Curricular Unit Form (FUC)

Course:	**FIRST CYCLE IN MECHANICAL ENGINEERING**					
Curricular Unit (UC)	**Computer Aided Engineering (CAE)**			Mandatory		
				Optional	**X**	
Scientific Area:	**Mechanical Project, Manufacturing and Industrial Maintenance**					
Year: **2**	Semester: 1	ECTS: **5**		Total Hours: **135**		
Contact Hours:	T:	TP:**45**	PL:	S:	OT:	TT:
Professor in charge		Academic Degree /Title		Position		
João Milho		**Doutor**		**Prof. Adjunto**		

T- Theoretical ; TP – Theory and practice ; PL – Laboratory ; S – Seminar ; OT –Tutorial ; TT – Total of contact hours

Entry into Force	Semester: **Winter**	Academic Year: **2016/2017**

Objectives of the curricular unit and competences (max. 1000 characters)

The aim of this course is to convey to the students a set of knowledge in Computer Aided Engineering (CAE) applied to product development in virtual environment.

The aim is to develop skills in modelling, simulation, motion analysis, structural analysis and optimization of product using commercial software of Multibody Systems, Finite Element Analysis and optimization.

Syllabus (max. 1000 characters)

1. Introduction to Computer Aided Engineering
-Virtual environment for product development
- CAD/CAE integrated modeling

2. Motion analysis
-Multibody Systems (MBS)
-Modelling, simulation and computational analysis
-Verification and validation

3. Structural analysis
-Finite Element Method (FEM)
-Modelling, simulation and computational analysis
-Verification and validation

4. Optimization
-Optimisation Methodologies
-Integrated optimization with motion analysis and structural analysis

Demonstration of the syllabus coherence with curricular unit's objectives (max. 1000 characters)

The fundamental concepts of UC are introduced in class, based in real mechanical and structural systems. It is intended that the students understand the physics of the problems and that they can reproduce them as faithfully as possible in computer models to be developed.

The sequence of syllabus leads the student to understand, in a first phase, the framework for computer aided engineering product development. In a next phase, the student understands and applies as project tools, the methodologies of multibody systems in motion analysis and the finite element method in structural analysis. The concepts of verification and validation needed to define the confidence of the computer models are also introduced at this stage. Finally, optimisation concepts are introduced and the student has the opportunity to apply them as an integrated project tool in the motion analysis and structural analysis.

Teaching methodologies (including evaluation) (max. 1000 characters)

The teaching methodology of UC is accomplished through theory and practice lessons. The classes work with slideshow presentations, which includes expositions on each theme, followed by practical examples, where the student intends to consolidate the concepts taught. The student applies knowledge gained and doubts that may arise are clarified. In order to assess the knowledge acquired and stimulate the written and verbal communication, two practical assignments pedagogically fundamental are performed with use of commercial software and their reports submitted. The two practical assignments can be integrated and replaced by a single practical assignments. The final grade is determined by the weighted average of the assignments.

Demonstration of the teaching methodologies coherence with the curricular unit's objectives (max. 3000 characters)

For the teaching methodologies, different lecturing strategies are used that make it possible to achieve the objectives of the UC. The concepts to be transmitted on each theme are taught at theory and practice lessons through slideshow presentations. Practical application examples are included and made available through the Moodle learning platform, with the aim of facilitating the student's consolidation of the concepts taught. It is also encouraged a greater motivation of the students by applying real mechanical and structural systems. The presentation of questions and issues on the part of students is encouraged, these being clarified with the participation of the whole class.

The assessment of UC is carried out through the realization of practical assignments pedagogically fundamental, including written report and oral presentation. The aim is thus to assess the knowledge gained on the fundamental concepts associated with the syllabus, as well as the use of commercial software as design and product development tools.

Main Bibliography (max. 1000 characters)

e-Design: Computer-Aided Engineering Design, Kuang-Hua Chang, Academic Press, 1 edition, 2015.

Manuais dos softwares (Software User Manuals): Solidworks Motion, SolidWorks Simulation, Ansys, LS-Dyna, Siemens NX, …

Motion Simulation and Mechanism Design with SolidWorks Motion 2013, Kuang-Hua Chang Ph. D., SDC Publications, 2014.

Analysis of Machine Elements Using SOLIDWORKS Simulation 2016, Shahin S. Nudehi Ph.D., John R. Steffen Ph.D., P.E., SDC Publications, 2016.

Finite Element Simulations with ANSYS Workbench 16, Huei-Huang Lee, SDC Publications, 2015.