ISEL
ADEM
Área Departamental de Engenharia Mecânica

Curricular Unit Form (FUC)

Course:	**FIRST CYCLE IN MECHANICAL ENGINEERING**					
Curricular Unit (UC)	**Biomechanics and Ergonomics**			Mandatory		
				Optional	**X**	
Scientific Area:	**Mechanical Project, Manufacturing and Industrial Maintenance**					
Year: **3**	Semester: **5**	ECTS: 4		Total Hours: **108**		
Contact Hours:	T:	TP:**45**	PL:	S:	OT:	TT:
Professor in charge		Academic Degree /Title		Position		
Inês de Carvalho Jerónimo Barbosa		**PhD**		**Assistant Professor**		

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

Entry into force: 2017/2018	Semester: **Winter**	Academic Year: **2017/2018**

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

The aim of the curricular unit of Biomechanics and Ergonomics is to convey to the students a set of knowledge and methodologies with which they are allowed to analyse the movement of biomechanical systems, in particular of the human body.

The knowledge and methodologies are based on the theory of Classical Mechanics, in the experimental measurement of the movement kinematics and dynamics and computer simulation as a tool in support of the clinical diagnosis and the detection of wrong postural positions or movements.

It is intended to develop skills of qualitative and quantitative analysis of human movement, anthropometric characteristics, kinematics and dynamics characterization of movement and modelling, simulation and computational analysis of biomechanical systems. It is also intended to develop skills in the study of ergonomics by applying the information obtained by biomechanical analysis and the regulation applied to the action in study.

Syllabus (max. 1000 characters)

1-Biomechanics of human movement

Biomechanical models. Qualitative and quantitative analysis.

2-Anthropometry

Density, mass and inertial properties. Direct experimental measurement. Muscle anthropometry.

3-Kinematics

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Conventions. Direct and imaging measurement technique. Kinematic data processing. Calculation of kinematic variables. 4-Dynamics Dynamic equilibrium equations. Force measurement techniques. Calculation of joint efforts. 5-Computer simulation Computational simulation tools. Modelling, simulation and analysis of biomechanical systems. 6-Ergonomics Concept of Ergonomics. Ergonomic analysis of an activity. 7-Ergonomics in the workplace. Regulatory rules. Job injury identification. Ergonomic analysis applied to the workplace.

Demonstration of the syllabus coherence with curricular unit's objectives (max. 1000 characters)
The fundamental concepts of the syllabus are introduced in class and are based on real biomechanical systems (in particular the human body), allowing students to perceive both the qualitative aspects and quantitative aspects of human movement analysis and of ergonomics, consistent with the objectives of the curricular unit.

Teaching methodologies (including evaluation) (max. 1000 characters)
The teaching will be carried out through theoretical and practical lessons. It is intended that by reading the bibliography the student is introduced to each topic to discuss. More theoretical classes work with brief presentations on each theme, followed by practical examples, where the student is intended to consolidate the concepts studied. Theoretical and practical classes will be based on the resolution of exercises where students apply the knowledge acquired. In more complex cases or with greater graphics or mathematical demands will be made use of symbolic computation programs and computer simulation tools. The knowledge assessment is carried out in continuous assessment or final exam. The continuous assessment evaluation consists of a written test (70%) and a set of computational/laboratory work (30%).

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Demonstration of the teaching methodologies coherence with the curricular unit's objectives (max. 3000 characters)
On the teaching methodologies are used different methodologies that make it possible to achieve the objectives of the curricular unit. Depending on the characteristics of the concepts to transmitted, Theoretical and practical classes are used, which constitute a set to be harmonious, in order to enable students to understand the fundamental concepts associated with the syllabus. In theoretical and practical classes the potential of new multimedia systems, symbolic computation software and computational simulation is used.

Main Bibliography (max. 1000 characters)
Winter D., "Biomechanics and Motor Control of Human Movement", Wiley, 4th edition, 2009. **Özkaya, N., Nordin, M., Goldsheyder, D., Leger, D., "Fundamentals of Biomechanics - Equilibrium, Motion, and Deformation", Springer, 3rd edition, 2012.** **Hall, S.,"Basic Biomechanics", McGraw-Hill,7th edition, 2015.** **Bridger R., "Introduction to Ergonomics", CRC Press, 3rd Edition, 2008.** **Pheasant, S., Haslegrave, C.M., "Bodyspace: Anthropometry, Ergonomics and the Design of Work", CRC Press, 3rd Edition, 2005.** **Kurowski, P., "Engineering Analysis with SolidWorks Simulation 2014", SDC Publications, 2014.** **Chang, KH, "Motion Simulation and Mechanism Design with SolidWorks Motion 2013", SDC Publications, 2013.**