Universidad Rey Juan Carlos

# TEACHING GUIDE

# Discrete Time Systems

## GRADO EN INGENIERÍA BIOMÉDICA (INGLÉS) (1º y 2º curso) (2384)

## ACADEMIC YEAR 2026-27

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

## II.-Presentation

The general objective of this subject is to describe the characteristics of the main diseases that affect the different organs and systems of the human body. Basic knowledge will be provided on the causes of the different diseases (etiology), the lesions they cause (pathogenesis), the physiological changes that appear (pathophysiology), the symptoms and the signs that are derived from it and that allow suspecting a disease and, In most cases, the main methods to confirm a medical diagnosis based on the physiopathology of the disease as well as sometimes notions about the general measures of treatment and prevention. The aim is that students understand the principles of physiopathology necessary to identify the most appropriate processing technologies for a given problem in biomedical engineering. This subject has 2 modules: General Pathology and Rehabilitation Technology

## III.-Learning outcomes

CG01 . Analyze and synthesize problems related to biomedical engineering, solve them and communicate them efficiently.
CB5 . That students have developed the learning skills needed to undertake further studies with a considerable degree of autonomy.
CE01 . Understand or acquire the principles of bioelectrical fundamentals, anatomy, physiology or pathophysiology needed to identify the most appropriate processing technologies for a given problem in biomedical engineering

- 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

**A. SECTION. GENERAL PATHOLOGY**

* Introduction to Medical-Surgical Pathology. Pathology concept. Health and sickness. The diagnostic process: the Clinical History and the physical examination. The usefulness of diagnostic tests, basic concepts of epidemiology applied to diagnosis.
* Clinical approach to the patient with cardiovascular disease.
* Cardiovascular prevention. Atherosclerosis. Hypertension. Systems for measuring blood pressure. Ischemic heart disease: chronic angina, acute coronary syndrome. Arrhythmias. Syncope.The Electrocardiogram. Valvulopathies. Heart failure: concepts and diagnosis.
* Respiratory infections: Chronic obstructive pulmonary disease. Asthma. Respiratory failure. Pleural pathology (pneumothorax, pleural effusion). Ventilation disorders. Sleep apnea syndrome. Polysomnography.
* Clinical approach to the patient with neurological disease. Epileptic crisis. Epilepsy. Cerebrovascular disease. Alzheimer's disease and other dementias. Parkinson's disease and other movement disorders. Demyelinating and motor neuron diseases. Diseases of the neuromuscular junction and muscles. Diseases of the peripheral nervous system.
* Osteoarthritis. Osteoporosis. Arthritis by microcrystals. Inflammatory arthritis. Lupus. Autoimmune diseases.
* Clinical approach to the patient with digestive system disease. Dysphagia. Gastroesophageal reflux. Gastritis. Peptic ulcer. Disorders of intestinal motility: diarrhea. Acute and chronic hepatitis. Diseases of the pancreas and the bile duct.
* Endocrinology diseases: Diabetes mellitus. Thyroid diseases. Nutrition disorders: malnutrition and obesity.
* Clinical approach to patients with kidney and urinary tract disease. Renal syndromes. Acute and chronic renal failure, concepts. Urinary tract disease. Nephritic colic. Obstructive uropathy. Urinary infection.
* Hematological alterations and main syndromes.
* Cancer. General Principles: chemotherapy, surgery, radiotherapy.
* General principles of infectious diseases and their treatment.

**B. SECTION: PRACTICAL CONTENT**

Students will do group work and prepare a presentation. The topics will be chosen by the teachers and have relation to technological advances related to different areas of Medicine.
As a guide, these topics are included, although they may vary:
1. Tools to help medical diagnosis through artificial intelligence (AI).
2. Wereable cardiovascular measurements (eg the Apple Watch electrocardiogram).
3. How to manage the next pandemic
4. Fans. Main parts and minimum sensors for operation.
5. Fundamentals and usefulness of functional brain magnetic resonance imaging.
6. Organ transplant.
7. “Second look” endoscopies, Use of AI in endoscopic techniques.
8. Capillary blood glucose sensors and insulin pumps.
9. Parts of a dialysis system and possibilities for improvement in them.
10. Nanorobots against cancer.
11. Artificial intelligence (AI) for the interpretation of clinical analyses.
12. Update on vaccines with m-RNA technique

