Universidad Rey Juan Carlos

TEACHING GUIDE

BIOMEDICAL EQUIPMENT

GRADO EN INGENIERÍA BIOMÉDICA (INGLÉS) (3º y 4º curso) (2374)

ACADEMIC YEAR 2026-27

Q2803011B UNIVERSIDAD REY JUAN CARLOS
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I.-Subject Identification	
Type	OBLIGATORIA
Teaching period	3 course, 1Q semester
Nº of credits	6
Language in wich the subject is taught	English

II.-Presentation

Biomedical equipment is the basis of any modern hospital. Whether for diagnosis, monitoring, or therapy, the patient's journey through the hospital always involves the use of specialized equipment. In this course, we will start by providing a general overview of equipment life cycle, management, and maintenance, and then go into detail and analyze the main equipment that a biomedical engineer must know and handle. Laboratory sessions will be carried out to design electronics for biosignal acquisition and to analyze clinical equipment.

III.-Learning outcomes

CG02. Use computational and experimental tools for the analysis and quantification of biomedical engineering problems
CB2 . That students are able to apply their knowledge to their work or vocation in a professional manner and have the skills that are typically demonstrated through the preparation and defense of arguments and problem solving within their field of study.
CB3 . That students have the ability to gather and interpret relevant data (usually within their field of study) to express judgments that include a reflection on relevant topics related to social, scientific or ethical areas.
CE17. Designing instruments for medical applications
CE18 .Use sensors, controllers and biomedical signal acquisition systems for the evaluation and design of biomedical devices and systems
CE21 . Extract biomedical data from its environment, including knowledge of medical consultation systems, and information standards in medical equipment.

- Key for degrees not adapted to RD 822/21: **CB** - basic competences, **CG** - generic competences, **CE** - specific competences, **CT** - transversal competences.
- Key for degrees adapted to RD 822/21: **CON** - knowledge, **COM** - competences, **HAB** - skills.

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IV.-Contents

IV.A.-Syllabus

1. General considerations: Life cycle, acquisition, maintenance.
2. Image acquisition systems: Sensors, instrumentation, image reconstruction.
- Conventional Radiology (X-Rays)
- Computerized Tomography (CT)
- Positron Emission Tomography (PET)
- Magnetic Resonance Imaging (MRI)
- Ultrasound imaging (US)
- Hybrid imaging systems: PET/CT, PET/MR and MRgFUS
- Image-guided interventionism

3. Signal acquisition systems: Sensors, instrumentation.
- Amplifiers
- Filters
- Electrocardiography (ECG)
- Electroencephalography (EEG)
- Electromyography (EMG)

4. Equipment for treatment and therapy.
- Equipment for treatment of cardiac dysfunctions. Pacemakers, implantable defibrillators.
- Equipment for the treatment of cancer. Radiation therapy equipment.

IV.B.-Training activities

Type	Title
Resolution of exercises, problems, case studies	Solving exercises and design problems in the classrom
Experimental and/or technological laboratories	Practical biomedical equipment design and operation
Theoretical sessions	Master class

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V.-Student workload	
Theoretical sessions	30
Resolution of exercises, problems, case studies, etc.	11
Practical sessions in experimental, technological and clinical laboratories, fieldwork, etc.	16
Tests and/or exams	3
Academic tutorials	32
Related activities: conferences, seminars, etc.	16
Preparation of theoretical sessions and self-study	30
Preparation of practical tasks, exercises, case studies, projects, etc.	20
Preparation for tests and/or exams	22
Total student workload	180

VI.-Methodology and academic programme

Type	Period	Content
Tests and/or exams	Week 9 to Week 16	Midterm and final exams. These activities are always in-person on-site, with a midterm exam in the middle of the course and a final exam at the designated date.
Experimental and/or technological laboratories	Week 4 to Week 16	Design, implementation, and operation of biomedical equipment in the laboratory. These activities are always in-person on-site, including a report submitted through Aula Virtual for each one of the four practical lab sessions.
Theoretical sessions	Week 1 to Week 1	Course introduction, explaining the information on the course guide.
Academic tutorials	Week 1 to Week 16	Clarification of doubts and in-depth analysis of select topics.
Theoretical sessions	Week 1 to Week 16	In-depth explanation of all course topics in-person and synchronous with the assigned class time. Material will be provided through Aula Virtual to facilitate understanding.

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VII.-Assessment methods

The general assessment method is continuous as established in the *Regulation for the Assessment of Learning Outcomes* of Rey Juan Carlos University.
All the assessment systems established in the degree report must be employed, except for those that have a minimum weight of 0%, which can be used by professors in the academic years they consider relevant. Each assessment system may be applied through one or more assessment activities, consistent with the system. No assessment activity can exceed individually 60% of the overall grade for the subject.
The sum of non re-evaluable activities cannot exceed 40% of the overall grade for the subject and, in general, should not have an established minimum grade (except for practical activities in which, strictly speaking, the conditions of the ordinary call cannot be reproduced in the extraordinary call).
Those students who do not manage to pass the subject in the ordinary call, or do not attend this first call, may attend the extraordinary call only for failed re-evaluable assessment activities.
The distribution and characteristics of the assessment activities are described below.

