Universidad Rey Juan Carlos

GUÍA DOCENTE

LINEAR SYSTEMS AND CIRCUIT APPLICATIONS

(Extinción examen y tutorías)

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

CURSO 2026-27

Q2803011B UNIVERSIDAD REY JUAN CARLOS
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I.-Identificación de la Asignatura	
Tipo	OBLIGATORIA
Período de impartición	2 curso, 1Q semestre
Nº de créditos	6
Idioma en el que se imparte	Castellano

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II.-Presentación

To understand the nature of information in Information and Communication Technologies (ICT), it is necessary to understand, from a mathematical point of view, the physical properties of signals and systems. The first part of the subject Systems and Applications to Circuits offers an introduction to these concepts. It will be deepened in the description of signals and systems in the time domain and in the frequency domain, covering the concepts called continuous time, related on the one hand with a large number of physical systems, and on the other hand with the same analog technologies. In the second part of the subject the theory of circuits is introduced, which is a fundamental part in the training of an engineer and his knowledge and mastery is very useful in many other disciplines such as electronics and communications.
Previous knowledge: To take this subject it is necessary to have completed the subjects **Calculus** and **Algebra**. Especially, it is necessary for the student to master the algebra of complex numbers, the integration and derivation, the representation of functions and relationships and basic concepts of trigonometry. For the circuits part it is also recommendable to have notions of Electromagnetic Physics.

III.-Resultados de Aprendizaje

CG01 . Analyze and synthesize problems related to biomedical engineering, solve them and communicate them efficiently.
CG02. Use computational and experimental tools for the analysis and quantification of biomedical engineering problems
CE12. Analyze and control discrete and continuous time dynamic biomedical systems, both linear and non-linear
CE16. Understand the basic concepts of linear systems and related functions and transforms, theory of electrical circuits, electronic circuits, the physical principle of semiconductors and logic families, electronic devices, and their application to solve problems in biomedical engineering.

- Leyenda para las titulaciones no adaptadas al RD 822/21: **CB** - competencias básicas, **CG** - competencias generales, **CE** - competencias específicas, **CT** - competencias transversales.
- Leyenda para las titulaciones adaptadas al RD 822/21: **CON** - conocimientos, **COM** - competencias, **HAB** - habilidades.

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IV.-Contenido

IV.A.-Temario de la asignatura

Block I: Circuits

1. Circuits theory. Resistive circuits.

- Active and passive elements.
- Kirchhoff laws.
- Node voltage and mesh current methods.
- Thevenin and Norton equivalents.
- Maximum power transfer.
- Dependent sources and sources transformation.

2. Filters in time.

- Passive elements with memory.
- Circuital differential equations.

3. Sinusoidal permanent regime.

- Phasor.
- Passive elements in sinusoidal regime.
- Impedance and admittance.
- Phasorial analysis: Kirchhoff, Thevenin, Norton, nodal analysis, mesh analysis, etc.
- Power in sinusoidal permanente regime.

Block II: Signals and Systems

4. Continuous time signals.

- Signals properties.
- Fundamental operations.
- Basic signals.

5. Systems in continuous time.

- Sytems properties.
- Linear time invariant systems.
- Convolution. Properties.
- Interconnection.

6. Fourier Transform in continuous time.

- Complex exponentials and linear systems.
- Frequency response.
- Fourier series. Properties.
- Fourier Transform. Properties.

IV.B.-Actividades Formativas

Las actividades formativas de esta asignatura se adecúan al proceso de extinción de la titulación. El personal docente facilitará los materiales y/o bibliografía a través de Aula Virtual y programará (en Teams o presencialmente) las tutorías académicas grupales necesarias para resolución de problemas y dudas, prácticas y/o aclaración de contenidos que estime oportunas.

El personal docente puede programar otras actividades formativas auxiliares, si así lo estima oportuno, siguiendo las indicaciones dadas por los centros, si las hubiera. De ello se informa al alumnado a través de Aula Virtual al inicio del cuatrimestre.

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V.- Metodología

Las metodologías docentes se adecúan al proceso de extinción de la asignatura:

1. El personal docente programará (en Teams o presencialmente) tutorías académicas grupales necesarias para resolución de problemas y dudas, prácticas y/o aclaración de contenidos que estime oportunas.
2. El personal docente puede emplear otras metodologías docentes auxiliares, si así lo estima oportuno, siguiendo las indicaciones dadas por los centros, si las hubiera. De ello se informa al alumnado a través de Aula Virtual al inicio del cuatrimestre.

VI.- Método de evaluación

Los sistemas de evaluación se adecúan al proceso de extinción de la asignatura. Las actividades de evaluación mediante las que se desarrollan los sistemas de evaluación previstos en la memoria verificada del título se aplicarán de modo que el alumnado pueda atenderlas adecuadamente. Esta adecuación es la misma para todas las convocatorias de evaluación. Por tanto, las actividades de evaluación podrán programarse durante las convocatorias oficiales (ordinaria, extraordinaria y adelantada).