**C. SECTION: REHABILITATION TECHNOLOGY**

**Theoretical content**

1. Disability and bioengineering.
2. Universal accessibility, assistive devices, and technical aids.
3. Diagnostic technologies in rehabilitation.
4. Robotics in rehabilitation: applications in the upper and lower extremities.
5. Virtual reality, video games, and telerehabilitation programs in rehabilitation.
6. Functional electrostimulation.
7. Brain-machine interfaces.

**Practical content**

1. Laboratories of Movement Analysis and Motor Control in Rehabilitation:

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- Kinematic, kinetic, and surface electromyography assessment systems.
- Computerized dynamic posturography.
- Instrumental muscle strength assessment systems.

**IV.B.-Training activities**

| **Type** | **Title** |
|---|---|
| Lectures | Master classes by the teacher |
| Oral presentations | CASP practical exercise |
| Group work | Work in groups of 3-4 students related to the different thematic blocks, preparation of presentation in power point |

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| V.-Student workload | |
|---|---|
| Theoretical sessions | 50 |
| Resolution of exercises, problems, case studies, etc. | 0 |
| Practical sessions in experimental, technological and clinical laboratories, fieldwork, etc. | 9 |
| Tests and/or exams | 1 |
| Academic tutorials | 24 |
| Related activities: conferences, seminars, etc. | 24 |
| Preparation of theoretical sessions and self-study | 40 |
| Preparation of practical tasks, exercises, case studies, projects, etc. | 14 |
| Preparation for tests and/or exams | 18 |
| Total student workload | 180 |

**VI.-Methodology and academic programme**

| Type | Period | Content |
|---|---|---|
| Practical sessions | Week 15 to Week 30 | Laboratories of Movement Analysis and Motor Control in Rehabilitation |
| Theoretical sessions | Week 15 to Week 30 | Critical appraisal of a scientific article |
| Theoretical sessions | Week 15 to Week 30 | Working group and presentation. The teachers will assign the topic of the work and the members of each group. The students will have support tutoring for its elaboration. |

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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

**DESCRIPTION OF THE TESTS FOR ASSESSMENT AND THEIR WEIGHTS**

**1. Theoretical Content (60%)**

The evaluation will be done by means of a multiple-choice test (single correct item) without penalty for failure, with a pass mark for 60% of the correct answers. The minimum grade required to pass the test is 5 (equivalent to 60% of the correct answers). An average grade on the written test lower than 5 will prevent obtaining the final grade. Approving the exam is a necessary condition to be able to pass the subject (85% of the questions will be general pathology and 15% rehabilitation).

**2. Working Group (40%)**

The grades obtained in the three extra assignments (one in groups and one individual) will be added to the exam grade to obtain the final score. It is mandatory to present both works to pass the subject. The delivery date of the work will be indicated at the beginning of the semester. Exceptional circumstances will be considered by the teacher in case the student is absent (in such cases the student should deliver the work on another date established by the teacher).
In the tutorials, you can consult all the doubts that arise regarding the approach and development of the group work and regarding the scientific article chosen for the individual work.

*2.1 Group work (30%)*

The work associated with each topic will be carried out in groups of 3-5 students and are mandatory. The final grade can be consulted in the tutorials with the assigned tutor. The teachers will choose the topics for the group work and assign the members of each group. They will be sent to each tutor (length no larger than four Word sides) and will be presented in class.

*2.2. Individual work (10%)*

Its presentation is mandatory. They will be sent to the tutor. Reading, summary, and critical comment on a scientific article on Medicine or Biomedical Technology. It is necessary to attend class and be guided by the teacher responsible for this thematic block. The teacher will select a scientific article and the student will analyze it, following a critical appraisal guideline established by the teacher. This work will be presented in class by the student and the assignment will be sent to the teacher.
Taking into account Article 19.11 of the “URJC Learning Results Evaluation Regulations” contemplates the possibility of a Call for Advance Evaluation that in any case will follow the same criteria as the general call.

