ESCUELA TÉCNICA SUPERIOR
DE INGENIERÍA

**GUÍA DOCENTE**
**CURSO 2015-2016**

## SUBJECT DATASHEET

| Subject basic Information | |
|---|---|
| Name | 3D Engineering design with dynamic simulation in SolidWorks |
| Code | |
| Study | Grado en Ingeniería Electromecánica |
| Course | |
| Semester | 2º |
| ECTS | 3 ECTS |
| Type | |
| Department | Ingeniería Mecánica |
| Area | Mecánica |
| University | Comillas |
| Timetable | |
| Teachers | María Ana Sáenz Nuño |
| Descriptor | |

| Faculty information | |
|---|---|
| **Teacher** | |
| Name | María Ana Sáenz Nuño |
| Departament | Ingeniería Mecánica |
| Área | Mecánica |
| Office | D-118 |
| e-mail | msaenz@comillas.edu |
| | |
| Students attention | A definir al comenzar el curso |

## SPECIFIC SUBJECT DATASHEET

### Subject contextualisation

**Contribution to the professional profile of the Title**

At the end of the course, the student will make technical drawings and to design 3D systems with Solidworks, to test them against real world conditions in order to ensure the best design before building it, and to validate them.

Students who successfully complete this course will be able to:

• develop strategies to analyze the dynamics of particles and rigid bodies

• apply the laws of dynamics to analyze and interpret the dynamics of particles and rigid bodies

**Pre requirements**

Basics on technical drawing.
Elemental dynamics.

### Competencies - Targets

**General Competencies of the course / qualification**

| | |
|---|---|
| CG3. | Knowledge on basic and technological matters that help the learning of new method and theories. Student will be trained to be flexible in front of new challenges. |
| CG4. | Ability to solve new problems, make decisions, be creative, critical reasoning and to communicate knowledge and skills inside the Industrial Engineering field. |

| Specific Competencies and learning outcome[1] |
|---|
| |
| **CE1 To learn to design a 3D part in Solidworks**<br><br>RA1 To learn to select the best sketch for each part.<br><br>RA2 To learn to build a 3D model of each part.<br><br>RA3 To learn to build a library of parts with Solidworks. |
| **CE2 To learn to design a 3D assembly in Solidworks**<br><br>RA1 To learn to select the best relations for building up an assemblie.<br><br>RA2 To learn to prepare its technical documentation with Solidworks. |
| **CE3 To learn to analyze the dynamic and kinematic behavior of a 3D assembly in Solidworks**<br><br>RA1 To learn to select the best relations for simulating different types of interactions between the parts in an assemblie.<br><br>RA2 To optimize the design. |

[1] Learning outcomes are indicators of the student competencies and internal deep knowledge.. The competencies are more general and abstract.. The R.A. are indicators showing student competencies.

## THEME SEGMENT AND CONTENTS

| Content – Theme segments |
|---|
| THEME 1: Essentials on part designing |
| **Unit 1: SolidWorks Basics and the User Interface** |
| Design Intent<br>File References<br>Opening Files<br>The SolidWorks User Interface<br>Using the Command Manager |
| **Unit 2: Introduction to Sketching** |
| 2D Sketching<br>Sketch Entities<br>Design Intent<br>Sketch Relations<br>Dimensions<br>Extrude |
| **Unit 3: Basic Part Modeling** |
| Terminology<br>Choosing the Best Profile<br>Choosing the Sketch Plane<br>Details of the Part<br>Boss Feature<br>Sketching on a Planar Face<br>Cut Feature<br>View Selector<br>Using the Hole Wizard<br>Filleting<br>Detailing Basics<br>Drawing Views<br>Center Marks<br>Dimensioning<br>Changing Parameters |
| **Unit 4: Symmetry and Draft** |
| Symmetry in the Sketch<br>Sketching Inside the Model<br>Using Model Edges in a Sketch<br>Creating Trimmed Sketch Geometry |
| **Unit 5: Patterning** |
| Reference Geometry<br>Linear Pattern<br>Circular Patterns<br>Mirror Patterns<br>Using Pattern Seed Only<br>Sketch Driven Patterns |
| **Unit 6: Revolved Features** |
| Revolved Features<br>Building the Rim<br>Building the Spoke<br>Edit Material<br>Mass Properties |
| **Unit 7: Shelling and Ribs** |
| Analyzing and Adding Draft<br>Shelling<br>Planes |