VII.A.-Description and weight of the assessment activities

The course consists of theoretical classes, exercises, and laboratory practical sessions. The evaluation will be the following:

Laboratory practical sessions:
- Represent **40% of the grade** which could be obtained by delivering scientific-technical documents that will account for **30% of the grade** (10% + 10% +10%) and a video presentation that will count for **10% of the grade**. Attendance is **mandatory**, and labs **cannot be re-evaluated**.

Written exams:
Ordinary call:
- Midterm exam (imaging biomedical equipment block 1) in November that represents **30% of the grade**.
- Final exam (imaging biomedical equipment block 2 and design block) in January/February that represents **30% of the grade**.
- To pass the course, it is necessary to obtain at least **5 out of 10** on each of the blocks.

Extraordinary call:
- The written exams **are re-evaluable**, by means of an exam that will represent **60% of the grade**.
- This exam will be divided into equivalent blocks of the midterm (30%) and final (30%).
- It's only necessary to re-take the exam blocks that were not passed during the ordinary call.

Advanced call:
- The written exams **are re-evaluable**, by means of an exam that will represent **60% of the grade**.
- This exam will be divided into equivalent blocks of the midterm (30%) and final (30%).
- The lab practical sessions must be delivered individually before the date of the advanced call exam and will account for **30% of the final grade**.

Artificial intelligence-based tools can enhance the learning experience, but they must be used in an ethical, legal, honest, and transparent manner. For this reason, the recommendations for appropriate use provided by the course instructors must be followed.

VII.B. Assessment of students with academic exemption from class attendance

Having Academic Exemption from Class Attendance (DAAC) does not imply that students are automatically exempt from participating in the continuous assessment activities or in the training activities of compulsory attendance as established in the teaching guide. Once the exemption has been granted, students must contact the subject's teaching staff, who will propose the adaptations he/she may consider relevant, as long as they guarantee the acquisition and adequate assessment of the learning goals established. Students must maintain adequate communication with the teaching staff so that they may provide information on the dates for training and assessment activities, if these are not established in the programme and available for students at the time of achieving the exemption.
Subject with possibility of academic exemption: Yes.

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VII.C. Review of assessment activities

In accordance with the Regulation for the Assessment of Learning Outcomes of Rey Juan Carlos University.

VII.D.-Students with a disability or special educational needs

In order to guarantee equal opportunities, non-discrimination, universal accessibility and academic success, students with disabilities or especial education needs may request curricular adaptations to follow their studies. These adaptations will be provided by the Unit of Attention to People with Disabilities of Rey Juan Carlos University, in accordance with the regulation which regulates the service for the Attention of People with Disabilities at the University. This Unit will issue a report for curricular adaptations, so that students with disabilities or special education needs must contact the service (at e-mail discapacidad.programa@urjc.es) in order to provide relevant information for different educational alternatives.

VII.E.-Academic behaviour, academic integrity and honesty

Rey Juan Carlos University is fully committed to the highest standards of academic integrity and honesty, so studying at the URJC means assuming and subscribing to the values of integrity and academic honesty set out in the University's Ethical Code. To support this process, the University has Rey Juan Carlos University's Academic Conduct Regulation as well as different tools (anti-plagiarism, supervision...) that offer a collective guarantee for the full development of these essential values.

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VIII.-Teaching resources and materials
Basic bibliography
Webb A. G. Principles of biomedical instrumentation. Cambridge University Press, 2018.
Gómez Blanco A., Añón Gómez L. El equipamento electromédico. Gestión y buenas prácticas de mantenimineto para la seguridad del paciente. Asociación Española de Ingeniería Hospitalaria, 2015.
Suetens P. Fundamentals ofmedical imaging. Cambridge University Press, 2017.
Consultation bibliography

IX.-Professors	
Name and surname	ÁNGEL TORRADO CARVAJAL
E-mail address	angel.torrado@urjc.es
Department	Matemática Aplicada, Ciencia e Ingeniería de los Materiales y Tecnología Electrónica
Campus	Fuenlabrada
Category	Titular de Universidad
Academic degree	Doctor
Person responsible for the subject	No
Tutorial timetable	Para consultar las tutorias póngase en contacto con el/la profesor/a a través de correo electrónico
Number of quinquennia	1
Number of sexennia	2
No. of positive evaluations by Docentia	2
Name and surname	BLANCA RODRÍGUEZ GONZÁLEZ
E-mail address	blanca.rodriguez@urjc.es
Campus	Fuenlabrada
Category	Investigador
Person responsible for the subject	No
Tutorial timetable	Para consultar las tutorias póngase en contacto con el/la profesor/a a través de correo electrónico
Number of quinquennia	0
Number of sexennia	0

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No. of positive evaluations by Docentia	0
Name and surname	EVA MILARA HERNANDO
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Department	Teoría de la Señal y Comunicaciones y Sistemas Telemáticos y Computación
Campus	Fuenlabrada
Category	Profesor/a Ayudante Doctor/a
Academic degree	Doctor
Person responsible for the subject	No
Tutorial timetable	Para consultar las tutorias póngase en contacto con el/la profesor/a a través de correo electrónico
Number of quinquennia	0
Number of sexennia	0
No. of positive evaluations by Docentia	0
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Campus	Fuenlabrada
Category	Profesor/a Asociado/a
Person responsible for the subject	No
Tutorial timetable	Para consultar las tutorias póngase en contacto con el/la profesor/a a través de correo electrónico
Number of quinquennia	1
Number of sexennia	0
No. of positive evaluations by Docentia	0
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