Curricular Unit Form (FUC)

Course:	**FIRST CYCLE IN MECHANICAL ENGINEERING**					
Curricular Unit (UC)	**Electrical Machines Fundamentals**			Mandatory	**X**	
				Optional		
Scientific Area:	**Control Systems**					
Year: **2º**	Semester:	ECTS: **4,0**		Total Hours: **3,0**		
Contact Hours:	T: **22,5**	TP: **22,5**	PL:	S:	OT:	TT:
Professor in charge		Academic Degree /Title		Position		
Nuno Paulo Ferreira Henriques		**Mestre**		**Professor Coordenador**		

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

Entry into Force	Semester: **Winter**	Academic Year: **2010/2011**

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

To provide students with a solid set of basic knowledge enabling them to understand the phenomenon of electromechanical energy conversion and the basic operation of electrical machines most used in industry. It is intended that students know the electrical machines from the user's viewpoint and can analyze their behaviour and operation based on their equivalent circuits.
Students should acquire basic skills that enable them:

- to identify the importance of electrical machines;
- to recognize and compare the different types of electrical machines;
- to understand the function modes, equivalent circuits and constructional characteristics of electrical machines;
- to use the equivalent circuits to analyse their behaviour in several steady state function modes;
- to evaluate comparative advantages of the different types of electrical machines;
- to select the most adequate electrical machines for different applications and working conditions.

Syllabus (max. 1000 characters)

Transformer: Power transformer (1-phase and 3-phase), construction themes, operation principles, off-load and load operation. 3-phase transformer connections and vector groups. Losses and efficiency. Auto-transformer.
Asynchronous Machines: Construction themes, operation principles, rotation field, slip, speed, torque. 1-phase and 3-phase motor operation. Starting and braking systems. Speed regulation.
DC Machines: Construction themes. Reversibility. Operation as motor and as generator. Operation principles, characteristics and applications. Starting and speed regulation.
Synchronous Machines: Construction themes. Synchronising. Operation as motor and as generator.
Special Electric Motors: Universal, linear and step motors
Use of electrical machines: Applications in generation systems and power transmission. Applications in drive systems. Faults and maintenance.

Demonstration of the syllabus coherence with curricular unit's objectives (max. 1000 characters)
Each basic skill that should be acquired by students is directly linked with each course main theme. Skills could be acquired by lectures and practical classes assistance and by the execution of a set of pedagogically fundamental activities for continuous evaluation done in the lab, each one related with one course main theme.

Teaching methodologies (including evaluation) (max. 1000 characters)
The course teaching is based on lectures, practical classes and lab work. Students are motivated to take an active approach on search of basic information, on solving practical problems and to prepare the laboratory work. It is also required a proper attitude in the laboratory, in compliance with the safety rules, equipment handling rules and test procedures. In order to successfully complete the course, students must succeed the following tests: – a final examination (60%) allowing to evaluate if the necessary knowledge about course themes was acquired; – a set of pedagogically fundamental activities for continuous evaluation (40%), consisting on lab sessions work and the elaboration and discussion of reports describing the tests and their results. The continuous evaluation and final examination are compulsory.

Demonstration of the teaching methodologies coherence with the curricular unit's objectives (max. 3000 characters)
Lectures are oriented to discussion and exposure of the syllabus and practical classes are used for the analysis and resolution of practical problems, allowing students to acquire the expertise needed about electromechanical power conversion and basic function of electrical machines and to enable them to select and use electrical machines in several industrial applications. The laboratory work, carried out in small groups, enable students to develop skills in the practice of testing electrical machines, including the simulation of faults and malfunctions. The continuous evaluation depends on the individual performance along the lab work, taking also into account the communications skills – oral while answering questions during the work or written on the report.

Main Bibliography (max. 1000 characters)
– Luis F. Hogan Teves, *Máquinas Eléctricas,* Edição do autor, 2003 – Stephen J. Chapman, *Electric Machinery and Power Systems Fundamentals*, McGraw-Hill, 2002 – Theodore Wildi, *Electrical Machines, Drives and Power Systems,* Prentice-Hall, 2002 – David Bradley, *Basic Electrical Power and Machines,* Chapman & Hall, London, 1994 – Bhag S. Guru & Huseyin R. Hiziroglu, *Electric Machinery and Transformers,* Oxford University Press, 2001 – José V. C. Matias, *Máquinas Eléctricas – Transformadores,* Didáctica Editora, 2005 – José V. C. Matias, *Máquinas Eléctricas – Corrente Alternada,* Didáctica Editora, 2005 – José V. C. Matias, *Máquinas Eléctricas – Corrente Contínua,* Didáctica Editora, 2005