Universidad Rey Juan Carlos

# TEACHING GUIDE

# HOSPITAL ENGINEERING

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

## ACADEMIC YEAR 2026-27

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| I.-Subject Identification | |
|---|---|
| **Type** | OBLIGATORIA |
| **Teaching period** | 3 course, 2Q semester |
| **Nº of credits** | 6 |
| **Language in wich the subject is taught** | English |

## II.-Presentation

The main objectives of the Hospital Engineering course are as follows:

- To know how a hospital works from the biomedical engineer's perspective.
- To understand the operation of electrical installations, air conditioning, thermal fluids, medical gases, communications, etc, as well as the safety and environmental management of a hospital, and the tools to offer solutions for this type of installations.

It is **recommended** to have some knowledge related to the **Biomedical Equipment** course (third year, first semester).

## III.-Learning outcomes

CG01 . Analyze and synthesize problems related to biomedical engineering, solve them and communicate them efficiently.
CG05. Know the rules, regulations and legislation in force, and apply them in biomedical engineering projects.
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.
CB4 . That students are able to transmit information, ideas, problems and solutions to both specialized and non-specialized audience.
CE24. Know and apply basic elements of economics and human resource management, project organization and planning, as well as legislation, regulation and standardization in the health sector.
CE34. Analyze and understand the operation of a hospital's electrical, heating, fluid, access, safety and environmental management facilities and their impact on the systems and services run by the biomedical engineer.

- 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

**Block I: Hospital operation**

- Unit 1. Introduction to the health system. Hospitals and their management frameworks.
- Unit 2. Hospital typology and morphology. Portfolio of services. Equipment.
- Unit 3. Introduction to management and contracting: State contract law, elaboration of technical specifications, management of human resources.
- Unit 4. Hospital engineering. Hospital design.

**Block II: Hospital facilities**

- Unit 5. Hospital facilities: Air conditioning, electrical installations, lighting, thermal fluids, fire protection, medical gases, communications and data processing centers.

**Block III: Efficiency, quality, environment and safety in hospitals**

- Unit 6: Efficiency in hospitals: Efficiency related to energy, design and construction, healthcare processes, maintenance and waste management.
- Unit 7: Quality, environment and safety in hospitals.

### IV.B.-Training activities

| Type | Title |
|---|---|
| Practical sessions | AF7. Application of the course contents to a specific biomedical equipment in a realistic scenario. |
| Practical sessions | AF7. Session: Biomedical engineer - Their role in the hospital. |
| Test and/or exams | AF5. Exams of the course contents. |
| Other activities | AF2. On-site or online tutorials. The tutoring sessions may be individual or group, and may be open or directed by the teacher to ensure the treatment of some specific questions. |
| Other activities | AF3. Preparation of lectures. |
| Lectures | AF1. Lectures about course contents. |
| Practical sessions | AF7. Resolution of exercises related to the design of the facilities explained in lectures. |
| Other activities | AF9. Preparation of practical sessions. |
| Other activities | AF4. Preparation of exams. |

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| V.-Student workload | |
|---|---|
| Theoretical sessions | 37 |
| Resolution of exercises, problems, case studies, etc. | 20 |
| Practical sessions in experimental, technological and clinical laboratories, fieldwork, etc. | 0 |
| Tests and/or exams | 3 |
| Academic tutorials | 18 |
| Related activities: conferences, seminars, etc. | 30 |
| Preparation of theoretical sessions and self-study | 12 |
| Preparation of practical tasks, exercises, case studies, projects, etc. | 30 |
| Preparation for tests and/or exams | 30 |
| Total student workload | 180 |

**VI.-Methodology and academic programme**

| Type | Period | Content |
|---|---|---|
| Theoretical sessions | Week 1 to Week 14 | MD1. In-depth explanation of all course units. Sessions are on site and synchronous with the course timetable. Materials will be provided through the Virtual Classroom to facilitate its followup (for example, presentations used in lectures that include links to complementary materials). |
| Practical sessions | Week 1 to Week 14 | MD2. Resolution of exercises related to the design of the installations explained in the lectures. Sessions are on site and synchronous with the course timetable. Materials will be provided through the Virtual Classroom. |
| Practical sessions | Week 13 to Week 15 | MD5. Students will participate in the "Biomedical engineer - Their role in the hospital" session where several biomedical engineers will explain their relationship with hospitals. This activity is on site and the teachers will try that the activity is synchronous with the course timetable. |

