Electronics engineering fundamentals

Academic Year: (2023 / 2024) **Review date: 11-04-2023**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: SANZ GARCIA, CLARA MARINA

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

It is strongly recommended to have passed Electrical Power Engineering Fundamentals (2nd course, 1st semester) before the beginning of this subject.

SKILLS AND LEARNING OUTCOMES

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.
CG1. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG9. Knowledge and ability to apply computational and experimental tools for the analysis and quantification of Industrial Engineering problems.
CG22. Knowledge of the fundamentals of electronics.
ECRT7. Applied knowledge of electronic instrumentation.
ECRT11. Knowing and using the main electronic components.
RA1. Knowledge and understanding: Have basic knowledge and understanding of science, mathematics and engineering within the industrial field, as well as knowledge and understanding of Mechanics, Solid and Structural Mechanics, Thermal Engineering, Fluid Mechanics, Production Systems, Electronics and Automation, Industrial Organisation and Electrical Engineering.
RA2. Engineering Analysis: To be able to identify engineering problems within the industrial field, recognise specifications, establish different resolution methods and select the most appropriate one for their solution
RA4. Research and Innovation: To be able to use appropriate methods to carry out research and make innovative contributions in the field of Industrial Engineering.
RA5. Engineering Applications: To be able to apply their knowledge and understanding to solve problems and design devices or processes in the field of industrial engineering in accordance with criteria of cost, quality, safety, efficiency and respect for the environment.

OBJECTIVES

By the end of this content area, students will be able to have:

1. knowledge and understanding of the theoretical fundamentals of electronics engineering and their practical applications;
2. awareness of the wider multidisciplinary context of electronics within industrial engineering;
3. the ability to apply their knowledge and understanding to identify, formulate and solve problems about electronics engineering and their main industrial applications by using both theoretical and practical established methods as well as basic electronic design rules for their real implementation.
4. the ability to design and conduct appropriate experiments about electronics engineering to characterize and implement basic electronic systems, to properly analyse and interpret the results/data obtained from an engineering point of view, and to draw conclusions about the electronic system performance;
5. the ability to properly apply the technical skills acquired for the experimental evaluation of an electronic system in an electronics engineering lab facility;
6. the ability to combine theory and practice to solve problems about electronics engineering.

DESCRIPTION OF CONTENTS: PROGRAMME

THEORETICAL PART

TOPIC 1. Electronic signals and systems
1.1 Block diagram of real electronic systems and subsystems.
1.2 Designing and building-up an electronic system. Main requirements.
1.3 Electronic signal types and their parameters that describe them.
1.4 Review of electric circuit analysis and basic circuit theory.

TOPIC 2. Electronic instrumentation. Sensors and transducers
2.1 Lab instrumentation and measurement of electronic signals.
2.2 Electronic sensors. Classification.
2.3 Transducers. Classification.

TOPIC 3. Amplifiers and analog electronic subsystems
3.1 Description and modeling.
3.2 Concept of transfer function. Classification.
3.3 Operational amplifiers. Negative feedback (stable) topologies. Electronic applications.

TOPIC 4. Electronic components
4.1 Transistors: description, operation and applications.
4.2 Diodes: description, operation and applications.
4.3 Introduction to Power systems and energy conversion

TOPIC 5. Digital electronic subsystems and analog-to-digital (A/D) and digital-to-analog (D/A) conversion
5.1 Fundamentals of digital electronics. Numbering and coding in digital systems.
5.2 Boolean algebra. Basic logic gates. Boolean logic functions and representation.
5.3 Combinational and sequential digital circuits. Memories
5.4 A/D and D/A converters. Characteristics.
5.5 Introduction to integrated electronic circuits

LABORATORY
Implementation of some laboratory practices which deal with the fundamentals of Analog and Digital Electronics. Lab equipment handling and application of techniques to perform measurements on electronic circuits.

LEARNING ACTIVITIES AND METHODOLOGY

- Theory - Lectures (large group), problem resolution Seminars (small groups), individual tutorials, mentoring and student personal homework; oriented to theoretical knowledge acquisition and to understand the use of electronics through real applications.

- Laboratory practices oriented to practical knowledge related to the contents of the course.

- Small group sessions in lab and/or computer classroom to promote the student self-learning and to encourage the self-knowledge through a PBL (problem-based learning) methodology, following the guidelines from the Higher Education European Space.

