Universidad Rey Juan Carlos

Q2803011B UNIVERSIDAD REY JUAN CARLOS
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TEACHING GUIDE

INFERENCE

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

ACADEMIC YEAR 2026-27

Publication date: 02-07-2026

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

II.-Presentation

The main objective of the Inference course is:

- To provide students with the ability to define inferential models to solve engineering problems with special emphasis on applications to biomedical problems.

Previous requirements & recommendations: It is recommended for the student to have coursed the subjects of Calculus, Algebra, Mathematical Methods of Bioengineering and Probability and Statistics, so that they possess knowledge about single variable real functions (limits, continuity, derivability), successions and function series, derivation, integration, calculation of primitives, vector spaces, linear applications, theory of probability and multivariate random variables. In order to facilitate the overcoming of the subject and reaching the formative goals the students are encouraged to read the contents of each lecture beforehand, the completion of the activities proposed in class and the resolution of problems proposed in the recommended bibliography. Finally, students may attend mentoring meetings with the teacher if necessary.

III.-Learning outcomes

CG02. Use computational and experimental tools for the analysis and quantification of biomedical engineering problems
CB1. Proven knowledge and understanding of an area of study based on general secondary education and at a level which, although supported by advanced text books, also includes certain aspects that imply knowledge from the forefront of the field of study.
CE02. Perform statistical analysis for the study, analysis and control of experiments and medical data.
CE03. Use state-of-the-art techniques in univariate and multivariate statistics, and rigorously propose new analyses in biomedical problems that cannot be addressed by standard methods of information analysis.

- 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

- **Unit 1.** Probability Distributions in Inference. Binomial, Normal, Poisson, Chi-square, t-distribution, F-distribution.
- **Unit 2.** Estimation. Point estimation. Interval estimation. Estimation for the Binomial and Poisson distribution. Likelihood function and maximum-likelihood estimation.
- **Unit 3.** Hypothesis testing. One sample inference (one-sided, two-sided). Two sample inference. Paired samples. Independent samples. Type I and II errors. Power of the test.
- **Unit 4.** Non-parametric methods. Sign test, Wilcoxon, Mann-Whitney U test.
- **Unit 5.** Categorical data. Difference of two proportions. Chi-square test. Fisher's exact test.
- **Unit 6.** Simple linear regression. Correlation coefficient. Regression analysis. Inference in linear regression. Introduction to multivariate regression.
- **Unit 7.** Analysis of variance. One-way ANOVA. ANOVA in linear regression.

IV.B.-Training activities

Type	Title
Theoretical sessions	Semanas 1-15
Resolution of exercises, problems, case studies	Semanas 1-15
Practical sessions	Semanas 1-15

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V.-Student workload	
Theoretical sessions	15
Resolution of exercises, problems, case studies, etc.	13
Practical sessions in experimental, technological and clinical laboratories, fieldwork, etc.	0
Tests and/or exams	2
Academic tutorials	24
Related activities: conferences, seminars, etc.	0
Preparation of theoretical sessions and self-study	12
Preparation of practical tasks, exercises, case studies, projects, etc.	12
Preparation for tests and/or exams	12
Total student workload	90

VI.-Methodology and academic programme

Type	Period	Content
Theoretical sessions	Week 1 to Week 1	Unit 0
Theoretical sessions	Week 2 to Week 2	Unit 1
Practical sessions	Week 3 to Week 3	Unit 1. Lab
Theoretical sessions	Week 4 to Week 4	Unit 2
Practical sessions	Week 5 to Week 5	Unit 2. Lab
Theoretical sessions	Week 6 to Week 7	Unit 3
Practical sessions	Week 8 to Week 8	Unit 3. Lab
Tests and/or exams	Week 9 to Week 9	Partial I
Theoretical sessions	Week 9 to Week 9	Unit 4
Theoretical sessions	Week 10 to Week 10	Unit 5
Practical sessions	Week 11 to Week 11	Unit 4, 5. Lab
Theoretical sessions	Week 12 to Week 12	Unit 6
Practical sessions	Week 13 to Week 13	Unit 6. Lab
Theoretical sessions	Week 14 to Week 14	Unit 7 + Unit 7 lab

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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

Ordinary Call
The course grade combines four assessment activities. The two theory-practical exams are re-evaluable; the continuous-assessment activities are not.

1. Theory-Practical Exam 1 (ExTP1): 35% (re-evaluable).
2. Theory-Practical Exam 2 (ExTP2): 35% (re-evaluable).
3. Progressive Assignment Assessment (PAA): 10% (not re-evaluable). It consists of seven theory-practical quizzes, one per thematic unit (Units 1 to 7), carried out progressively across the term; the PAA grade is the average of the seven quizzes, and each one carries an equal weight (about 1.43% of the final grade).
4. Project report and oral presentation/defence (PA): 20% (not re-evaluable).

Re-evaluable activities (ExTP1 + ExTP2) account for 70% of the grade. Non-re-evaluable activities (PAA + PA) account for 30%, which does not exceed the 40% limit for non-re-evaluable activities. The non-re-evaluable activities (PAA and PA) carry no minimum grade.
Theory-practical exams average: ExTP_Media = 0.5·ExTP1 + 0.5·ExTP2. A minimum of ExTP_Media ≥ 5 is required; this minimum applies only to the average of the two re-evaluable theory-practical exams and is re-tested when the theory-practical exams are repeated in the extraordinary call.
Final grade: Nota_global = 0.35·ExTP1 + 0.35·ExTP2 + 0.10·PAA + 0.20·PA. The course is passed when Nota_global ≥ 5 and ExTP_Media ≥ 5.
The PAA and PA are not re-evaluable because their assessment conditions cannot be reproduced in the extraordinary call: the PAA consists of seven theory-practical quizzes carried out progressively across the term, and the PA consists of a written report together with an in-person oral presentation and defence of the group project, delivered synchronously before the teacher in the final weeks of the course; these conditions of group work cannot be reproduced in the extraordinary call.
Extraordinary Call
Only the re-evaluable activities (ExTP1 and ExTP2) are repeated, under the same conditions as in the ordinary call, and the ExTP_Media ≥ 5 minimum is re-tested on the repeated theory-practical exams. The grades obtained during the course in the non-re-evaluable activities (PAA, 10%, and PA, 20%) are carried over. The weights and the passing rule are unchanged: Nota_global = 0.35·ExTP1 + 0.35·ExTP2 + 0.10·PAA + 0.20·PA, passed when Nota_global ≥ 5 with ExTP_Media ≥ 5.
Sum of weights: 35 + 35 + 10 + 20 = 100%.

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
- Fundamentals of Biostatistics, Bernard Rosner, Seventh Edition, Brooks/Cole CENGAGE Learning, 2011 - D. Díez, M Cetinkaya-Rundel and CD Barr. OpenIntro Statistics. - B. Caffo. Statistical Inference for Data Science. Leanpub
Consultation bibliography
- Introduccion a la Estadística, Sheldon M. Ross, Editorial Reverté, 2008 - Introduction to Bayesian Statistics, William M. Bolstad and James M. Curran, Third Edition, Wiley, 2016

IX.-Professors	
Name and surname	ANTONIO FERNÁNDEZ CABALLERO
E-mail address	antonio.fcaballero@urjc.es
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	Yes
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	0
Name and surname	LUIS MIGUEL LÓPEZ RAMOS
E-mail address	luismiguel.lopez@urjc.es
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

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