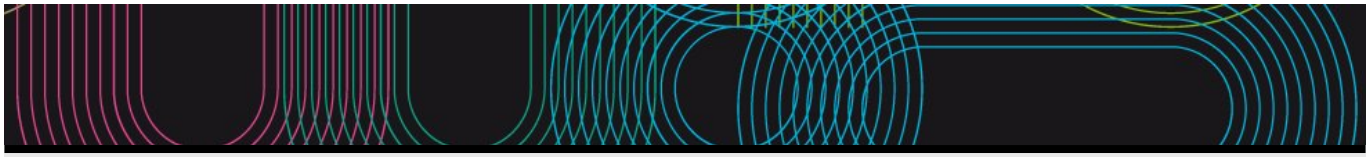

IDENTIFYING DATA				
(*)Bioinstrumentación. Sistemas de monitorización				
Subject	(*)Bioinstrumentación. Sistemas de monitorización			
Code	V04M192V01305			
Study programme	Máster Universitario en Ingeniería Biomédica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Optional	2nd	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Fariña Rodríguez, José Machado Domínguez, Fernando			
Lecturers	Fariña Rodríguez, José Machado Domínguez, Fernando			
E-mail	fmachado@uvigo.es jfarina@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	(*)Neste curso analízase a estrutura e especificacións de dispositivos de monitorización de sinais fisiolóxicas. Abórdase o estudo das características básicas deste tipo de equipos electrónicos, afóndase na utilización de microcontroladores, dispositivos lóxicos programables e dispositivos embebidos, e refórzanse os coñecementos sobre a transmisión de sinal a través de diferentes medios. Durante o curso, o alumnado fará un conxunto de prácticas orientadas ao desenvolvemento e proba dun equipo de medida e monitorización completo de sinais biomédicos.			

Training and Learning Results

Code	
A3	That students are able to integrate knowledge and handle complexity and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
B6	Capacity for handling specifications, regulations and mandatory standards.

Expected results from this subject

Expected results from this subject	Training and Learning Results
Knowledge of the methods and current techniques in bioinstrumentación for the diagnostic, therapy and monitoring of patients.	B6
Knowledge of the methods and techniques of wireless transmission in the corporal surroundings	B6
Knowledge of the procedures and strategies for the implementation in embedded systems of measurement algorithms and processing of biomedical signals.	B6
Create biomedical systems using specific sensors and mobile devices, with application to monitoring, diagnostic, treatment or therapy systems.	A3 B6

Contents

Topic	
Topic 1. Introduction to advanced instrumentation in Medicine.	Structure of a measurement equipment. Processor technologies. Monitoring of biomedical signals. Practical case: Box UCI.
Topic. 2 Evaluation of the uncertainty of the measure.	Static characteristics of a measuring equipment. Specifications and comparison criteria of biomedical instruments.
Topic 3. Wireless transmission in the body environment.	Characteristics of a wireless transmission. Technologies: Wi-Fi, Bluetooth.
Topic 4. Sensor networks.	Technology and communication protocols. Measurement synchronization. Examples.

Topic 5 Embedded systems. Application in biomedical equipment.	Concept and structure of an embedded system. Programmable Logic Devices and system-on-chip. Examples of application in biomedical equipment.
Topic 6. Technologies and portable health devices.	Wearable device concept. basic structure. examples

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	10	10	20
Problem solving	7	14.5	21.5
Laboratory practical	12	18	30
Project based learning	6	24	30
Objective questions exam	1	10	11

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

Methodologies

	Description
Lecturing	Presentation by the teaching staff of the relevant aspects of the contents labeled with the heading of Theory. For a better understanding of the contents and an active participation in the session, the students must carry out a previous personal work on the proposed bibliography. In this way, the students will be able to ask questions, request clarifications or raise doubts, which can be resolved in the session or in personalized tutorials. The students will have to carry out subsequent personal work to assimilate the concepts and acquire the skills corresponding to each session. These sessions will take place at the times and in classrooms indicated by the Center's Management.
Problem solving	This activity aims to reinforce the knowledge acquired in the master sessions with the analysis of biomedical signal monitoring problems. Statements and specifications of equipment for the measurement and processing of biomedical signals are presented to the students and they are resolved by applying the concepts and methodologies developed in the master sessions.
Laboratory practical	Application activities of the theoretical knowledge acquired. They are intended for students to acquire abilities and skills related to the design, simulation, debugging, testing of digital electronic circuits based on microcontrollers or FPGAs for the measurement of biomedical signals. In these sessions, students use electronic instrumentation to analyze the behavior of digital electronic circuits, tools for design, simulation, and debugging of digital electronic circuits based on reconfigurable devices, and tools for programming, simulation, and debugging of digital electronic circuits based on microcontrollers. For each practice there is a statement that indicates the previous personal work that the students must carry out and the tasks that they must carry out in the practical session. The practices are developed in the laboratory and the schedules indicated by the Management of the Center. The students are organized into groups. Assistance control is carried out.
Project based learning	In this activity, students acquire abilities and skills related to the design, simulation, debugging, testing, and maintenance of electronic equipment for monitoring biomedical signals. In work groups, students must face the design, assembly and start-up of a digital electronic system for the measurement and monitoring of physiological signals. Each working group will be assigned a project with a detailed description of the specifications and the milestones that must be met. Students must organize and plan their activity to comply, in due time and form, with said project specifications. The face-to-face part of this activity takes place in the laboratory under the tutorship of the professor.

