69716 - Models and systems of physiological control

Syllabus Information

Academic Year: 2021/22
Subject: 69716 - Modelos y sistemas de control fisiológico
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 633 -
ECTS: 3.0
Year: 2 and 1
Semester: Second semester
Subject Type: Optional
Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process that is designed for this course is based on the following:

- A01 Participatory master class (15 hours). Presentation of the main contents of the subject by the teacher. This activity will take place in the classroom in person.
- A02 Problem resolution and case study (7 hours). Problems and Case Studies resolution individually or in group.
- A03 Laboratory Practices. (4 hours). Laboratory Practices are divided in: 1) Acquisition and registration of biomedical signals at the Laboratory. 2) Study and characterization of the Cardiovascular System Control. This activity itself assessed by means of the memory that the students as well as its attitude in the laboratory (see Evaluation).
- A05 Realization of Practical Application and Research. The student will solve individually Case Studies stated by the teacher. If the case is complex the activity could be achieved in group as established by the teacher. This activity will be evaluated in accordance with the previsions of the Evaluation Section
- A06 Tutoring. Personalized service to review and discuss materials and themes presented in the theoretical and practical classes.
- A08 Evaluation. Set of written tests of theoretical and practice aspects, reports and works proposed for evaluation. Detailis in the evaluation section.

4.2. Learning tasks

- The program offered to help you achieve the expected results includes the following activities:
- Physiological Dynamical systems modeling
- Physiological Dynamical systems analysis
- Feedback systems
- Control of physiological systems

- System Identification
- Control of physiological systems
- Physiological devices control
- Models, diagnostic and therapeutic applications

4.3. Syllabus

1. Basic Concepts of modeling and control of systems.

1.1 Signals and Systems. Basic concepts of signals and systems. Types of systems. Dynamical systems. Physiological systems. Simulation.
1.2 Modeling of dynamic systems. Modeling physical systems. Models of differential equations. Transfer Function models. Block diagrams. Poles and zeros of a system. Analogies. Nonlinear systems. Linearization. Examples of physiological system modeling.
1.3 Temporal analysis of dynamical systems. Stability concept. Criteria for the stability analysis of dynamical systems. Transient and steady-state behaviors. First order systems. Second-order systems. Higher order systems. Pure delay. Stability. Feedback. Examples of temporal analysis of physiological systems.
1.4 Analysis in the frequency domain. Fourier transform. Frequencial description. Frequency transfer function. Bode diagrams. Examples of frequency analysis of physiological systems. Identification.
1.5 Concepts and techniques of control. Basic feedback control systems. Control actions. Types of drivers. Controller tuning methods. Control Examples of physiological systems.

2. Physiological Systems and Applications

2.1 Cardiovascular control system
2.1.1 Model for cardiac output regulation
2.1.2 Representations and models for heart rate regulation
2.1.3 Modeling and regulation of blood pressure
2.1.4 Models for cardiovascular control
2.2 Respiratory control system
2.2.1 Regulation of respiration
2.2.2 Periodic breathing and obstructive sleep apnea

4.4. Course planning and calendar

Scheduling and presentation of works:

The schedule of the course, both the sessions in the classroom and the laboratory sessions, will be determined by the academic calendar that the Center established for the corresponding course. The schedule for submission of papers shall be announced at the beginning of the course.

4.5. Bibliography and recommended resources

Software y equipment:
- Software: Matlab-Simulink
- Equipment for biosignal processing

http://biblos.unizar.es/br/br_citas.php?codigo=69316&year=2019