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| | | |
|---|---|---|
| Tests and/or exams | Week 7 to Week 16 | Partial exam and final exam. These activities will always be on site, having a partial exam (units 1-4, also including some facilities of unit 5; mid-term, synchronized with the course timetable) and a final exam (rest of the course contents, date established for the official ordinary period of exams). Week 16 refers to that of the ordinary exam. |
| Academic tutorials | Week 1 to Week 16 | On-site or online (Microsoft Teams) tutorials to solve doubts. Appointments will be previously arranged with the teacher. Week 16 refers to that of the ordinary exam. |
| Practical sessions | Week 4 to Week 15 | MD5. Project applying course contents for a specific biomedical equipment in a realistic scenario. This activity (six sessions) are on site and synchronous with the course timetable (compulsory attendance, confirmed by name check-off sheet). Search for information to carry out this activity may include visits to hospital services (agreed by students). This activity includes a delivery (final report uploaded to the Virtual Classroom) and a on-site defense (presentation). This is a group activity, not allowing individual works. |

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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.<br>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.<br>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).<br>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.<br>The distribution and characteristics of the assessment activities are described below. |
| **VII.A.-Description and weight of the assessment activities** |

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**Assessment activities**

- Written exam, theoretical-practical (SE2) – Character: Individual – Modality: On site – Type: Re-evaluated – Minimum grade: 5 – Weighting: 35% – Period: Week 7-8 – Content: Partial exam: Units 1-4, also including some facilities of unit 5.
- Preparation of report and presentation (SE1) – Character: Group – Modality: On site (compulsory) – Type: Re-evaluated – Minimum grade: 5 – Weighting: 30% where report (20%) and presentation (10%) – Period: From week 3 to week 15 (6 sessions) – Content: Application of the course contents to a specific biomedical equipment in a realistic scenario.
- Written exam, theoretical-practical (SE2) – Character: Individual – Modality: On site – Type: Re-evaluated – Minimum grade: 5 – Weighting: 35% – Period: Official ordinary period of exams – Content: Final exam: Unit 5 (rest of facilities) and units 6-7.

Notes:

- SE (assessment system) indicated in the course file in the verified degree report.
- Assessment activities can be carried out online just in online degrees.
- Weightings must add up to 100%.

**Continuous ordinary assessment**

- The **final grade** is calculated as the **weighted average** of the grades of the assessment activities described above according to the indicated weighting.
- If the weighted average is equal to 5 or higher than 5 but any of the assessment activities has not been passed with the required minimum grade, the final grade of the course will be 4.9 (**Fail**).
- If the student has not submitted any of the assessment activities of the ordinary assessment, the final grade will be 0 (**Fail**).
- If none of the assessment activities has been presented, the final grade will be "**Not presented**".

**Extraordinary assessment**

- In the extraordinary assessment, students will only take the re-evaluation of the non-passed assessment activities. The final grade in the extraordinary assessment is calculated as indicated in the previous section with the grade of the activities passed in the ordinary assessment and the grade of the re-evaluated assessment activities.
- For the re-evaluation of the activity related to the application of the course contents to a specific biomedical equipment, a deadline to be determined within the extraordinary assessment period will be planned.
- The re-evaluation of the exam will take place on the official date indicated for the extraordinary assessment.

**Early assessment**

- Same evaluation method as for the extraordinary assessment is used for the early assessment.

**Academic behaviour**

- In the case of **academic fraud** in any of the assessment activities, a grade of zero points will be graded for that activity, which for those assessment activities with a minimum grade higher than zero implies failing in the corresponding assessment (ordinary or extraordinary).
- The use of **generative artificial intelligence (Gen-AI)** in an evaluation activity can lead to reduction of the grade for that activity.

