SUBJECT TEACHING GUIDE

G831 - Instrumentation and Process Control Electronics

Degree in Telecommunication Technologies Engineering

Academic year 2022-2023

1. IDENTIFYING DATA					
Degree	Degree in Telecommunication Technologies Engineering			Type and Year	Optional. Year 3
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Applied Electronics				
Course unit title and code	G831 - Instrumentation and Process Control Electronics				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERÍA INFORMÁTICA Y ELECTRÓNICA
Name of lecturer	M. MERCEDES GRANDA MIGUEL
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Office	Facultad de Ciencias. Planta: + 3. DESPACHO DE PROFESORES (3060)
Other lecturers	MARIA ELENA MEDIAVILLA BOLADO MARIA SANDRA ROBLA GOMEZ LUIS GARCIA RODRIGUEZ

3.1 LEARNING OUTCOMES

- Know and apply electronic technologies for analysis and design of devices, subsystems and electronics systems: instrumentation and measurement systems and control systems.

4. OBJECTIVES

The course, with a strong practical orientation, aims to introduce students into electronic measurement and control systems. The objectives are oriented in four directions:
- Study the components, architectures and standards of electronic measurement systems. Analyze and design electronic circuits used in electronic instrumentation and interconnect these circuits to build electronic measurement systems.
- The student must be able to use the data sheets of electronic circuits to extract and interpret data provided by manufacturers and know how they affect the real behavior of electronic systems.
- The student will be able to characterize the measurement and measure skillfully using laboratory electronic instrumentation, both manually and programming instruments with a computer, and know how to evaluate the effects that the interference and real characteristics of the equipment produce on measurement processes.
- Introduce students into the basic tools of analysis and design of dynamic control systems. The analysis and design methods are developed in the time domain and frequency domain.

6. COURSE ORGANIZATION

CONTENTS	
1	FIRST PART: ELECTRONIC INSTRUMENTATION
1.1	CHAPTER 1. INTRODUCTION TO ELECTRONIC INSTRUMENTATION AND MEASUREMENT TECHNIQUES. Components and architecture of electronic measurement systems. Instrumentation systems regulations. Digital measurement systems. Virtual instrumentation. Static, dynamic and input characteristics of instrumentation systems. Errors and characterization of the measure.
1.2	CHAPTER 2. SIGNAL CONDITIONING. Noise and interference. Instrumentation amplifiers. Analog filters.
1.3	CHAPTER 3. Transducers. Temperature transducers. Force transducers. Position transducers.
2	SECOND PART: ELECTRONIC CONTROL
2.1	CHAPTER 4: INTRODUCTION TO CONTROL SYSTEMS. Introduction. General concepts. Application of the Laplace transform. Mathematical models of physical systems. Transfer function. Linearization of nonlinear models. Block diagrams. Multivariable systems.
2.2	CHAPTER 5: ANALYSIS OF CONTROL SYSTEMS Time response. Dynamic and steady-state behavior. Errors. Type and static accuracy of a system. Response of first and second order systems. Higher order systems. Stability concept. Methods to determine stability. Routh-Hurwitz method. Basic control actions: proportional, derivative and integral control. Tuning PID for process control.
2.3	CHAPTER 6: ROOT LOCUS AND FREQUENCY RESPONSE. Root locus. Modular and angular conditions. Construction of the root locus. Calculation of regulators by the method of root locus. Bode diagram. Amplitude and phase margins. Relationship between frequency response and transient response. Lead and lag phase compensation networks.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
THEORY EXAM OF THE FIRST PART	Written exam	No	Yes	30,00
THEORY EXAM OF THE SECOND PART	Written exam	No	Yes	30,00
LABORATORY PRACTICES EXAM OF THE SECOND PART	Laboratory evaluation	No	Yes	20,00
LABORATORY PRACTICES CONTINUOUS ASSESSMENT OF THE FIRST PART	Laboratory evaluation	No	Yes	20,00
TOTAL				100,00

Observations

The course consists of two parts that are evaluated separately. The first part of the course consists of theory and practices of chapters 1, 2 and 3 and the second part includes the theory and practices of chaptes 4, 5 and 6. Each of these two parts will contribute a 50% of the final mark. To pass the course is necessary to obtain a weighted average mark equal to or greater than 5 (see details in assessment methods).

If the subject has not been fully passed with the continous evaluation activities, the student can retake it in the final examinations taking only the non-passed part, both in the ordinary and extraordinary exams.

Finals exams of the theory of each part of the course will consist of a written test in which the students will have to resolve issues and problems.

The laboratory practices are mandatory, and non-recoverable. Exceptionally, a laboratory final exam will be held for those students who need it and who have regularly attended (70%) laboratory and classroom practical sessions and who have completed at least 70% of practical work. This final exam will consist in a practical laboratory development for the full syllabus of the first or second part of the course (as appropriate), to be take in the laboratory. The final mark of the practices will be 50% of the final exam laboratory plus 50% of the mark of the continuous evaluation of practices.

Remote evaluation of work, practical laboratory exercises and written tests is envisaged in the event that a new health alert by COVID-19 makes it impossible to carry out the assessment in person. Under this circumstance, any of the exams or practices may be replaced by alternative work or other methods of evaluation.

Observations for part-time students

Part-time students will be governed by the same rules as full-time students.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

GRANDA M. y MEDIAVILLA E., Instrumentación Electrónica: Transductores y Acondicionadores de señal. PUbliCan, Ediciones de la Universidad de Cantabria, Santander, 2010.

PÉREZ ORIA, J.M., Sistemas Continuos de Control. TGD 1992

LLATA J.R., GLEZ. SARABIA E., FDEZ. PÉREZ D., ARCE HERNANDO J. y PÉREZ ORIA J.M., Problemas de Ingeniería de Sistemas: Sistemas continuos. TGD 1999

LLATA J.R., PÉREZ ORIA J.M. y GLEZ. SARABIA E., Matlab y Simulink para Ingeniería de Sistemas. TGD 1999