Personalized assistance

Methodologies	Description
Lecturing	The students have at their disposal personalized tutorials with the teaching staff of the subject. The tutorials can be face-to-face, in the corresponding office, or online, through Remote Campus. The tutorial schedule is established at the beginning of the course and is published on the subject's website in Moovi (https://moovi.uvigo.gal). In these tutorials, the students can solve the doubts that arise about the contents taught in the master sessions and they will be guided on how to approach their study.
Problem solving	Students have personalized tutorials with the subject's teachers at their disposal. The tutorials can be face-to-face, in the corresponding office, or online, through Remote Campus. The tutorial schedule is established at the beginning of the course and is published on the subject's website in Moovi (https://moovi.uvigo.gal). In these tutorials, students can resolve doubts about the resolution of the problems raised and assess alternative solutions.

Laboratory practical	The students have at their disposal personalized tutorials with the teaching staff of the subject. The tutorials can be face-to-face, in the corresponding office, or online, through Remote Campus. The tutorial schedule is established at the beginning of the course and is published on the subject's website in Moovi (https://moovi.uvigo.gal). In addition to the attention of the practical teacher during the realization of the same, the students will be able to attend personalized tutorials to raise and solve the difficulties derived from the preparation and realization of the laboratory practices.
Project based learning	Students have personalized tutorials with the subject's teachers at their disposal. The tutorials can be face-to-face, in the corresponding office, or online, through Remote Campus. The tutorial schedule is established at the beginning of the course and is published on the subject's website in Moovi (https://moovi.uvigo.gal). The student body has personalized tutorials to clarify and resolve all the doubts that arise about the planning and execution of the tasks necessary to finish the entrusted project.

Assessment

	Description	Qualification	Training and Learning Results	
Laboratory practical	Each laboratory practice is evaluated individually. In order to pass it, it is necessary to achieve a minimum grade of 40% of the maximum possible grade. To assess each practice, the previous work for the preparation of each practice session and the content of the document results of the practice will be taken into account. The total practical mark is calculated with the arithmetic mean of the practical mark. To pass the practices it is necessary to obtain at least 50% of the maximum possible mark.	30	A3	B6
Project based learning	In the documentation delivered to the students, in addition to the design and operation specifications of the electronic equipment for the measurement and monitoring of biomedical signals, 3 task evaluation milestones are established. For these evaluations, students must submit a report justifying the solution applied to the evaluated task. Each of these evaluations will have a weight of 20% in the final grade of this evaluation. In addition, an evaluation of the final solution is carried out with a weight of 40% in the final grade. For this, the students must demonstrate the operation of the equipment according to the specifications received and submit a report justifying the applied solution. The temporal planning of these evaluations will be published at the beginning of the teaching activity of the subject. To pass this part it is necessary to obtain 50% of the maximum possible grade.	40	A3	B6
Objective questions exam	With this type of tests the knowledge acquired in the master sessions will be evaluated. A single test will be carried out at the end of said sessions on the date and time established by the School Management. To pass this part it is necessary to obtain 50% of the maximum grade.	30	A3	B6

Other comments on the Evaluation

1. Continuous evaluation

1.1. ordinary opportunity

The final grade for the course will be obtained as a weighted average of the laboratory practice grade (A), the project-based learning grade (B) and the objective questions exam grade (C). To pass the subject it is necessary to obtain a minimum of 50% of the maximum grade. To be able to do the average it is necessary to obtain a minimum of 40% of the maximum grade in each part.

If the minimum threshold (40%) is not reached in any of the parts, the final grade for the subject will be failed and the numerical value will be calculated by multiplying the grade obtained with the weighted average by 0.64.

Clarification on the coefficient: This coefficient is obtained by dividing 4.99 (maximum fail grade) by 7.56 (maximum grade of the arithmetic mean that can be obtained by failing the subject: grade A=3; grade B=3 .9x0.4=1.56; grade of C=3; total=7.56).

1.2. extraordinary opportunity

In the extraordinary opportunity it will not be necessary to appear before the approved parties.

The evaluation of students who have to take the extraordinary opportunity of the academic year will be carried out with:

Final exam: Test with short answer questions. Theoretical concepts and case studies will be evaluated.

Practice exam: Test of completion of any of the tasks indicated in the practical statements.

Project presentation: The assigned project will be evaluated, according to the criteria described for the ordinary opportunity.

The final grade will be obtained with the same criteria specified for the calculation of the ordinary opportunity grade.

2. Global evaluation and call for the end of the degree

The students of global evaluation and end of degree call will be qualified by means of a final exam of theoretical knowledge (C) and a laboratory exam: practices (A) and project (B). The weight and evaluation criteria are the same as in continuous evaluation.

3. Ethical commitment

Students are expected to present appropriate ethical behavior. In case of detecting unethical behavior (copying, plagiarism, use of unauthorized electronic devices, and others), it will be considered that the student does not meet the necessary requirements to pass the subject. In this case, the overall grade for this academic year will be fail (0.0).

Sources of information

Basic Bibliography

Saeid Sanei, Delaram Jarchi, Anthony G. Constantinides, **Body Sensor Networking, Design and Algorithms**, 1119390028, 1st, Wiley, 2020

John G. Webster, **Medical instrumentation: application and design**, 9781119457336, 5th, John Wiley, 2020

Complementary Bibliography

Haider Raad, **Fundamentals of IoT and Wearable Technology Design**, 9781119617549, 1st, IEEE Press, 2021

Myer Kutz, **Biomedical Enineerind and Design Handbook**, 978-0-07-170472-4, 2nd, Mc Graw Hill, 2009

Khandpur, Raghbir Singh, **Compendium of Biomedical Instrumentation**, 9781119288121, 1st, Wiley, 2020

Recommendations