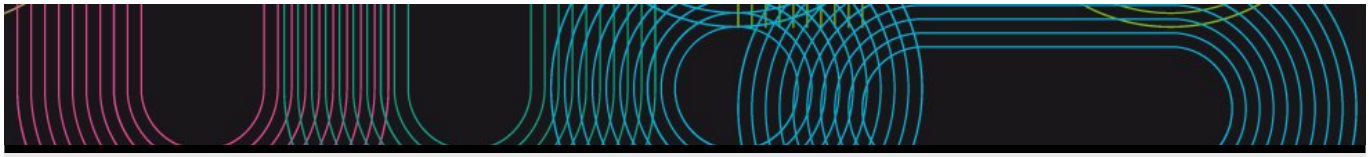

IDENTIFYING DATA				
Electronic Technology				
Subject	Electronic Technology			
Code	V09G291V01208			
Study programme	Grado en Ingeniería de la Energía			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Valdés Peña, María Dolores			
Lecturers	Valdés Peña, María Dolores			
E-mail	mvaldes@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The objective of this course is to provide the students with the theoretical and practical fundamental knowledge in electronics' five main areas: analog electronics, digital electronics, industrial sensors, power electronics and communications electronics. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
A1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
A2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
A3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
A4	That the students can transmit information, ideas, problems and solutions to a specialized and non-specialized audience
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
B1	Ability to draw links between the different elements of all the knowledge acquired, understanding them as components of a body of knowledge with a clear structure and strong internal cohesion.
B2	Ability to develop a project to completion in any field of this branch of engineering, combining appropriately the knowledge acquired, consulting the relevant sources of information, carrying out any required inquiries, and joining interdisciplinary work teams.
C16	Knowledge of the fundamentals of the electrical power system: generation of energy, transportation, distribution and delivery networks, along with the types of lines and conductors. Knowledge of the regulations of high and low tension. Basic knowledge of electronics and control systems.
C44	To be familiar with sensors for measuring physical variables.
C45	Ability to choose and use systems of data collection and electronic instrumentation.
D3	Understanding engineering within a framework of sustainable development with environmental awareness.
D4	Understanding the importance of safety issues and being able to foster awareness about safety among people within their environment.

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Know the basic operation of the electronic devices.	A4 A5	B1 B2	C16 C45	D4
Know the operation of basic digital circuits	A3 A4 A5	B1 B2	C16	
Know the structures of data acquisition systems.	A1 A3 A4 A5	B1 B2	C16 C45	
Understand the basics of different types of sensors and their applications.	A1 A2 A3 A4 A5	B1	C44	D3
Select and use computer tools for the analysis, visualization and storage of the value of variables.	A3 A4 A5	B1 B2	C16	
Know the basic principles of the programmable instrumentation and its use	A4 A5	B1	C16 C45	D4
Know the structure of basic power electronic converters.	A1 A2 A3 A4 A5	B1	C16	D4

Contents

Topic	
Introduction	- Control and supervision of industrial systems by means of electronics - Some representative cases
Electronic devices, circuits and systems	- Electronics components and devices - Active and passive electronic devices - Analog and digital electronic circuits - Electronic systems
Diodes and rectification	- The diode - Operation modes and characteristics - Diodes types - Operation Models - Analysis of circuits with diodes - Rectifier circuits - Filtering for rectifier circuits - Thyristors
Transistors	- The Bipolar Junction Transistor (BJT.) Operation principles and characteristic curves - Work zones - Quiescent point design - The transistor operating as a switch - The transistor operating as an amplifier - Field Effect Transistors (FET).
Amplification	- Amplification concept - Feedback concept - The Operational Amplifier (OA) - Basic circuits with OA - The Instrumentation Amplifier
Digital Electronics I	- Numbering Systems - Boolean Algebra - Combinatorial logic functions. Analysis, synthesis and reduction - Combinatorial circuits
Digital electronics II	- Flip-flops - Sequential logic circuits - Programmable Systems - Microprocessors - Memories
Electronic Sensors	- Sensors - Types of sensors as function of the measuring magnitude - Some sensors of special interest in industry applications - Electrical model of some common sensors - Study of some examples of coupling sensors and CAD system

