VNIVERSITAT DE VALÈNCIA

Course Guide
34780 Principles of electrical engineering and electronics

COURSE DATA

DATA SUBJECT

Code: 34780
Name: Principles of electrical engineering and electronics
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	Escola Tècnica Superior d'Enginyeria	2	Second quarter
1934 - Double Degree Program in Chemistry-Chemical Engineering	Facultat de Química	2	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	Foundations of electrotechnics and electronics	COMPULSORY
1934 - Double Degree Program in Chemistry-Chemical Engineering	Segundo curso	COMPULSORY

COORDINATION

FERRERES SABATER AGUSTIN

SUMMARY

This course develops the course "Fundamentals of Electrical and Electronics" for the Chemical Engineering Graduate. The main goals are to introduce the student in the basic principles of circuit theory and the use of the basic tools of circuit analysis, the utilization of the basic equipment of an electronics lab, learn the basic semiconductor devices (diodes and transistors) and their operation, and study the physical principle of some sensors used in the chemical industry and their electronic conditioning, including the analogue to digital and digital to analogue conversion, and finally, to present an introduction to the basic facilities and electrical machines that can be found in any chemical plant.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

As this is a basic subject that is taught in the second year, there are no prerequisites for Electronics or Circuit Theory, although it is convenient for the student to be fluent in some physical concepts such as:

Knowledge of physical concepts associated with signals such as amplitude, period, frequency and angular frequency.
Knowledge of the units associated with the fundamental physical quantities and flow to work with them.
Knowledge of field, force, energy and power concepts.

COMPETENCES / LEARNING OUTCOMES

1401 - Degree in Chemical Engineering

Ability to handle specifications, regulations and standards of compliance.

Acquire knowledge of basic and technological subjects to facilitate the learning of new methods and theories, and develop the versatility to adapt to new situations.

Act autonomously in learning, make informed decisions in different contexts, issue judgements based on experimentation and analysis and transfer knowledge to new situations.

Be able to understand and apply the legislation required for the practice of the profession of technical industrial engineer.

Collaborate effectively in work teams, assume responsibilities and leadership roles, and contribute to collective improvement and development.

Knowledge and use of the principles of circuit theory and electrical machines.

Knowledge for carrying out measurements, calculations, valuations, appraisals, expert opinions, studies, reports, work plans and other similar work.

Propose creative and innovative solutions to complex situations or problems, specific to the field of knowledge, to respond to diverse professional and social needs.

Solve problems with initiative, make decisions, think creatively and critically, and communicate and convey knowledge, skills and competences in the field of industrial engineering.

Understand the fundamentals of electronics.

DESCRIPTION OF CONTENTS

Topic 1. Circuit theory. DC and AC analysis
Components, R, L and C. DC analysis. Circuit resolution: Kirchhoff's laws: meshes and nodes. Voltage and current divider. Theorem of Thévenin and Norton. Superposition Theorem. AC analysis.

Topic 2. Test and Measurement Equipment
Multimeter, oscilloscope. Current clamp ammeter, current measurement.

Topic 3. Power in AC circuits
AC electrical power. Concept of active, reactive and apparent power. Electricity billing.

Topic 4. Semiconductor devices and applications
Semiconductor materials. Diodes. Rectifiers. Transistors. Amplifiers.

Topic 5. Sensors
Introduction to measurement systems. Temperature, concentration and luminosity sensors.

Topic 6. Conditioning circuits
Sensor signal conditioning to obtain useful variables in process controls. Wheatstone bridge. Circuits based on operational amplifiers.

Topic 7. The electrical network, single-phase and three-phase
The distribution of industrial and domestic electrical energy. Available voltages standardized in three-phase and single-phase. Introduction to the basic rules of electrical installations. Electrical safety.

Topic 8. Electrical Machines
Fundamentals of Transformers. Motors.

Laboratory of Principles of Electrical Engineering and Electronics

- Handling of basic equipment: digital multimeter, signal generator and oscilloscope. Measurements of electrical magnitudes in DC.
- AC circuits. Measurements of electrical quantities in AC
- Temperature measurement and electronic conditioning of the system.
- Humidity measurement
- Gas detection and alarm activation.

  Electrical installation. Power factor correction.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Laboratory	20,00
Classroom practices	10,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	27,00
Preparation of lessons	20,00
Preparation for assessment activities	33,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The development of the course is structured around two themes: learning with the teacher (theory sessions, seminars, workshop problems and tutorials) and laboratory sessions. Students must make individual works (deliverables) through the virtual classroom.

Learning with the teacher

In the theory sessions the model of master classes with the use of PowerPoint will be used.

In the problem sessions, the professor will explain a number of problems-type corresponding to the different themes of the course. The teacher will advance which day will be devoted to solving problems and what problems will be solved, so that the student can prepare these problems in advance.

