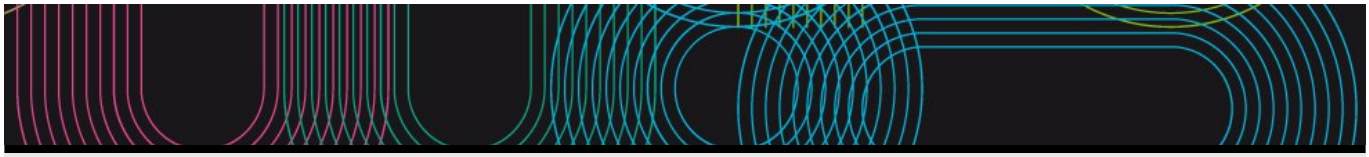

IDENTIFYING DATA				
Electronic instrumentation				
Subject	Electronic instrumentation			
Code	V12G340V01801			
Study programme	Grado en Ingeniería en Organización Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Eguizábal Gándara, Luis Eduardo			
Lecturers	Eguizábal Gándara, Luis Eduardo			
E-mail	eguizaba@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The Electronic Instrumentation is part of the electronic technology, mainly analog, that occupies of the measurement of any type of physical magnitude, of the conversion of the same the electrical magnitudes and of his treatment to provide the suitable information to a system of control, the a human operator or both. The instrumentation has two big subjects of work: - The study of the sensors and of his circuits of conditioning. - The study of the teams of instrumentation that employ for the measure of any type of physical variable. This matter frames inside the degree of Engineering in Industrial Organisation, that's why they will describe the most important appearances for this type titled. Between which fits to stand out: 1º) Sensors 2º) Circuits of conditioning of signal 3º) Systems of acquisition of data 4º) Systems of capture of data in plant 5º) Teams of *instrumentation 6º) Introduction to the Microcontrollers 7º) The pyramid of the automation. Control of the production and control of processes. 8º) Introduction to the Electronics of Power This matter has a marked practical character, approaching to the futures titled the capacity of selection of the technical solution more suitable, so much for the acquisition of physical variables, like the incorporation of the same in systems of business management, to do tasks of control of processes and control of the production.			

Skills	
Code	
B3	CG 3. Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
C11	CE11 Knowledge of the fundamentals of electronics.
D2	CT2 Problems resolution.
D9	CT9 Apply knowledge.
D17	CT17 Working as a team.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
Know the principles of operation of distinct type of sensors and his applications.	B3		
Know the general structure of a circuit of acondicionamiento	B3	C11	D2
Comprise the parameters of specification and design of electronic circuits of acondicionamiento of signal			D9
Know the structures of the system of acquisition of data	B3	C11	

Know and know use tools informáticas for the analysis, visualization and almacenamiento of the information supplied by the sensors.	D9 D17
Realize relative technical memories to the individual works or in group.	C11

Contents	
Topic	
Subject 1: Introduction to the electronic instrumentation	Description of the blocks that form the structure of a system of control of an industrial process. Need of treatment of the signals that take part in the control of a process. Introduction to the systems of acquisition of data. Noise and distortion in the systems of measure. Introduction to the Industry 4.0. IIoT.
Subject 2: Sensors	Definition, classification and study of the characteristics of operation. Criteria of selection.
Subject 3. Data Acquisition Systems (DAS or DAQ). Auxiliary circuits	Bridges of measure. References of tension and current. Converters V/I and I/V
Subject 4: DAS. Amplification and signals filtering.	Amplification of instrumentation, amplifiers of programmable gain, amplifiers of isolation. Introduction to the filtered of signals. Method of filtered. Technicians of implementation of active filters.
Subject 5: DAS. Circuits of conversion and multiplexed	Conversion D/To and To/D, types and characteristic. Circuits of sampling and retention (S&H). Analog switches. Analog multiplexers.
Subject 6: Implementation data acquisition systems	Generalities. Basic elements. Typical configurations. Monolithic systems of acquisition of data. System of wireless acquisition.
Subject 7: Systems of instrumentation	Classification, Systems based in autonomous instruments. Modular instrumentation. Buses of instrumentation. Systems based in cards of acquisition of data. Datalogger
Subject 6: Introduction to the control of processes based in the use of microcontrollers	Introduction to the control of processes Introduction to the microcontrollers Introduction to the actuators: hydraulic, tyres and electronic (Electronics of Power)
Subject 8: Introduction to the Electronics of Power	Structure of a system of Electronic of Power. Devices of power. Applications. Types of conversion of the electrical energy
Subject 7: Integration of data of manufacture in systems of information	The pyramid of the automation. Systems SCADA, MES, ERP. Concept of control of the production and of the control of processes Captures of data for the control of the production: parts of work, bar codes. RFID.
Laboratory practice 1: Circuits with operational amplifiers	Study of basic settings with operational amplifiers, linear settings and no linear
Laboratory practice 2: Introduction to the Virtual instrumentation. LabVIEW.	the execution of data flow onLabVIEW. Frontal panel, diagrams of blocks. Description of the main types of data and structures of programming.
Laboratory practice 3: Application of the LabVIEW with hardware of commercial electronic instrumentation: Data Acquisition Cards (DAQ) and datalogger	Description of the DAQ NI 6008 and of the datalogger DT80. Example of application based in LabVIEW
Practice 4: data acquisition systems for the measurement of temperature	It will implement a system of acquisition of data for the conditioning of a sensor of temperature PT1000.
Mentored work	- Implementation of a circuit of the measure and the control of a physical variable and his back acquisition by means of distinct hardware of capture. - Incorporate the information captures in a system of business management, to make tasks of control of production and control of processes.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	26	22	48
Problem solving	8	16	24
Laboratory practical	10	10	20
Mentored work	6	30	36
Objective questions exam	1	8	9
Essay questions exam	3	10	13
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description

