ISEL
INSTITUTO SUPERIOR DE ENGENHARIA DE LISBOA

ISEL ADEM
Área Departamental de Engenharia Mecânica

Sheet course ()

Course	MSc IN MECHANICAL ENGINEERING		
Unit	Programmable Logic Controllers	Mandatory	☐
		Optional	☒
Unit scientific area	Control Systems	Category	C

Unit category: B - Basic; C - Core Engineering; E - Specialization; P - Complementary.

Year: 1st	Semester: 2nd		ECTS: 5,0			
Contact time	Total:	T:	TP: 45,0	PL:	S:	OT:

T - Lectures; TP - Theory and practice; PL - Lab Work; S - Seminar; OT - Tutorial Guidance.

Unit Director	**Title**	**Position**
Mário José G. Cavaco Mendes	Ph.D.	Associate Professor

Learning Objectives (knowledge, skills and competences to be developed by students) (max. 1000 characters)
To acquire and to deepen the PLC's knowledge; To acquire and to deepen the knowledge in PLC programming languages; To practice on the PLC's, didactic simulators and laboratory process; To acquire knowledge in fieldbus and other industrial networks; To develop control and supervision applications to industrial processes.

Syllabus (max. 1000 characters)
1. INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLERS (PLC's) AND EXAMPLES OF APPLICATION:PLC's characteristics and classification. Maintenance of PLC's. 2. LINEAR PROGRAMMING OF PLC's. Revisions of programming languages: List of instructions (STL); Ladder Diagram (LAD); Functional Blocks (FBD); 3. STRUCTURED PROGRAMMING OF PLC's: With Ladder Diagram - LAD; With Functional Blocks - FBD; With GRAFCET – Step/Transition Command Graph: Sequential GRAFCET, Alternative and Simultaneous; Processing of analogical variables. Processing of interruptions and errors. Programming of PLC's with high level languages.

4. DISTRIBUTED SYSTEMS AND INDUSTRIAL NETWORKS: Distributed systems. Field Networks. Multi-point nerwork - MPI. Industrial Ethernet network. PROFIBUS network. PROFIBUS-DP network. Network Programming of PLC's.

5. SUPERVISION OF INDUSTRIAL PROCESSES: Monitoring programming applications. Fault diagnosis in PLC's.

Demonstration of consistency of the syllabus with the objectives of the course

(max. 1000 characters)

The curricular unit objectives are achieved by making an oral and practical presentation of the syllabus, with main emphasis on the concepts, methods and programming languages for logic programmable controllers. The programming projects applied to laboratory scale models allows acquiring theoretical and practical skills in programmed automation. With the syllabus of this curricular unit a student will be able to automate any industrial process using logic programmable controllers. The concepts of industrial networks and monitoring systems are introduced with practical examples.

Teaching methodology (evaluation included)

(max. 1000 characters)

Teaching methodologies

Exposition;

Demonstration;

Activities.

Assessment

1 theoretical/practical exam, classified between 0 and 20 points, and whose weight is 50% of the final grade;

1 practical work, classified between 0 and 20 points, and whose weight is 50% of the final grade;

Final grade = 50% Theoretical/practical Exam + 50 % practical work;

The students should have a minimum grade of 9,5 points in the theoretical/practical exam and practical work.

Demonstration of consistency of teaching methods with the learning objectives of the course (max. 3000 characters)
The curricular unit teaching is done with theoretical and practical classes with other practical laboratory classes using several modules with PCs and logic programmable controllers. Students use scaled industrial processes and electropneumatic components, as well as informatics tools and logic programmable controllers to develop a programming project in group; also they have to submit written reports of the project developed and presentation of the work to the teacher. 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.

Main Bibliography (max. 1000 characters)
Francisco, A., Autómatos Programáveis (Programação, GRAFCET, Aplicações), 4ª Edição, Lidel, 2007; Novais, J. M. A., Programação de Autómatos – Método GRAFCET, 3ª Edição, Fundação Calouste Gulbenkian, 1992; Bolton W., Programmable Logic Controllers, 4ª Edição, Elsevier Newnes, 2006; Caro, D., Automation Network Selection, ISA, 2004. Weigmann, J. e Kilian, G., Decentralization with profibus-dp: architecture and fundamentals, configuration and use with SIMATIC S7, Verlag : Publicis MCD, 2000. Pinto, J. R. C., Técnicas de Automação, Lidel, 2004; Pires, J. Norberto., Automação Industrial, Lidel, 2002;