Control Engineering I

Academic Year: (2023 / 2024) **Review date: 02/02/2024 13:06:27**

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: ESCALERA HUESO, ARTURO DE LA

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 2

LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CG1. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG3. Ability to design a system, component or process in the field of Industrial Technologies to meet the required specifications
CG9. Knowledge and ability to apply computational and experimental tools for the analysis and quantification of Industrial Engineering problems.
CG10. Ability to design and carry out experiments and to analyse and interpret the data obtained.
CG23. Knowledge of the fundamentals of automatisms and control methods.
ECRT6. Ability for the analysis, design, simulation and optimisation of processes and products.
ECRT9. Knowledge of automatic regulation and control techniques and their application to industrial automation.
RA1. Knowledge and understanding: Have basic knowledge and understanding of science, mathematics and engineering within the industrial field, as well as knowledge and understanding of Mechanics, Solid and Structural Mechanics, Thermal Engineering, Fluid Mechanics, Production Systems, Electronics and Automation, Industrial Organisation and Electrical Engineering.
RA2. Engineering Analysis: To be able to identify engineering problems within the industrial field, recognise specifications, establish different resolution methods and select the most appropriate one for their solution
RA5. Engineering Applications: To be able to apply their knowledge and understanding to solve problems and design devices or processes in the field of industrial engineering in accordance with criteria of cost, quality, safety, efficiency and respect for the environment.

OBJECTIVES

By the end of this content area, students will be able to have:
1. a systematic understanding of the key aspects and concepts of their branch of engineering in control engineering;
2. coherent knowledge of their branch of engineering including some at the forefront of the branch in control engineering;
3. the ability to apply their knowledge and understanding of control engineering to identify, formulate and solve engineering problems using established methods;
4. the ability to apply their knowledge and understanding to develop and realise designs to meet defined and specified requirements;
5. an understanding of design methodologies, and an ability to use them.
6. workshop and laboratory skills.
7. the ability to select and use appropriate equipment, tools and methods;
8. the ability to combine theory and practice to solve control engineering problems;
9. an understanding of applicable techniques and methods in control engineering, and of their

limitations;

DESCRIPTION OF CONTENTS: PROGRAMME

0- Introduction

1- Transformations.
- 1.1 Basic concepts
- 1.2 Fourier Transform
- 1.3 Laplace Transform.

2- Modelling of systems
- 2.1 Mathematical models
- 2.2 Linealization.
- 2.3 Transference function.
- 2.4 Diagram Blocks.
- 2.5 Mason

3- Temporary analysis of systems
- 3.1 The concept ofTemporal analysis
- 3.2 Response to the step signal
- 3.3 Equivalent systems
- 3.4 Routh-Hurwitz's Method
- 3.5 Influence of poles and zero.
- 3.6 Response to standard signals.
- 3.7 Systems of first and second order.
- 3.8 Root Locus.

4- Introduction to control systems
- 4.1 Architectures of control.
- 4.2 Precision.
- 4.3 Sensitivity to disturbances.
- 4.4 Temporary design of regulators PID.
- 4.5 Empirical adjustment of regulators PID.

5 - Frequential analysis of systems
- 5.1 Diagram of Bode.
- 5.2 Nyquist Diagram.
- 5.3 Frequential design of regulators PID.

LEARNING ACTIVITIES AND METHODOLOGY

- Skillful classes, classes of resolution of doubts in reduced groups, individual presentations of the students, individual tutorials and personal work of the student; oriented to the theoretical knowledge acquisition (3 credits ECTS).
- Practices of laboratory and individual classes of problems in reduced groups, individual tutorials and personal work of the student; oriented to the acquisition of practical abilities related to the program of the subject (3 credits ECTS).

ASSESSMENT SYSTEM

% end-of-term-examination/test:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

- Continuous evaluation (deliverables problems) 10%
- Compulsory Practices 10%
- 2 Midterms 15% and 15%
- Final exam 50%
- You will need to get at least a 4 on the final exam to pass the course.

BASIC BIBLIOGRAPHY

- Jacqueline Wilkie & Michael A. Johnson & Reza Katebi Control Engineering: An Introductory Course, Palgrave Macmillan, 2002

- K. Ogata Modern Control Engineering, Pearson-Prentice Hall, 2002

ADDITIONAL BIBLIOGRAPHY

- Farid Golnaraghi, Benjamin C. Kuo Automatic Control Systems, John Wiley & Sons, 2009

BASIC ELECTRONIC RESOURCES

- Eric Cheever . Linear Physical Systems Analysis: http://lpsa.swarthmore.edu/index.html

- Michigan U. and Carnegie Mellon . Control Tutorial for Matlab: http://ctms.engin.umich.edu/CTMS/index.php?aux=Home