Control Engineering

Academic Year: (2024 / 2025) **Review date: 17-04-2024**

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: MORENO LORENTE, LUIS ENRIQUE

Type: Compulsory ECTS Credits : 3.0

Year : 3 Semester :

SKILLS AND LEARNING OUTCOMES

RA3: Be able to carry out conceptual designs for bioengineering applications according to their level of knowledge and understanding, working in a team. Design encompasses devices, processes, protocols, strategies, objects and specifications broader than strictly technical, including social awareness, health and safety, environmental and commercial considerations.
RA4: Be able to use appropriate methods to carry out studies and solve problems in the biomedical field, commensurate with their level of knowledge. Research involves conducting literature searches, designing and carrying out experimental practices, interpreting data, selecting the best approach and communicating knowledge, ideas and solutions within their field of study. May require consultation of databases, safety standards and procedures.
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.
CB3: Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.
CB4: Students should be able to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.
CG2: Ability to design, draft and develop scientific-technical projects in the field of biomedical engineering.
CG4: Ability to solve problems with initiative, decision-making, creativity, and to communicate and transmit knowledge, skills and abilities, understanding the ethical, social and professional responsibility of the biomedical engineer's activity. Capacity for leadership, innovation and entrepreneurial spirit.
CG7: Drafting, representing and interpreting scientific-technical documentation.
CG9: Ability to analyse and conceptually design electronic devices to solve problems in biology and medicine.
ECRT28: Ability to analyse and control continuous and discrete time dynamic systems, both linear and non-linear.
CT1: Ability to communicate knowledge orally and in writing to both specialised and non-specialised audiences.
CT2: Ability to establish good interpersonal communication and to work in multidisciplinary and international teams.
CT3: Ability to organise and plan their work, making the right decisions based on the information available, gathering and interpreting relevant data in order to make judgements within their area of study.

OBJECTIVES

With this subject the students are aimed to acquire basic knowledge that allows them to analyze and control dynamic systems in continuous time with application to bioengineering. The study of the behavior of the systems will be carried out by means of the classic theory of control of linear systems, using the representation of a system by means of input-output relations.

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DESCRIPTION OF CONTENTS: PROGRAMME

1. Laplace Transform.
2. Modelling of systems:
   2.1 Linealization.
   2.2 Diagram Blocks.
   2.3 Transfer function.
3. Temporal analysis of systems:
   3.1 Influence of poles and zero.
   3.2 Response to standard signals.
   3.3 Systems of first and second order.
4. Frequential analysis of systems:
   4.1 Diagram of Bode.
   4.2 Design of filters.
5. Introduction to control systems:
   5.1 Architectures of control.
   5.2 Precision.
   5.3 Sensitivity to disturbances.
6. Temporary analysis of feedback systems:
   6.1 Root Locus.
7. PID Controllers:
   7.1 Temporary design of regulators PID.
   7.2 Empirical adjustment of regulators PID.
   7.3 Practical control schemes of regulators PID.

LEARNING ACTIVITIES AND METHODOLOGY

- Master clasess and reduced group sessions for resolution of problems.
- Laboratory sessions with personal work of the student, oriented to the acquisition of practical abilities related to the program of the subject.

ASSESSMENT SYSTEM

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

In order to pass the course it is necessary to satisfy:

1) Do all the practical sessions
2) Pass the two midterms (in case both midterms exam are passed the student don't need to do the final exam)
3) Pass the final exam (in that case the student will do at the final exam the midterm not passed)

BASIC BIBLIOGRAPHY

- Jacqueline Wilkie & Michael Johnson & Reza Katebi Control engineering: an introductory course, Palgrave Macmillan, 2002

- OGATA, K. Modern Control Theory, Prentice-Hall, 1987..

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