Ribs
Full Round Fillets
Thin Features

THEME 2: Essentials on assembly designing

Fundamentals on Assemblies
Advanced Mate Techniques
Top-Down Assembly Modeling
Assembly Features, Smart Fasteners, and Smart Components
Using Configurations with Assemblies
Display States and Appearances
Assembly Editing
Layout-based Assembly Design
Large Assemblies

THEME 3: Dynamical and kinematic behaviour of systems with Solidworks

**Unit 1: Introduction to user interface**

Constraint mapping concepts
Action only forces and moments
Action/Reaction forces and moments
Motion drivers
Building models for kinematic analysis
Create displacement, velocity, acceleration and force graphics
Translatory and torsional springs
Translatory and torsional dampers
3D Contact to simulate realistic interaction between parts
Impact forces
Using Function builder and Expressions to build complex motions and forces
Flexible connectors - Bushings

**Unit 2: Advance topics**

Kinematic and Dynamic analysis
Redundancies - Importance and how to avoid/solve them
Export of results to SolidWorks Simulation (stress analysis)

## TRAINING METHODOLOGY

**Subject methodological aspects**

Both In-class and distance teaching are developed to imply the students within the learning activities. The subjects are developed to keep the student attention and following the competencies acquisition by the students. Student activities are key factors to develop this course.

**In-class methodology: Activities**

1. **Life presentations.** The teacher will explain basic concepts for every theme showing the more important aspects. Examples will be presented, discussed and solved to complete the understanding.
2. **In class case discussion and problem solving.** Students will discuss the cases and problems proposed by the teacher. Cases will be open challenges that can be analyzed and solved by the use of the concepts already presented in class.

**Distance Methodology: Activities**

1. **Self-learning** on the concepts presented in class. Material to be used are slides,

multimedia files, personal and teacher notes, recommended books and magazines.

2. **Cases study**. To be revised and updated with the rest of information given in the subject.

Main target of the distance Works is to be able to understand theoretical concepts and to be able to apply them.

| STUDENT SCHEDULE SUMMARY (Hours) | | | |
|---|---|---|---|
| LIVE | | | |
| **Teacher Lessons** | **Case discussion** | **Evaluation** | |
| 8 | 20 | 2 | |
| DISTANCE | | | |
| **Self study on theory** | **Self work on cases** | **Prepare for Examination** | |
| 8 | 50 | 2 | |
| | | **ECTS:** | **3 (90 hours)** |

## EVALUATION AND SCORING CRITERIA

| Evaluation activities | Criteria | Weight |
|---|---|---|
| Tests::<br>• Mid term exam.<br>• End of term exam | - Concepts understanding.<br>- Use of concepts to solve real cases.<br>- Problem solving solution analysis and results interpretation.<br>- Presentation. | 60% |
| Continuous evaluation.:<br>• Case solving | - Concepts understanding.<br>- Concepts use to solve real cases. | 40% |

## Scoring.

| Scoring |
|---|
| The grade will be determined by midterm (15%), homework (10%), continuos evaluation (30%), and a final examination (45%). The exams are all closed notebook, closed textbook and no calculator. The course will not be graded on a curve, i.e., there is no bound on the numbers of A's, B's, C's etc. |

## WORKING SCHEDULE

| Distance Activities | Do Date | Delivery date |
|---|---|---|
| • Reading of multimedia files to be showed in class (Slides) | Before lesson | |
| • Study on the slides showed in class. | After lesson | |
| • Study with additional information coming from other sources: Hand written notes, books, etc. | After lesson | |
| • Case solving | In class | |
| • Solved problema understanding. | In class | |
| • Presentation, cases, problems preparation as part of continuous scoring. | After lesson | |
| • Mid-term and final exam preparation. | February and May | |

## BIBLIOGRAFÍA Y RECURSOS

| Bibliography |
|---|
| • Resource Center at Dassault Systemes web. |