Analog - Digital Converters	- The Analog and Digital Signals. - The Analog to Digital Converter (ADC) - Sampling, quantification and digitization - More important ADC characteristics: number of bits, sampling speed, conversion range and cost
Industrial Communications	- Introduction to Industrial Communications - Industrial data buses.
Power Electronics	- Circuits for Power Conversion - Rectifiers - Lineal and Switched Power Sources
Laboratory practices	- Management of circuit design and simulation software tools. - Management of electrical signals measurement instrumentation. - Assembly and test of electric circuits based on diodes, transistors, operational amplifiers, analog/digital and digital/analog converters.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	0	28
Problem solving	8	0	8
Previous studies	0	49	49
Autonomous problem solving	0	48.5	48.5
Laboratory practical	14	0	14
Essay questions exam	2.5	0	2.5

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	These sessions will be held in the rooms and dates fixed by the direction of the school. They will consist in an oral explanation by the professor of the most important parts of the course, all related with the materials that the student had to work previously. This is intended to favor the active participation of the students, that will have occasion to rise doubts and questions during the sessions. Active participation is desired during all the sessions.
Problem solving	During these sessions, in the classroom, interleaved with the lectures, the professor will proceed to solve examples and/or exercises that properly illustrate the problems to solve. As long as the number of participants in the classroom allows, active participation will be promoted.
Previous studies	Previous preparation of the theoretical sessions: Prior to the start of the theoretical sessions, the students will have available a series of materials that have to prepare, as the sessions will relay on them. Previous preparation of the laboratory sessions: It is mandatory that the students make all the assigned previous tasks prior to access the laboratory. These task are intended to greatly improve the laboratory knowledge acquisition. The achieved report will be taken into account when the laboratory session is to be evaluated.
Autonomous problem solving	Self study and review of the theoretical sessions for knowledge consolidation: The student must study, in a systematic time schedule, after each lecture session, in order to dissipate any doubts. Any doubts or unsolved questions will have to be expose to the professor as soon as possible in order to enhance the feedback of the learning process.
Laboratory practical	Laboratory sessions will be held in the time schedule established by the school's head teacher. The sessions will be supervised by a professor, who will control the assistance and will also evaluate the harnessing of it. During the laboratory sessions the students will make activities of the following kinds: - Assembling electronics circuits - Use of electronic instrumentation - Measure of physical variables on circuits - Do calculations related to the circuit and/or the measurements - Collect data and represent it (diagrams, charts, tables) At the end of each laboratory session each group will deliver the corresponding score sheets. Problem-solving assessment test will be conducted during three one-hour practice sessions.

Personalized assistance

Methodologies	Description

Problem solving	Professor will answer questions and queries of the students. Students will have the opportunity to attend individual or group tutorials. Email: Students will also be able to request guidance and support via email from the subject teachers, either for specific questions or to request a tutorial through Remote Campus.
Lecturing	Professor will personally answer questions and queries of the students about course issues. Students will have the opportunity to attend individual or group tutorials. Email: Students will also be able to request guidance and support via email from the subject teachers, either for specific questions or to request a tutorial through Remote Campus.
Laboratory practical	Professors will answer questions and queries of the students about laboratory practices and issues. Students will have the opportunity to attend individual or group tutorials. Email: Students will also be able to request guidance and support via email from the subject teachers, either for specific questions or to request a tutorial through Remote Campus.

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	Assessment of the laboratory sessions: The laboratory sessions will be evaluated in a continuous way, on each session. The applied criteria are: - Previous task preparation of the sessions - Make the most of the session The documents of the practices will be available prior to the sessions. Previous preparation of the practice will be evaluated through scored activities previous to the face-to-face session. The students will fill report, that will be delivered when the session ends. This report serves to justify both the attendance and how they have done the work asked for. This methodology assesses expected results related to the basic functioning of electronic devices, the use of computer tools for the analysis and visualization of the value of variables and the correct use of instrumentation.	30	A1 A2 A4 A5	B1	C16 C45	D4
Essay questions exam	Problem solving tests and/or development questions that are carried out throughout the semester in which the theoretical contents of the subject are evaluated. They will consist of the individual completion of objective tests referring to a set of subjects of the subject. This methodology assesses expected results related to the basic functioning of electronic devices, basic digital circuits, structures of data acquisition systems, basic aspects of different types of sensors and basic electronic power converters.	70	A1 A2 A3 A4 A5	B1	C16 C44 C45	D3

