Course guide
820060 - VD - Design Validation

Last modified: 02/10/2025

Unit in charge: Barcelona East School of Engineering
Teaching unit: 717 - DEGD - Department of Engineering Graphics and Design.

Degree: BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** Spanish

LECTURER

Coordinating lecturer:

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Model and simulate systems.
2. Understand and apply materials engineering techniques.
3. Understand the basics behind the use and programming of PCs, operating systems, databases and software with applications in engineering.
4. Understand and apply graphic engineering techniques.

Transversal:
5. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.
6. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

TEACHING METHODOLOGY

The course uses the methodology exhibition by 50%, individual work by 30%, work in groups by 20%.
Computation of total project-based learning represents 25%.

LEARNING OBJECTIVES OF THE SUBJECT

Ability to verify the design of parts and mechanisms through simulation techniques SolidWorks.
Knowledge of SolidWorks Simulation components for practical work and projects.
Ability to use motion simulation techniques for time and events, as well as simulation techniques using Finite Element Analysis.
Ability to use the Motion Simulation and Animation parameters for acceleration, speed and strength.
Ability to use techniques Static Finite Element Analysis.

STUDY LOAD

Type	Hours	Percentage
Guided activities	15,0	10.00
Hours small group	45,0	30.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

Kinematic and dynamic analysis of mechanisms.

Description:
It in-depth study and practice the techniques of motion simulation of mechanisms by SolidWorks Motion.

Specific objectives:
Topic1- Speeds, accelerations, forces, rigid contacts, friction, damping.
· Use the range of motion of an assembly to generate animations
· Use SW Motion to simulate the operation of a manual mechanism and determine the required torque.
· Build models to simulate kinematics.
· Create local relations to a study of movement.
· Create and modify diagrams of results (post-processing)
· Check the interference of the components.
· Apply Contact the components.
· Specify Contacts Friction of solid bodies.
· Add springs with damping assembly.

Topic2- Contacts advanced, cams, flexible joints. Using expressions to prescribe magnitudes.
· Understand the definition and description of contacts
· Learn about the flexible connections "sockets" (bushings) vs. rigid.
· Create the path that a point for the profile of a cam.
· Use expressions for forces and motors
· Use a spline to control the motor

Topic3- Study of redundancies, based on simulation events Export to Finite Element Analysis.
· Understand the redundancies and how they affect the simulation.
· Use flexible relations to automatically eliminate redundancies in a mechanism.
· Assign the stiffness of each relationship individually.
· Know how to build assemblies without redundancies.
· Understand the event-based simulation.
· Applying Servo Motors.
· Create events with timing and specific logic.
· Define a Single Moment of Action.
· Export loads from SW to SW Motion Simulation.
· Perform a structural analysis in SW Simulation.

Full-or-part-time: 50h
Theory classes: 5h
Laboratory classes: 10h
Self study (distance learning): 16h 40m
Group work (distance learning): 13h 20m
Guided activities: 5h

Simulation of the static structural behavior of parts and assemblies.

Description:
As an application of the results obtained by simulation techniques of movement, is made a basic study of the static structural simulation techniques of SolidWorks Simulation.

Specific objectives:
Topic 1 - Basic study, environmental conditions.
· Run a linear static analysis with solid elements.
· Understand the influence of mesh density on the results of stresses and displacements.
· Use various methods to present the results of FEA.

Topic 2 - Sets and mesh refinement.
· To illustrate the differences between modeling errors and individualization.
· Use the control mesh.
· Understand stress concentrations.
· Perform simple structural assemblies.

Topic 3 - Adaptive meshing.
· Analyze assemblies with different connectors and contact conditions.
· Apply and define contact conditions.
· Understand the mesh compatibility with different contact conditions.

Full-or-part-time: 50h
Theory classes: 5h
Laboratory classes: 10h
Self study (distance learning): 16h 40m
Group work (distance learning): 13h 20m
Guided activities: 5h

Definition and validation of design on a real project.

Description:
Based on project designed, depending on their characteristics, each group of students can perform the tasks required to achieve the objectives:

Specific objectives:
· Describe the parameters that you want to verify and validate.
· Make decisions about which elements are important for the simulation.
· Simplify the Assemblies to generate simulations that can be implemented and to obtain the desired values¿¿.
· Perform the simulation of movement, obtaining the animation and the values ¿¿of the parameters.
· Perform the simulation of loads on a piece critical of the values ¿¿obtained.

Full-or-part-time: 50h
Theory classes: 5h
Laboratory classes: 10h
Self study (distance learning): 16h 40m
Group work (distance learning): 13h 20m
Guided activities: 5h

Flow Simulation

Description:
It in-depth study and practice the techniques of flow simulation by SolidWorks Flow Simulation.

Specific objectives:
Practicing the techniques of flow simulation by SolidWorks Flow Simulation.

Related activities:
Topic1- Stages in the process
- Model preparation.
- Internal flow analysis
- External flow analysis.
- Manifold analysis
- Lids
- Checking the geometry
- Project wizard
- Computational domain
- Post-processing

Topic2- Meshing
- Computational mesh
- Geometry resolution (minimun gap size, wall thickness, Mesh settings).
Topic3- Thermal analysis and external transient analysis
Topic4- Free surface
Topic5-Particle tracing
Topic6-Heat transfer, parametric study.

Related competencies :
CEMEC-25. Understand and apply materials engineering techniques.
CEEIA-25. Model and simulate systems.

Full-or-part-time: 4h
Theory classes: 3h
Guided activities: 1h

GRADING SYSTEM

Continuous evaluation of the student's work for the three parts of the course: Motion (kinematics and dynamics), Simulation (mechanical and thermal behaviour) and CFD (Fluidic behaviour).
The evaluation is based on the delivery of the problems posed in class (lessons), the individual work (Exercises) and group work (Team work) carried out in non-class hours and the final project with ABP methodology (Project Based Learning). For each of the parts there will be an exam.

Motion Simulation CFD
Lessons (10%) 10% 10% 10%
Exercises (30%) 30% 30% 30%
Team work (20%) 20% 20% 20%
Examen (40%) 40% 40% 40%

The final grade of the course: Motion (25%), Simulation (35%), CFD (15%) and ABP group project (25%).
The evaluation is continuous. No reassessment test is contemplated.

BIBLIOGRAPHY

Basic:
- Dassault Systèmes SolidWorks Corporation. Manual SolidWorks motion: SW 2020. Massachusetts: Dassault Systèmes SolidWorks Corporation, 2020.
- Dassault Systèmes SolidWorks Corporation. Manual SolidWorks simulation : SW 2020. Massachusetts: Dassault Systèmes SolidWorks Corporation, 2020.
- Dassault Systèmes SolidWorks Corporation. Manual SolidWorks simulation professional : SW 2020. Massacgusetts: [Dassault Systèmes SolidWorks Corporation], [2020].
- Dassault Systèmes SolidWorks Corporation. Manual SolidWorks Flow: SW 2020. Massachusetts: Dassault Systèmes SolidWorks Corporation, 2020.

Complementary:
- Dassault Systèmes SolidWorks Corporation. Manual SolidWorks simulation premium : nonlinear SW 2020. [s.l.]: [Dassault Systèmes SolidWorks Corporation], [2020].
- Dassault Systèmes SolidWorks Corporation. Manual SolidWorks simulation premium : dynamics SW 2020. [s.l.]: [Dassault Systèmes SolidWorks Corporation], [2020].