69316 - Models and systems of physiological control

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	547 - Master's in Biomedical Engineering
ECTS	3.0
Course	1
Period	Second semester
Subject Type	Optional
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

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 .

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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. Detail is in the evaluation section.

5.2.Learning activities

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

5.3.Program

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

5.4.Planning and scheduling

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.

5.5.Bibliography and recomended resources

BB Craig, John J.. Introduction to robotics : mechanics and control / John J. Craig . - 2nd ed. Reading, Massachusetts : Addison-Wesley, cop. 1989

BB Fundamentos de robótica / Antonio Barrientos ... [et al.]. - 2ª ed. Madrid [etc.] : McGraw-Hill, cop. 2007

BB Pons, José L. Wearable robots: biomechatronics exoskeletons / J.L. Pons. Chichester : Wiley, 2008

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BC Dudek, Gregory. Computational principles of mobile robotics / Gregory Dudek, Michael Jenkin . - 2nd ed. New York : Cambridge University Press, 2010

BC Medical robotics / edited by Vanja Bozovic. Viena : I-Tech EDucation and Publishing, 2008

Software and equipment to be used:

Software: Matlab - Simulink

Biosignal processing equipment