**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.

**VII.C. Review of assessment activities**

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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** |
| **Miguel Mediavilla et al. Logística sanitaria: Retos y nuevas tendencias. Pirámide (2014).** *https://brain.urjc.es/primo-explore/fulldisplay?docid=34URJC_ALMA21113356650004216&context=L&vid=34URJC_VU1&lang=es_ES&search_scope=TAB1_SCOPE1&adaptor=Local%20Search%20Engine&tab=tab1&query=any,contains,Log%C3%ADstica%20Sanitaria&offset=0*<br><br>**Gestión y mantenimiento del equipamiento electromédico.** Colegio Oficial de Ingenieros Industriales de Madrid. *https://portal.coiim.es/app/uploads/2022/06/Guia-de-gestion-y-mantenimiento-de-equipamiento-electromedico.pdf*<br><br>**Guía de gestión y mantenimiento de instalaciones hospitalarias.** Colegio Oficial de Ingenieros Industriales de Madrid. *https://portal.coiim.es/app/uploads/2023/01/20210920_Guia_Gestion_Mantenimiento_Instalaciones_Hospitalarias.pdf* |
| **Consultation bibliography** |
| Real Decreto 314/2006, de 17 de marzo, por el que se aprueba el **Código Técnico de la Edificación.** *https://www.boe.es/buscar/doc.php?id=BOE-A-2006-5515*<br><br>Real Decreto 1027/2007, de 20 de julio, por el que se aprueba el **Reglamento de Instalaciones Térmicas en los Edificios.** *https://www.boe.es/buscar/doc.php?id=BOE-A-2007-15820*<br><br>Real Decreto 842/2002, de 2 de agosto, por el que se aprueba el **Reglamento Electrotécnico para Baja Tensión.** *https://www.boe.es/buscar/doc.php?id=BOE-A-2002-18099*<br><br>**Guía técnica de eficiencia energética en iluminación. Hospitales y centros de atención primaria.** *https://www.idae.es/sites/default/files/documentos/publicaciones_idae/guia_eficiencia_energetica_en_hospitales.pdf*<br><br>Real Decreto 513/2017, de 22 de mayo, por el que se aprueba el **Reglamento de Instalaciones de Protección Contra Incendios.** *https://www.boe.es/diario_boe/txt.php?id=BOE-A-2017-6606*<br><br>Real Decreto 1800/2003, de 26 de diciembre, por el que se regulan los **gases medicinales.** *https://www.boe.es/buscar/doc.php?id=BOE-A-2004-617*<br><br>Decreto 83/1999, de 3 de junio, por el que se regulan las **actividades de producción y de gestión de los residuos biosanitarios y citotóxicos en la Comunidad de Madrid.** *https://gestiona.comunidad.madrid/wleg_pub/secure/normativas/contenidoNormativa.jsf?opcion=VerHtml&nmnorma=1308#no-back-button*<br><br>UNE 179003:2013: **Servicios sanitarios. Gestión de riesgos para la seguridad del paciente.** *https://www.une.org/encuentra-tu-norma/busca-tu-norma/norma?c=N0051018* |

| IX.-Professors | |
|---|---|
| **Name and surname** | BORJA RODRÍGUEZ VILA |
| **E-mail address** | borja.rodriguez.vila@urjc.es |
| **Department** | Matemática Aplicada, Ciencia e Ingeniería de los Materiales y Tecnología Electrónica |
| **Campus** | Fuenlabrada |
| **Category** | Titular de Universidad |

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| | |
|---|---|
| **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** | 1 |
| | |
| **Name and surname** | SYDNEY NICOLE WILLIAMS |
| **E-mail address** | sydney.williams@urjc.es |
| **Department** | Matemática Aplicada, Ciencia e Ingeniería de los Materiales y Tecnología Electrónica |
| **Campus** | Fuenlabrada |
| **Category** | Profesor/a Ayudante Doctor/a |
| **Academic degree** | Doctor |
| **Person responsible for the subject** | Yes |
| **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** | 1 |
| **No. of positive evaluations by Docentia** | 0 |
| | |
| **Name and surname** | VERÓNICA GARCÍA VÁZQUEZ |
| **E-mail address** | veronica.gvazquez@urjc.es |
| **Department** | Matemática Aplicada, Ciencia e Ingeniería de los Materiales y Tecnología Electrónica |
| **Campus** | Fuenlabrada |
| **Category** | Profesor/a Permanente Laboral |
| **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 |

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|---|---|
| **Number of quinquennia** | 1 |
| **Number of sexennia** | 3 |
| **No. of positive evaluations by Docentia** | 0 |

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