Other comments on the Evaluation

1.- Continuous assessment

First Call:

The continuous evaluation will be carried out throughout the semester. Both the theoretical contents (70% of the final mark) and the laboratory practices (30% of the final mark) will be evaluated.

The theoretical part of the subject is evaluated through three partial exams that will be carried out within the hours assigned to the subject classrooms. The weight of each exam is 23.3% of the final grade. The grade for the theory part (T) will be obtained from the average of the grades of the three partial exams.

Regarding laboratory practices, students will be evaluated in all practical sessions and will obtain a grade for each practice. Sessions without assistance will be scored with a zero. The laboratory grade (L) will be obtained from the average of the practical sessions grades. If the student does not pass the subject in the current course, the NL grade will be retained for two academic years.

The continuous assessment (C) rating will be calculated as:

$C = 0.7 \times T + 0.3 \times L$

To pass the subject by continuous assessment, both L and C must be greater than or equal to 5 points out of 10. When L is less than 5, the maximum continuous assessment grade (C) will be 4.5.

Students who have not passed the continuous assessment during the semester, will be able to recover the theoretical part on the date established for the first call final exam. In this case, the students will take an exam on all the theoretical contents of the subject. The mark obtained in this exam will replace the T grade obtained during the semester.

Second call:

Students who have not passed the continuous assessment on the first call may take an exam of all the theoretical contents of the subject on the date of the second call. The grade obtained in this exam will replace the T grade obtained at the first call.

The final continuous assessment (C) grade will be calculated as:

$C = 0.7 \times T + 0.3 \times L$

2.- Global assessment

Students who opt for the global evaluation method must request it by email to the teaching staff within a maximum period of one month before the end of the semester.

Those who opt for global assessment will also have two opportunities, first and second call. In both cases the assessment will consist of two exams, one of the theoretical part of the subject with a weight of 70% of the final grade, and another of the laboratory practices with a weight of 30%.

The theoretical exam will be a written test lasting two hours. The laboratory practice exam will last one hour and will take place in the practice laboratory assigned to the subject.

To pass the subject by global evaluation it will be necessary to obtain a minimum grade of 5 points out of 10, both in the theoretical and practical exam.

Sources of information

Basic Bibliography

Malvino, Albert; Bates, David J., **Principios de Electrónica**, 7ª,

Boylestad, R. L.; Nashelsky, L., **ELECTRÓNICA: TEORIA DE CIRCUITOS Y DISPOSITIVOS ELECTRONICOS**, 10ª,

Rashid, M.H., **CIRCUITOS MICROELECTRONICOS: ANALISIS Y DISEÑO**, 2ª,

TOCCI, RONALD J., NEAL S. WIDMER , GREGORY L. MOSS, **Sistemas digitales. Principios y aplicaciones**, 10ª,

Lago Ferreiro, A.; Nogueiras Meléndez, A. A., **Dispositivos y Circuitos Electrónicos Analógicos: Aplicación práctica en laboratorio**,

Complementary Bibliography

Malik N. R., **Electronic Circuits. Analysis, simulation, and design**,

Wait, J.; Huelsman, L.; Korn, G., **INTRODUCCION AL AMPLIFICADOR OPERACIONAL**, 4ª,

Pleite Guerra, J.; Vergaz Benito, R.; Ruíz de Marcos; J. M., **Electrónica analógica para ingenieros.**,

Recommendations

Subjects that it is recommended to have taken before

Mathematics: Linear algebra/V09G291V01103
Physics: Physics I/V09G311V01102
Physics: Physics II/V09G311V01107
Mathematics: Calculus I/V09G311V01104
Mathematics: Calculus II/V09G311V01109
Circuits and electrical machines/V09G311V01201