El uso de herramientas basadas en inteligencia artificial está prohibido en cualquier ejercicio y prueba de evaluación de la asignatura salvo que el profesor lo indique de forma explícita en el enunciado o en el material de esta. En caso de que esté permitido, se darán indicaciones precisas de qué usos están permitidos y cuáles no.

V.A.B.- Descripción de la metodología de las actividades de evaluación y su ponderación

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Los sistemas de evaluación aplicados en esta asignatura son los siguientes:

Assessment Activities					
Assessment System	Activity	Type	Minimum Score	Weight	Content
SE 2	Written Exam (**Ex1)**	Re-Assessable	4.5/10	40%	Theoretical and practical contents related to Block I: Circuit Applications
SE 2	Written Exam (**Ex2**)	Re-Assessable	4.5/10	40%	Theoretical and practical contents related to Block II: Signals and Systems
SE 5	Practice (**Pr1**)	No Re-Assessable	No	10 %	Preparation and Results of the practical contents related to Block I:Circuit Applications
SE 5	Practice (**Pr2**)	No Re-Assessable	No	10%	Preparation and Results of the practical contents related to Block II: Signal and Systems

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1) Ordinary Assessment

The midterm exam, covering the contents of Block 1 (**Ex1**), will take place midway through the semester. Students who obtain the minimum required score of **4.5 or higher in Ex1** will exempt Block 1 in both the ordinary and extraordinary assessment periods. If the minimum score is not achieved in **Ex1**, students will be given the opportunity to **retake Ex1 on the date of the ordinary assessment call**, in addition to taking the examination corresponding to Block 2 (**Ex2**).

The laboratory practices for Block 1 (**Pr1**) will take place around the middle of the semester, whereas those for Block 2 (**Pr2**) will be held at the end of the semester. Students repeating the course who have already passed the laboratory sessions in previous academic years will retain their most recent laboratory grade and will therefore not be required to complete them again

- In order to **pass the course** the student mark **must meet all** of the following **requirements**:
- **Ex1 >= 4.5** and **Ex2 >= 4.5** (i.e., reach the minimum grade of 4.5 in both partial exams)
- The **weighted grade for each block must be equal to or higher than half of the points assigned to them**, that is, **0.8*Ex1 + 0.2*Pr1 >= 5** and **Ex2 * 0.8 + Pr2 * 0.2 >= 5**.
- Only if these requirements are met, the **final grade (FG) of the course** will be calculated as follows: **FG = 0.4*Ex1 + 0.4*Ex2 + 0.1*Pr1 + 0.1*Pr2**
- **Only in this case**, **the student** is considered to have acquired the competencies associated with the subject, and **will be graded with pass, notable, outstanding, or honors** depending on the FG value.
- **Important considerations**:
- If **Ex1<4.5, Ex2<4.5 , 0.8*Ex1 + 0.2*Pr1 <5 or 0.8*Ex2 + 0.2*Pr2 <5**, **FG** will be the grade of **the lowest-scoring partial**

exam taken by the student.

- Students will be marked as **no-show** if they do **not attend Ex1 and Ex2** and do **not deliver Pr1 and Pr2**. **In all other cases**, if the marks obtained are below the minimum scores in Ex1, Ex2 or the block marks, **the student will be graded with a fail** according to the previous criteria.
- Deliveries corresponding to Block I (Pr1) and Block II (Pr2) are not re-assessable.
- The performance of the exams will be individual and with the absence of all external help except that expressly allowed by professors. Failure to comply with these rules will lead to fail in the call affected as well as to take pertinent actions established in the regulations of the university.
- In all the period of evaluation (including the revision of the exams and/or the deliveries), Professors can require an additional oral exam that can vary the final mark.

2) Extraordinary Assessment

- The method of evaluation of the extraordinary call will consist of the **attendance of the student to an exam of each of the blocks failed in the ordinary call** (that is, with a grade inferior to 5) and **that are re-assessable**: Block I Theory (Ex1), Block II theory (Ex2) or both (Ex1 and Ex2).
- Only in the cases in which a minimum mark of 4.5 is reached in Ex1 and Ex2, and the minimum mark of both blocks are reached, that is 0.8*Ex1 + 0.2*Pr1 >= 5 and 0.8*Ex2 + 0.2*Pr2 >= 5., the final grade of the extraordinary call will be calculated as in the ordinary call: FG = Ex1 * 0.4 + 0.4*Ex2 + 0.1*Pr1 + 0.1*Pr2.
- Students who passed a re-assessable part in the ordinary call and attend the extraordinary call to raise a grade, must know that **the latter grade will be taken into account for the weighting of the final grade**, no matter if it is inferior or failed.
- Students who passed the course in the ordinary call are not allowed to attend the extraordinary call to raise the grade.
- In the period of extraordinary evaluation, Professors can require an additional oral exam that can vary the final mark.

