Electronic technology in biomedicine

Academic Year: (2023 / 2024) **Review date: 19/12/2023 13:53:03**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: GUTIERREZ FERNANDEZ, ERIC

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Systems and Signals (First Semester, Second year)

LEARNING OUTCOMES

RA1: Acquire knowledge and understanding of the basic general fundamentals of engineering and biomedical sciences.
RA2: Be able to solve basic engineering and biomedical science problems through a process of analysis, identifying the problem, establishing different methods of resolution, selecting the most appropriate one and its correct implementation.
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.
CG1: Adequate knowledge and skills to analyse and synthesise basic problems related to engineering and biomedical sciences, solve them and communicate them efficiently.
CG3: Knowledge of basic scientific and technical subjects that enables them to learn new methods and technologies, as well as providing them with great versatility to adapt to new situations.
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.
CG8: Ability to solve mathematical, physical, chemical and biochemical problems that may arise in biomedical engineering.
CG9: Ability to analyse and conceptually design electronic devices to solve problems in biology and medicine.
ECRT27: Understanding and mastery of the basic concepts of electrical and electronic circuit theory, physical principles of semiconductors, electronic and photonic devices, and their operation and applications in basic circuits. Basic knowledge of the particularities of biomedical applications.
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

- Knowing the purpose and operation of analog and digital electronic systems.
- Operation of basic electronic instrumentation.

- Knowledge and use of main electronic devices.
- Ability to design, size, build and make use of basic electronic functions.
- Ability to use computer aided design tools for electronic circuit design, identify the parts in an electronic circuit and knowing its funtion in a diagram.

DESCRIPTION OF CONTENTS: PROGRAMME

T1: Circuit Theory
1. Ohm law.
2. Kirchhoff laws
3. Current and voltage sources.
4. Superposition theorem.
5. Thevenin and Norton theorem.
6. Real voltage and current sources.
7. Capacitors and Inductors (C and L).
8. Time response of C and L.
9. Universal equation for C and L.
10. DC and AC circuit analysis.
11. Frequency response of R, C and L circuits.
12. First order passive Filters and Bode Diagram.
13. Computer circuit simulation of AC and DC circuits.

T2: Electronic components
1. Applications and electronics systems. Biomedicine applications.
2. Diodes and Transistors (MOSFET).
3. Single stage amplifier using MOSFETs.
4. Computer circuit simulation of diodes and transistors.

T3: Amplification (Operational Amplifiers)
1. Inverting Amplifier.
2. Non-Inverting Amplifier.
3. Comparator.
4. Differential Amplifier.
5. Input and Output impedance.
6. Cascade Amplifiers.
7. Computer simulation of amplifier and power supply circuits.

T4: Digital Electronics
1. Binary system and Boole Algebra.
2. Combinational circuits: Decoders and Multiplexers.
3. Sequential circuits: Flip-Flops
4. Acquisition systems and data conversion. Transducers and sensors.

T5: Electronics Laboratory
1. Basic electronics instrumentation and measurement.
2. Electronics applications design.
3. Electronics applications implementation.

LEARNING ACTIVITIES AND METHODOLOGY

- Theory lectures (large group), problem resolutions lectures (small groups), individual and group tutoring sessions and student personal homework; oriented to theoretical knowledge acquisition.

- Laboratory practices and problems resolution lectures in small groups, individual tutorials and student personal homework; oriented to practical knowledge related with the fields of the course.

- Computer sessions in small groups using CAD tools for electronics circuits simulations. The goal of these sessions is to encourage the use of the CAD tools to complement the theoretical-practical learning during the course.

ASSESSMENT SYSTEM

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

The partial exam in the continuous assessment is valued 25% of total mark. Lab exercises are also valued 25%. The final examination has a value of the remaining 50%. The last course block is evaluated together with the final examination. The minimum mark in the final exam is 4 points to keep on the continuous assessment. For students not following continuous evaluation, the general rules of the university apply. Requirements to keep the continuous assessment are attending all the laboratory sessions, sitting all the midterm exams and sitting the final exam.

Ordinary call with continuous assessment:
- 25% Laboratory.
- 25% Midterm Exams (15% first, 10% second).
- 50% Final Exam (minimum mark of 4).

Ordinary call without continuous assessment:
- 25% Laboratory.
- 55% Final Exam.

Maximum mark of 8/10.

Extraordinary call with continuous assessment:
- 25% Laboratory.
- 25% Midterm Exams (15% first, 10% second).
- 50% Final Exam (minimum mark of 4).

Extraordinary call without continuous assessment:
- 100% Final Exam.

Maximum mark of 10/10.

BASIC BIBLIOGRAPHY

- A. Bruce Carlson Circuits: Engineering Concepts and Analysis of Linear Electric, TBS , 1999

- Debashis De; Kamakhya Prasad Ghatak, Basic Electronics, Pearson India, 2010

- Floyd, Thomas L. Digital Fundamentals, Pearson International Edition, 2015

- Tildon H. Glisson Introduction to Circuit Analysis and Design, Springer Nature Switzerland AG. , 2018