Lecturing	Exhibition by part of the professor of the contents of the subject object of study. The student, by means of autonomous work, will have to learn the concepts entered in the classroom and prepare the subjects on the bibliography proposed. They will identify possible doubts
Problem solving	Complementary activity of the sessions magistrales in which formulate problems and/or exercises related with the asignatura. The student will have to develop the felicitous solutions of the problems and/or exercises proposed in the classroom and of other extracted of the bibliography. They will identify possible doubts that will resolve in the classroom or in tutorías personalizadas.
Laboratory practical	Activities of application of the theoretical knowledges purchased. The student will exercise the basic skills related with the handle of the instrumentation of a laboratory of electronic instrumentation, the utilization of the tools of programming and the montaje of circuits proposed. The student will purchase skills of personal work and in group for the preparation of the works of laboratory, using the available documentation and the theoretical concepts related. They will identify possible doubts that will resolve in the laboratory or in tutorías personalizadas.
Mentored work	In the laboratory classes will pose a series of works to realize in group, that will develop with the teams of available instrumentation in the laboratory. They will identify possible doubts that will resolve in the laboratory or in personalized tutorials.

Personalized assistance

Methodologies	Description
Mentored work	In the laboratory classes and in tutorials will resolve personally each one of the doubts that show up in the realization of the works.

Assessment

	Description	Qualification	Training and Learning Results	
Laboratory practical	The practices of laboratory will evaluate of continuous form (session to session). The criteria of evaluation are: - minimum Assistance of 80% - Puntualidad - previous Preparation of the tasks. The sessions of practices will realize in groups of two students. To the finalizar each one of the sessions of practices, the students will owe to present a leaf of results, this and the work realized will serve like elements of evaluation.	10		D2 D9 D17
Mentored work	Once realized the work tutelado, the students will owe to elaborate a memory descriptiva. It will fix a day for the delivery of the memory and the presentation of the work realized. This note will form part of the continuous evaluation.	30		D2 D9 D17
Objective questions exam	To the finalizar the cuatrimestre will realize a proof written of type test, in the date indicated by the centre.	30	C11	
Essay questions exam	In the dates indicated by the calendar of examinations of the centre, will realize the final proofs that will consist in questions of theory and problems of development.	30	B3	D2 D9 D17

