Universidad Rey Juan Carlos

# TEACHING GUIDE

# PHYSIOLOGICAL SIGNALS PROCESSING

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

## ACADEMIC YEAR 2026-27

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| I.-Subject Identification | |
|---|---|
| **Type** | FORMACIÓN BÁSICA |
| **Teaching period** | 1 course, 1Q semester |
| **Nº of credits** | 6 |
| **Language in wich the subject is taught** | English |

## II.-Presentation

The main contents of this subject are Classical Dynamics and Fluid Mechanics. The main goal of "Physics" is to make the student become familiar with the basic principles, laws and methodologies of Physics. In addition, "Physics" aims to provide the students with a good understanding on how to apply these principles to the different fields that they will study along the degree. Finally, the student will familiarise with laboratory activities, by carrying out different experiments, measuring different physical magnitudes and analysing their different governing laws. The basic knowledges required for this subject are the ones adquired in Physics and Mathematics during high school.

*ATTENTION: INDICATIONS REGARDING THE SUBJECT'S EVALUATION SYSTEM ADDRESSED TO STUDENTS COURSING THIS SUBJECT IN THE FUENLABRADA AND ALCORCÓN CAMPUSES: Students coursing the subject under 25% fee modality will be attending online lectures, delivered by the professor in charge of the 100% fee modality. Students from the extinguished degree taught in the Alcorcón Campus are allowed enroll in the Fuenlabrada Campus subject and attend regular lectures. Laboratory sessions will take place in the Fuenlabrada Campus (in person).*

## III.-Learning outcomes

COM16. Ability to identify, formulate and solve engineering problems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to recognise the importance of non-technical ¿societal, health and safety, environmental, economic and industrial ¿ constraints. (EURACE 2.2)
CON03. Understanding and mastery of basic concepts related to the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism, as well as their application to solving engineering problems
CON04. Understanding and mastery of basic concepts related to the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism, as well as their application to solving engineering problems.
CON20. Knowledge and understanding of the mathematics, computation and other basic sciences underlying their engineering specialisation, at a level necessary to achieve the other programme outcomes. (EURACE 1.1)
HAB17. Ability to analyse complex engineering products, processes and systems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to correctly interpret the outcomes of such analyses. (EU-RACE 2.1)

- 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

Lesson 1: Physical magnitudes and units. Vector analysis.
Lesson 2: Kinematics. Basic concepts and applications to different motions.
Lesson 3: Dynamics. Newton's Laws and applications. Linear and angular rmomentum.
Lesson 4: Work and Energy. Conservation of the Energy. Power. Conservative and Non-conservative forces. Applications.
Lesson 5: Dynamics of systems of particles. Systems of particles and rigid body. Momentum and Center of Mass. Central Forces. Second Newton's Law for the rigid body. Conservation of linear and angular momentum. Rotation and translation of a rigid body.
Lesson 6: Oscillations and waves. Simple harmonic motion in physical systems. Damped and forced oscillations. Applications. Resonances phenomena. Wave motion. Transversal and Longitudinal. Periodic waves. Interference: Standing waves.
Lesson 7: Fluid statics. Concept of density and pressure. Hydrostatic. Pressure in a static fluid. Pascal's Principle. Applications. Archimedes's Principle. Applications.
Lesson 8: Fluid Dynamics. Basic concepts. Equation of continuity. Equations of Euler and Bernoulli. Applications. Theorem of Torricelli. Venturi effect.
Lesson 9: Viscous fluids. Concepts of Viscosity. Non-Newtonian Fluids. Laminar and Turbulent regimes. Reynolds number. Boundary layer. Viscometers.

