Curricular Unit Form (FUC)

Course:	**FIRST CYCLE IN MECHANICAL ENGINEERING**					
Curricular Unit (UC)	**Automation of Industrial Processes**			Mandatory	**X**	
				Optional		
Scientific Area:	**Energy and Control Systems**					
Year: **3º**	Semester: **2º**	ECTS:**4,0**		Total Hours: **3,0**		
Contact Hours:	T:	TP:**45,0**	PL:	S:	OT:	TT:
Professor in charge		Academic Degree /Title		Position		
Mário José G. Cavaco Mendes		**PhD**		**Assistant Professor**		

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)

- To acquire knowledge about production of industrial compressed air.
- To acquire logical reasoning in order to conceive automatic logical systems; To know different methodologies for designing automated systems;
- To build pneumatic and electropneumatic processes using wired and programmed systems;
- The student should be able to control several pneumatic processes using the Sequential Method.
- To gain knowledge, characterize and program (in several programming languages) programmable logic controllers;
- To know the importance of industrial supervision, remote monitoring and how to program a simple synoptic supervision mask.
- It is intended that the student acquires the necessary skills to write a report with a correct and scientific treatment of experimental data.

Syllabus (max. 1000 characters)

Production of industrial compressed air. Pneumatic physical principles. Compression methods: volumetric and dynamic; Types of volumetric compressors.

Introduction to Industrial Automation. Wired versus Programming Automation. Logical and sequential control.

Boolean algebra: Basic Logic Function. Special Function. Truth Table. Boole Theorems. Morgan Laws. Functions simplification using analytic method. Functions simplification using matrix method – Karnaugh Maps.

Pneumatic Automation: Sequential Method - Models: Physical, Mathematical and Technological. Diagram of Movements and the Possibility Table; Incompatibility, Memory and Timer Concept; Combinatorial and sequential systems; Implementation in Standard Symbolic DIN ISO 1219; Practice

in pneumatic simulators.

Programming Automation: Programmable Logic Controllers (PLC's) - Compacts and Modular's; Characterization: Architecture, Inputs, Outputs, Bus, Communication, Memory Types, Cycle time, Timers and Counters. PLC Programming Languages: Ladder Diagram; Function Block Diagram; Statement List; Basic and Special functions programming;

Human Machine Interfaces. Supervision Systems. Industrial Automation projects. Digital Factories.

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

The curricular unit objectives are achieved by making an oral presentation and practice of the syllabus, with main emphasis on the concepts, methods and techniques for analysis. The acquisition of logical reasoning and the development of practical laboratory work in group allow students to acquire theoretical and practical skills in wired and programmed automation, as well as study visits to manufacturing industries allow a more effective acquisition of skills, allowing students to check the real implementation of the concepts and techniques learned during the semester. With the syllabus of this curricular unit the students will be able to automate any industrial process either via wired either via programmed using logic programmable controllers.

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

The curricular unit teaching is done with theoretical and practical classes using oral matter exposition and solving practical problems. Often the students use the laboratory equipment to solve practical application exercises.

The evaluation is done with one final examination (theoretical plus practical) and a practical component in the laboratory which includes practical works with reports.

Final grade: 70% Theory + 30% Lab

Demonstration of the teaching methodologies coherence with the curricular unit's objectives (max. 1000 characters)
The curricular unit teaching is done with theoretical and practical classes and with other practical laboratories classes using several laboratory modules. Students use pneumatic and electro pneumatic components as well as informatics tools and programmable logic controllers to develop laboratory works in groups, and even submit written reports of the performed work. Apart from oral and practical exposition, application examples are given and the students are stimulated to participate and discuss the issues. Students are always encouraged to previous study and to analyze the matters to be addressed soon. A final exam assesses individual theoretical and practical skills acquisition and the study visits help in the understanding and acquisition of skills in the field of industrial automation.

Main Bibliography (max. 1000 characters)
• J. M. A. Novais, "*Método Sequencial para Automatização Electropneumática***"**, Lisboa, Fundação Calouste Gulbenkian, 1991. • J. M. A. Novais, "*Ar Comprimido Industrial – Produção, Tratamento e Distribuição*", Lisboa, Fundação Calouste Gulbenkian, 1995. • A. Francisco, "*Autómatos Programáveis (Programação, GRAFCET, Aplicações)*", 4ª Edição, Lidel, 2007. • J. N. Pires, "*Automação Industrial*", 3ª Edição, Lidel, 2007. • J. R. C. Pinto, "*Técnicas de Automação*", Lidel, Lisboa, 2004. • P. Oliveira, "Curso de Automação Industrial", ETEP, LIDEL, 2008 • J. M. A. Novais, "*Programação de Autómatos – Método GRAFCET*", Lisboa, Fundação Calouste Gulbenkian, 1992.