

Academic Year: (2020 / 2021)

Review date: 15-07-2020

Department assigned to the subject: Bioengineering and Aerospace Engineering Department, Electronic Technology

Coordinating teacher: HERNANDEZ CORPORALES, LUIS

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Phsyscs, Electronic technology in biomedicine, Measuring Instrumentation

OBJECTIVES**COMPETENCES THAT THE STUDENT ACQUIRES WITH THIS MATTER**

CB6 Possess and understand knowledge that provides a base or opportunity to be original in the development and / or application of ideas

CB7 That students know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study

CB9 That students know how to communicate their conclusions and the technical knowledge and the ultimate reasons that sustain them to specialized and non-specialized audiences in a clear and unambiguous way

CG1 Ability to learn new methods and technologies, from the domain of scientific and special techniques of Clinical Engineering, as well as for new situations.

CE2 Ability to understand and use advanced statistical methods for conducting scientific studies, evaluating equipment from the point of view of the effectiveness of the practice, accreditation for medical use or the study of comparative effects in patients.

CE4 Ability to evaluate the functioning of electromedical systems by analyzing complex data from the control / electronic / mechanical subsystems involved.

LEARNING RESULTS THAT THE STUDENT ACQUIRES

After studying this matter, students may be able to:

- Describe the bases of maintenance and repair of electrical equipment in the hospital environment.
- Understand and design analogue and digital electronic systems with special emphasis on aspects related to the design of biomedical instrumentation.
- Cite and use the electronic components used in the development of biomedical instrumentation.
- Identify the most characteristic circuits and the most extensive applications related to biomedical instrumentation.
- Manage electronic instrumentation equipment and perform measurements with them.
- Apply visual and electrical visualization and visualization techniques, describe equipment and analyze the procedures used.
- Determine the characteristics and applications of type analog circuits, identifying their functional blocks and analyzing the interrelation of their components.
- Determine the structure of instrumentation circuits, identifying their application and analyzing the interrelation of their components.
- Verify the operation of electronic and optical circuits, interpret diagrams and apply visualization techniques.

DESCRIPTION OF CONTENTS: PROGRAMME

This course provides knowledge about the purpose and operation of analog and digital electronic systems, as well as optical systems, with special emphasis on the aspects related to the design of biomedical instrumentation. The laboratory practices will allow to know and use the electronic components used in the development of biomedical instrumentation and to gain experience in the handling of basic electronic instrumentation equipment.

The subject is divided into three thematic blocks:

Block I Analog Subsystems (2 ECTS)**Topic I.1 Amplifiers for medical instrumentation****I.1.1 Review of basic circuits with operational amplifiers****I.1.2 Instrumentation amplifiers**

- I.1.3 Isolation amplifiers
- I.1.4 Noise in amplifier circuits
- Topic I.2 Frequency response of amplifiers. Filters and Oscillators
- I.2.1 Definition of bandwidth and cutoff frequencies of an amplifier
- I.2.2 Filters active in continuous time
- I.2.3 Oscillators
- Topic I.4 Power amplifiers and power converters
- I.3.1 Linear power amplifiers
- I.3.2 Switching amplifiers in class D
- I.3.3 Linear power supplies
- I.3.4 DC / DC converters
- Topic I.5 Data converters
- I.4.1 Basic definitions on data conversion
- I.4.2 Digital / Analog Converters
- I.4.3 Analog / Digital Converters
- I.4.4 Sigma-Delta Converters
- Block II Digital Subsystems (2 ECTS)
- Topic II.1 Embedded systems
- II.1.1 General architecture of a recessed system
- II.1.2 Types of embedded systems
- II.1.3 Microcontrollers
- II.1.4 Peripherals
- II.1.5 Examples of biomedical application
- Topic II.2 Capture and generation of signals
- II.2.1 General purpose inputs and outputs (GPIO)
- II.2.2 Interruptions
- II.2.3 Timers
- II.2.4 Generation of timed signals
- II.2.5 Capture of timed signals
- Topic II.3 Interfaces
- II.3.1 Parallel interfaces
- II.3.2 Serial interfaces
- II.3.3 Interfaces with A / D and D / A conversion circuits
- Block III: Optical subsystems (2 ECTS)
- III.1 Basic components of optical measurement circuits
- III.2 Laser and photonic detector technology.
- III.3 Optical systems of analysis in laboratories and hospitals (ELISA, FACS, etc).
- III.4 Advanced systems of optical microscopy (confocal, multiphoton, flat laser beam microscopy, optical coherence tomography, etc.).

ASSESSMENT SYSTEM

ASSESSMENT SYSTEMS OF THE STUDY PLAN REFERRED TO SUBJECTS

SE2 Individual or group work carried out during the course

SE3 Final exam

System of

Evaluation Minimum weight (%) Maximum weight (%)

SE2 30% 30%

SE3 70% 70%

The grade of the subject will be divided into theory and laboratory. The theory grade corresponds to the grade of the exam of the subject with a weight of 70%. The laboratory note will be obtained from the evaluation of the lab work and will weigh 30% of the subject.

% end-of-term-examination: 70

% of continuous assessment (assignments, laboratory, practicals...): 30

BASIC BIBLIOGRAPHY

- Adel S. Sedra Kenneth Carless Smith Circuitos Microelectronicos, Mc Graw Hill, 2006
- David Boas, Constantinos Pitris and Nimmi Ramanujam Handbook of Biomedical Optics, CRC press, 2011
- Miguel Angel Perez Garcia Instrumentacion Electronica, Paraninfo, 2014
- Renk, Karl F. Basics of Laser Physics For Students of Science and Engineering, Springer, 2017
- Wang, K.C.. Embedded and Real-Time Operating Systems, Springer, 2017