3) Deliveries assessment (No re-assessable)

- The **evaluation** of the practices (Pr1 and Pr2) will be carried out by taking into account the **preparation of the practical session and the produced deliveries**, which can be done **individually or in groups** depending on the number of students.
- For the delivery of the reports, a **delivery date will be set in advance**.
- **Reports** of practices **must be original** (it is not allowed the use of solutions made, totally or partially, by other people than those reflected in the authorship of the solution). Delivering solutions made, totally or partially, by other people than those reflected in the authorship of the solution would be considered and unloyal practice. The failure to comply with this rule will lead to failure of the subject as well as to take the actions established in the regulations on the university coexistence regime.
- Professors can ultimately decide to maintain the grades of the practices (Pr1 and Pr2) from previous courses or to carry out a new activity. The professor will anounce this decission in advance at the beginning of the course or of each theoretical block.

4) Early Call

- The assessment method for the early assessment period requires students to attend both written exams, **Ex1 and Ex2**, which cover the theoretical and practical contents of the course.
- **Grades for the practice deliveries Pr1 and Pr2 will be kept from the previous course**. If the **student did not follow the course** in the previous year, the **professor will have the right to decide** if **the** student has to provide a new delivery or any other **grading activity** (course, practical sesion, exercises, deliveries, oral exam...), **for each of the practices** individually.
- The student **must meet** the same **considerations** drawn for the **ordinary call** in order to pass the course, if so, the **final Grade** will be computed as in the ordinary call: **FG = 0.4*Ex1 + 0.4*Ex2 + 0.1*Pr1 + 0.1*Pr2**

5) Oral defense of the evaluation activities:

- If professors consider it appropriate, they may require from any student the oral defense of any of the tests/deliveries of the course.
- The result of the defense will be the ratification of the qualification obtained or a new rating different from the previous one.
- Failure to appear for said defense would imply a failure (grade = 1) in the required tests for defense.

V.C.- Revisión y reclamación de las actividades de evaluación

Se realizará conforme al Reglamento de evaluación de los resultados de aprendizaje de la Universidad Rey Juan Carlos.

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V.D.- Alumnado con discapacidad o necesidades educativas especiales

Con el fin de garantizar la igualdad de oportunidades, la no discriminación, la accesibilidad universal y la mayor garantía de éxito académico, las adaptaciones curriculares para alumnado con discapacidad o con necesidades educativas especiales serán pautadas por la Unidad de Atención a Personas con Discapacidad, de acuerdo con la normativa que regula el servicio de Atención a Estudiantes con Discapacidad, aprobada por Consejo de Gobierno de la Universidad Rey Juan Carlos.
Para que esas adaptaciones puedan realizarse, será requisito la emisión de un informe de adaptaciones curriculares por parte de dicha Unidad, por lo que el alumnado con discapacidad o necesidades educativas especiales deberán contactar con este servicio para analizar conjuntamente las distintas opciones.

V.E.- Conducta académica, integridad y honestidad académica

La Universidad Rey Juan Carlos está plenamente comprometida con los más altos estándares de integridad y honestidad académica, por lo que estudiar en la URJC supone asumir y suscribir los valores de integridad y la honestidad académica recogidos en el Código Ético de la Universidad.

Para acompañar este proceso, la Universidad dispone de la Normativa de Convivencia de la Universidad Rey Juan Carlos y de diferentes herramientas (antiplagio, supervisión) que ofrecen una garantía colectiva para el completo desarrollo de estos valores esenciales.

Las herramientas basadas en inteligencia artificial pueden mejorar la experiencia de aprendizaje, pero debe utilizarse de forma ética, legal, honesta y transparente. Por este motivo, deben seguirse las recomendaciones de uso adecuado indicadas por los docentes de la asignatura.

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VI.-Recursos y materiales didácticos

Bibliografía básica

Hayt, W. H., Kemmerly, J. E., & Durbin, S. M. (2003). *Engineering Circuit Analysis* (6a ed.). Mc Graw Hill

Nilsson, J. W., & Riedel, S. A. (2001). *Electric circuits*. Prentice Hall International

Thoma , R., & Rosa, A. (2002). *Circuits and Signals: Introduction to Linear and Interface Circuits* (2nd ed.). Ed. Reverté

Oppenheim, A. V., Willsky, A. S., & Nawab, S. H. (1997). *Signals & systems*. Prentice-Hall International

Bibliografía complementaria

VII.-Profesorado

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