- Flipped classroom contents through a SPOC (Small Private Online Course) about lab skills.

ASSESSMENT SYSTEM

The subject involves the following assessable contents:
- 4 practical sessions.
- Part 1 of the theoretical contents.
- Part 2 of the theoretical contents.

The activities of the assessment are:
1. Midterm exam. Students will be evaluated of Part 1 contents at a specific day within the semester.
2. Final Exam: The Final Exam has two differentiated parts (Part 1 and Part 2). The student will be exempt from being evaluated of Part 1 (theory/problems) within the Final Exam if the score achieved on the Midterm Evaluation was greater than or equal to 5 points/10 points.

The student must fulfill the below requirements to follow the Continuous Assessment:
- To attend to the practical sessions
- To do the Midterm Exam (Part 1 contents) of the subject that will be held within the semester.

ORDINARY EXAM
Two options:
1. If the student fulfills the continuous assessment process requirements, the Final score will be obtained from:
a. Practical sessions (4 points).
In case of having a mark lower than 3 points out of 10 in one practice, obtained final Lab mark will be multiplied
by 0.75.
In case of having a mark lower than 3 points out of 10 in two practices, obtained final Lab mark will be multiplied by 0.5.
In case of having a mark lower than 3 points out of 10 in three practices or more, obtained final Lab mark will
be multiplied by 0.25.
b. Evaluation of Part 1 (3 points) which corresponds to the midterm exam if its score is greater or equal to 5 points. On the contrary, the score will be that of the corresponding part of the final exam.
c. Evaluation of Part 2 (3 points) corresponds to the score of the second part of the final exam.
d. The student must obtain a minimum score of 4 out of 10 (4 points/10points) on each part of the subject (Evaluation of Part 1 and Evaluation of Part 2).

Final Grade= Practice (4 points) + Evaluation of Part 1 (3 points) + Evaluation of Part 2 (3 points)

2. If the student failed to fulfill any of the requirements to be considered within continuous assessment process, the final score (outside the continuous assessment process) will be obtained from, where the student must obtain a minimum score of 4 out of 10 (4 points/10points) on each part of the subject (Evaluation of Part 1 and Evaluation of Part 2).

Final Grade= Evaluation of Part 1 (3 points) + Evaluation of Part 2 (3 points)

RETAKE EXAM
Two options:
1. If the student fulfills the continuous assessment process requirements, the Final score will be obtained from:
a. Practical sessions (4 points)
In case of having a mark lower than 3 points out of 10 in one practice, obtained final Lab mark will be multiplied
by 0.75.
In case of having a mark lower than 3 points out of 10 in two practices, obtained final Lab mark will be multiplied by 0.5.
In case of having a mark lower than 3 points out of 10 in three practices or more, obtained final Lab mark will
be multiplied by 0.25.
b. Evaluation of Part 1 (3 points) which corresponds to the midterm exam if its score is greater or equal to 5 points. On the contrary, the score will be that of the corresponding part of the final exam.
c. Evaluation of Part 2 (3 points) corresponds to the score of the second part of the final exam.
d. The student must obtain a minimum score of 4 out of 10 (4 points/10points) on each part of the subject (Evaluation of Part 1 and Evaluation of Part 2).

Final Grade= Practice (4 points) +Evaluation of Part 1 (3 points) + Evaluation of Part 2 (3 points)

2. If the student failed to fulfill any of the requirements to be considered within continuous assessment process, the final score (outside the continuous assessment process) will be obtained from, where the student must obtain a minimum score of 4 out of 10 (4 points/10points) on each part of the subject (Evaluation of Part 1 and Evaluation of Part 2).

Final Grade= Evaluation of Part 1 (5 points) + Evaluation of Part 5 (5 points)

Students within the continuous assessment process will be finally graded with the best score obtained from either Option 1) or Option 2)

% end-of-term-examination:	30
% of continuous assessment (assigments, laboratory, practicals…):	70

BASIC BIBLIOGRAPHY

- Floyd, Thomas L Principles of electric circuits: Conventional current version, Ed. Pearson Prentice Hall, 2012

- Floyd, Thomas L. Electronic devices: conventional current version, Ed. Pearson Prentice Hall, 2012

- Floyd, Thomas.L Digital fundamentals, Pearson Prentice Hall, 2012