Other comments on the Evaluation

The long answer test will be carried out on the date set by the center and will represent 30% of the final grade. The remaining 70% will correspond to the grade obtained throughout the course, through continuous evaluation, of the laboratory practices, supervised work and multiple choice tests. In each of these evaluations a minimum grade of 30% will be required. Students who are recognized by the management of the center for their resignation from continuous assessment, must attend the final test. This will represent 60% of the grade, the remaining 40% will be obtained through a practical exam and the completion of a work. In this case, the practical exam and the work will be compulsory, and in these tests a minimum grade of 50% must be obtained. In the second call, the same procedure will be followed. The practice note will only be saved for one academic year. The student is expected to exhibit appropriate ethical behavior. In case of detecting unethical behavior (copying, plagiarism, use of unauthorized electronic devices, for example), it will be considered that the student does not meet the necessary requirements to pass the subject. Depending on the type of unethical behavior detected, it could be concluded that the student has not reached the B2, B3 and CT19 competencies. In this case, the overall grade in the current academic year will be a failure (0.0). The use of any electronic device will not be allowed during the evaluation tests unless expressly authorized. The fact of introducing an unauthorized electronic device in the exam room will be considered a reason for not passing this subject in this academic year and the overall grade will be failed (0.0). THE ACQUISITION OF SKILLS AND ITS INFLUENCE ON ASSESSMENT In this subject there is no competency assessment approach. Next, it is specified how the different teaching activities exercise the student in the different competencies and

how their acquisition conditions the final grade obtained by the student. CG3. Knowledge of basic and technological matters, which enables them to learn new methods and theories and gives them the versatility to adapt to new situations. The acquisition of this competence is guaranteed (in the scope of the subject) by its own contents. The self-assessment activities, the practicals and the various assessment tests deal with these content of a technological nature. CE11. Knowledge of the fundamentals of electronics. Also the acquisition of these competences is guaranteed by the contents of the subject, since the practices and the different evaluation tests deal with these fundamental contents of electronics. Both in the theory and problems classes, as well as in the laboratory practices, a set of activities are carried out whose main objective is the fulfillment of this competence. Likewise, the evaluation activities of the subject are aimed at measuring the capacity reached by the students in this competence. CT2. Problem resolution. Students exercise in this competence through the proposed activities: problem sets and theoretical resolution of the assemblies proposed in the practice statements. The acquisition of competence in the field of the subject is justified by the fact that the assessment tests (thematic blocks and individual tests) consist almost entirely of problem solving. CT9. Apply knowledge. The students exercise this competence, especially in the laboratory sessions, where they have to transfer to the simulations and to the assembly and real measurements what was studied in the theoretical sessions. The laboratory sessions are evaluated one by one, averaging the final grade as long as there is minimal attendance and use. The proposed laboratory works are carried out in groups of two and at the end of them, each group must submit a written report of the activities carried out. The students who prepare the best works must make an oral presentation. CT17 Teamwork. The students exercise this competence in the laboratory sessions, since these sessions are carried out in teams of two. Collaboration between both students is necessary to successfully carry out the setups, measurements and data collection required in each experiment. The practice teacher verifies that the prior preparation and development of each of the sessions is the result of the collaboration of the two members of each group. In case of detecting anomalies in this sense, the qualifications of each member of the group are penalized and individualized.

Sources of information

Basic Bibliography

Pérez García, M.A, **Instrumentación Electrónica**, 2ª ed.,

Franco, S., **Diseño con amplificadores operacionales y circuitos integrados analógicos**, 3ª ed.,

Pérez García, M.A., **Instrumentación Electrónica: 230 problemas resueltos**, 1ª ed.,

del Río Fernández, J., **LabVIEW: Programación para Sistemas de Instrumentación**, 1ª ed.,

Robert Faludi, **Bulding wireless sensor network**,

Godinez González, L., **RFID: oportunidades y riesgos, su aplicación practica**,

Pallás Areny, R., **Sensores y Acondicionadores de Seña**, 4ª ed.,

Complementary Bibliography

Antonio Rodríguez Mata, **Sistemas de Medida y Regulación**, 2ª ed, 2004

Carson Chen, **Active filter design**,

Paul Bildtein, **Filtros Activos**,

S.A. Pactitis, **Active filters. Theory and design.**,

Daniel W. Hart, **Electrónica de Potencia**,

Recommendations

Subjects that continue the syllabus

Manufacturing technologies and systems/V12G340V01701
Advanced programming for engineering/V12G340V01906
Information systems and integrated management systems/V12G340V01914

Subjects that are recommended to be taken simultaneously

Operations management/V12G340V01601

Subjects that it is recommended to have taken before

Computer science: Computing for engineering/V12G340V01203
Mathematics: Calculus 1/V12G340V01104
Automation and control fundamentals/V12G340V01403
Fundamentals of electrical engineering/V12G340V01303
Electronic technology/V12G340V01402