It is highly recommended to attend class and be guided by the teacher responsible for each thematic block. Each topic has been worked on by the teacher who teaches it. A great synthesis effort has been developed to summarize the medical pathology and apply it to the Degree in Biomedical Engineering. Therefore, although the student can rely on the bibliography that is recommended, it is essential that you specifically attend to what the teacher selects and determines as important and which is reflected in the development of the class, without failing to ask any questions that may arise.

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

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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**

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** |
| **GENERAL PATHOLOGY MODULE**<br>-Sisinio De Castro. Manual De Patología General. Jose Luis Perez Arellano. 2013. Isbn: 9788445825112<br>-SERIE. Cursho Crash de Mosby. Lo esencial en... Diferentes Autores. ElSEVIER.<br>-Manual Oxford de Medicina Interna Wilkinson, I. —Raine, T. —Wiles, K. —Goodhart, A. —Hall, C. —O'Neill, H.ISBN-13: 9788478856312. AULA MÉDICA. Julio / 2018. 10ª Edición. Español<br>-HARRISON Manual de Medicina. Kasper, D. —Fauci, A. —Hauser, S. —Longo, D. —Jameson, J. —Loscalzo, J. ISBN-13: 9786071514875. MCGRAW HILL. Agosto / 2020. 20ª Edición Español<br>-Farreras. Medicina Interna. Rozman C. —Cardellach F. ISBN: 9788491135456. ELSEVIER. Mayo / 2020 19ª Edición Español<br>-García Conde. Patología General: Semiología Clínica y Fisiopatología. Merino Sanchez J. —González Macías J. ISBN-13: 9788448605506. Mcgraw Hill. December 2006<br>**MODULE REHABILITATION**<br>-Cano-de la Cuerda R, Collado S [eds]. Neurorrehabilitación. Métodos específicos de valoración y tratamiento. Panamericana: Madrid; 2012. ISBN: 9788498354102<br>-Cano-de la Cuerda R, Martínez RM, Miangolarra JC [eds]. Control y Aprendizaje Motor. Fundamentos, desarrollo y reeducación del movimiento humano. Panamericana: Madrid; 2016. ISBN: 9788498353631.<br>-Cano-de la Cuerda R [eds]. Nuevas tecnologías en Neurorrehabilitación. Aplicaciones diagnósticas y terapéuticas. Panamericana: Madrid; 2018. ISBN: 978-84-9110-239-7.<br>-Molina F, Carratalá M [eds]. La Marcha Humana: Biomecánica, evaluación y patología. Panamericana: Madrid; 2020. ISBN: 9788491104056. |
| **Consultation bibliography** |

| IX.-Professors | |
|---|---|
| **Name and surname** | DIEGO FERNÁNDEZ VÁZQUEZ |
| **E-mail address** | diego.fernandez@urjc.es |
| **Department** | Fisioterapia, Terapia Ocupacional, Rehabilitación y Medicina Física |
| **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** | 1 |
| | |
| **Name and surname** | LEANDRO PEDRO CASTRO BOURNISSEN |

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| | |
|---|---|
| **E-mail address** | leandropedro.castro@urjc.es |
| **Department** | Especialidades Médicas y Salud Pública |
| **Campus** | Fuenlabrada |
| **Category** | Profesor/a Asociado/a CC Salud (Vinc.) |
| **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 |
| | |
| **Name and surname** | MARÍA DOLORES GOR GARCÍA FOGEDA |
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| **Department** | Fisioterapia, Terapia Ocupacional, Rehabilitación y Medicina Física |
| **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** | 1 |
| | |
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| **Department** | Especialidades Médicas y Salud Pública |
| **Campus** | Fuenlabrada |
| **Category** | Profesor/a Asociado/a |
| **Academic degree** | Doctor |

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| **Person responsible for the subject** | No |
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