the software adapted to the requested needs. Through this project, the student should be capable to solve any other type of assembly.

1.5. Topics

The topics for this lecture are listed in this section.

Topics

1. Topic: Introduction to CAD system. Structure and analysis of the software. Applications.
2. Topic: Introduction to Solid Edge. Working interfaces. Tutorials.
3. Topic: Theory of the design process. Planning of the product and Rubrics. Concept design of the assembly. Specific design.

4. Topic: Definition of an assembly. Types.

Practices, exercises and activities

5. Topic: Selection of an assembly and resolution.
    5.1. Topic: Planning.
    5.2. Topic: Concept design.
    5.3. Topic: Design of the assembly.
    5.4. Topic: Specific design.
    5.5. Topic: Technical drawings

Process for the self-evaluation

6. Topic. Rubric.

More practicing

7. Practice. Holder for a reading lamp.

1.6. Methodology

For this lecture, the active methodology based on PBL will be used. As mentioned before, in a traditional methodology in first place, the information, the theory is presented and then an application example. Conversely, in a PBL methodology, a problem is presented, then the problem is analysed and the needs are identified, finally the required information in searched in order to solve the detected problems.

In this lecture the problem suggested is an assembly which is explained in detail in Topic 5. Once the problem is presented, the process of the design is followed (Topic 3). To solve the assembly, 5.1, 5.2, 5.3, 5.4 and 5.5 topics are used. Topics 1 to 4 can be used as introductory and additional information for the resolution of the assembly.

This lecture is presented as a self-learning choice. However, it is recommended to carry it out in small teams to shear experiences and to work on transferable skills.

1.7. Schedule

The schedule of the lecture is sequential. First of all the introductory topics are presented within the context of the lesson. Then an assembly is proposed and it is solved. Once it is solved, the evaluation matrix is projected.

Time (weeks)	1	2	3	4	5	6	7	8	9
1.Topic									

2.Topic									
3.Topic									
4.Topic									
5.Topic									
6.Topic									
7.Topic									

Table 1. Schedule

1. Limit: basic concepts of CAD and theory of the process of the industrial design.
2. Limit: resolution of the assembly. Exploded and technical drawings.

The time sequence proposed in the table is flexible depending on the student. The period proposed for each topic is a week, where the student should include time to go through the material included in this lecture, as well as extra information found in the provided bibliography.