Laboratory sessions

The objectives to be achieved in the laboratory sessions can be summarized as:

- Learning and management of the main equipment that can be found in a basic electronic laboratory.
- Learn to design the conditioning circuit of different sensors.
- Learn how to calibrate an electronic measuring circuit.
- Know the circuits of conditioning of the sensors.
- Know the three phases systems and domestic electrical installations.
- Know the principles of the electric machines.

Lab sessions will be organized around working groups of a maximum of two people.

Tutorials

The students will have a schedule of tutorials whose purpose is to solve problems, doubts, orientation in works, etc. The schedule of these tutorials will be indicated at the beginning of the academic year. They will also have the opportunity to clarify some doubts by email or discussion forums through the use of the tool \\\"Virtual Classroom\\\", provided by the University of Valencia.

In order to successfully complete the teaching methodology described, the student will have the following documents:

- **Teaching Guide**, provides sufficient information to determine what is intended to learn the student, how it will be done, under what conditions and how it will be evaluated.
- **Transparencies** of each of the subjects of the subject.
- **Bulletin of problems** of each one of the subjects of the subject.
- **Script Practice-Preparation and calculations** with the following structure:
    - Goals
    - Material
    - Previous knowledge
    - Theoretical fundament
- **Script of Practices-Experimental procedure**, formed by the following sections:
    - Previous data
    - Goals
    - Activities and experimental procedure

EVALUATION

Modality A (continuous assessment):

The evaluation of the learning of the students attending will be of a formative nature and will be carried out through a continuous evaluation of the progress and the work developed throughout the course. This will take into account:

- The resolution of activities (deliverables) that are being proposed for them to work autonomously (multiple response tests, questions, problems Seminars, exhibition of group work, etc...).
- Evaluation of laboratory practices through the delivery of some reports or questionnaires of the practices.
- Exam that will consist of multiple-choice questions that will evaluate the theory and laboratory part and several practical questions related to problems done in class.

Laboratory practices are considered non-recoverable activities and the completion of the practices is a necessary condition to pass the subject.

The weighting of the ratings over 100% will be as follows.

1.1. Deliverables of theory and problems: 10%

1.2. TEST on all contents of the subject: 73%

1.3. Attendance and completion of laboratory practices and the corresponding deliverables: 17%

To be evaluated in this way, it is necessary to attend at least 80% of the laboratory sessions, deliver at least one of the proposed deliverables, and obtain a grade greater than or equal to 4 out of 10 in the items 1.1, 1.3. In the TEST exam, it will be a necessary condition to pass it that the student answers a minimum number of questions in each block of the exam, and the grade is greater than or equal to 4. To pass the subject it is necessary to obtain a weighted average greater than or equal to 5 points.

Modality B:

The evaluation in the modality B will only be possible in second call. It will apply to students who:

- In a justified way, they have not been able to attend at least 80% of the laboratory sessions.

- Those who have not submitted any work.

- Those who have not passed the first call.

There will be a multiple-choice exam with content from all parts of the subject:

Whose weight in the final grade will depend on if the student delivers the works during the continuous assessment. The weight of each part in the final grade of the subject is as follows:

1. Multiple choice exam: 73% if at least one work has been submitted. If no work has been delivered, its weight rises to 83%

2. Delivered works: 10%. If they did not give up their weight, they pass the multiple-choice exam.

3. Attendance and realization of the laboratory practices with the reports of the practices delivered at the end of the laboratory session. 17%

To pass the subject, it is considered mandatory to obtain a grade equal to or greater than 4 out of 10 in section 3. In the TEST exam in section 1, it will be a necessary condition to pass it that the student answers a minimum number of questions in each block of the exam, and the grade is greater than or equal to 4. To pass the subject, a weighted average greater than or equal to 5 points must be obtained.

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the *ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA* (ACGUV 123/2020).

Anyhow, the evaluation system will be based on the guides stated in the "Reglament d'Avaluació i Qualificació de la Universitat de València per a Graus i Màsters" (ACGUV 108/2017).

REFERENCES

- José Espí López, Gustavo Camps Valls, Jordi Muñoz Marí. "Fundamentos de Electrónica Analógica". Servei de Publicacions de la Universitat de València. Juny, 2006. (ebook en UV)
- Malvino, A.; Bates, D. J. Principios de Electrónica. McGraw-Hill, Séptima edición, 2007. (ebook en UV)
- Tecnología Eléctrica. DAWSONERA ISBN 9788448192983. (ebook en UV)
- V. Esteve, J. Jordán. Equipos Electrónicos. Ed. Moliner
- José Espí López, Gustavo Camps Valls, Jordi Muñoz Marí. "Electrónica Analógica. Problemas y Cuestiones" Prentice-Hall/Pearson Educación
- Problemas de Tecnología eléctrica - Roger Folch, José, Riera Guasp, Martín, Roldán Porta, Carlos. Sintesis Editorial. EISBN: 849077580X, 9788490775806 (ebook en UV)