### IV.B.-Training activities

| Type | Title |
|---|---|
| Realización de Pruebas | Continous assesment. There will be one assesment test along the course (date will be defined by the teacher at the beginning of the course). |
| Practical sessions | The students will attend mandatory laboratories practical sessions. |
| Theoretical sessions | Theoretical lectures delivered by the teacher. |
| Resolution of exercises, problems, case studies | Problem solving in lectures. |

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| V.-Student workload | |
|---|---|
| Theoretical sessions | 30 |
| Resolution of exercises, problems, case studies, etc. | 12 |
| Practical sessions in experimental, technological and clinical laboratories, fieldwork, etc. | 14 |
| Tests and/or exams | 4 |
| Academic tutorials | 42 |
| Related activities: conferences, seminars, etc. | 6 |
| Preparation of theoretical sessions and self-study | 24 |
| Preparation of practical tasks, exercises, case studies, projects, etc. | 24 |
| Preparation for tests and/or exams | 24 |
| Total student workload | 180 |

**VI.-Methodology and academic programme**

| Type | Period | Content |
|---|---|---|
| Tests and/or exams | Week 1 to Week 15 | One written test, that will include all the contents explained since the course beginning. One final exam that will include all contents of the course, theoretical questions and exercises. Date of exam will be defined by ETSIT. |
| Group work | Week 1 to Week 15 | All topics and subjects conforming the course will be discussed as follow up of theory classes. |
| Resolution of exercises, problems, case studies | Week 1 to Week 15 | One practical lesson will be devoted to each main topic once the corresponding theoretical contents have been completed. |
| Experimental and/or technological laboratories | Week 1 to Week 15 | The students will be divided into two or three groups for the actual lab activities. Each individual will attend the lab practical sessions, carrying out several experiments, and will submit a lab report assigned by the teacher. |
| Academic tutorials | Week 1 to Week 15 | Six hours per week, detailed time schedule to be defined. |

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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

20% **Midterm Test**. Written test (theoretical questions and exercises). All contents previously explained in the classroom. Non-reassessable (No reevaluable).
20% **Laboratory report**. Written report of one of the experiments carried out in the laboratory sessions. Non-reassessable (No reevaluable). The laboratory report grade expires 5 years after its submission.
60% **Final Exam**. Written exam (theoretical questions and exercises). All contents of the subject. Reassessable (Reevaluable): there is a second opportunity in June.
The **final grade** is obtained according to the weights indicated above.
The necessary conditions to pass the subject are:
i) To attend in a satisfactory way all lab sessions and complete and submit the corresponding lab report
ii) To get a 4 over 10 in the final exam in first (ordinary) or second (extraordinary) convocation.
iii) To get a final grade is equal or bigger than 5.
**Evaluation in Early Convocation (Convocatoria Adelantada)**
Students requesting Early Convocation will have to contact the subject's responsible teacher as soon as possible, in order to receive the information and/or materials necessary for evaluation, which will be similar to those given to the students regularly enrolled in the subject.

### 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

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** |
| *Física General - Problemas*. Santiago Burbano De Ercilla and Enrique Burbano García. Mira Editores (2006). |
| *Física. Problemas y ejercicios resueltos*. Olga Alcaraz i Sendra, José López López and Vicente López Solanas. Prentice Hall/Pearson (2006). |
| *Princeton Problems in Physics with Solutions*. Nathan Newbury and John Ruhl. Princeton University Press (1991). |
| *Physics for Engineers and Scientists*. Volume 1. Hans C. Ohanian and John T. Markert. W. W. Norton & Company (2006). |
| *University Physics with Modern Physics*. Wolfgang Bauer and Gary Westfall. McGraw-Hill Education (2013). |
| *Physics for Scientists and Engineers*. Paul A. Tipler and Gene Mosca. W. H. Freeman (2007). |
| **Consultation bibliography** |
| *Physics in Biology and Medicine*. Paul Davidovits. Academic Press (2007). |

| IX.-Professors | |
|---|---|
| **Name and surname** | DAVID VALLE FERNÁNDEZ |
| **E-mail address** | david.valle@urjc.es |
| **Department** | Geología, Física y Química Inorgánica |
| **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** | JUAN IGNACIO ORTEGA PIWONKA |
| **E-mail address** | juanignacio.ortega@urjc.es |
| **Department** | Geología, Física y Química Inorgánica |
| **Campus** | Fuenlabrada |
| **Category** | Profesor/a Ayudante Doctor/a |
| **Academic degree** | Doctor |

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| **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** | 1 |
| **No. of positive evaluations by Docentia** | 1 |
| | |
| **Name and surname** | RODRIGO CRESPO MIGUEL |
| **E-mail address** | rodrigo.crespom@urjc.es |
| **Department** | Geología, Física y Química Inorgánica |
| **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 |
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