Universidad Rey Juan Carlos

TEACHING GUIDE

Mathematics I

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

ACADEMIC YEAR 2026-27

Q2803011B UNIVERSIDAD REY JUAN CARLOS
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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

Calculus is one of the main building blocks of modern mathematics and has a wide range of uses and applications in the sciences and engineering. This course, Mathematics I, along with linear algebra (Mathematics II), is essential for building an adequate basis that allows the student to successfully tackle challenges in other courses of this degree and later in the workplace.
Course aims. The general objective of this course is to provide theoretical concepts, basic techniques and fundamental applications in calculus in one variable. The specific aim of this course is to introduce the student to real and complex numbers, limits, continuity, differentiability and integration of real functions in one variable, as well as to numerical sequences and series.
Learning outcomes. On successful completion of this course, students should be able to: operate with real and complex numbers, distinguish continuous and differentiable functions, calculate derivatives and integrals of functions of one variable, approximate functions using the Taylor polynomial, operate with sequences and series.
Expected requirements: Knowledge of high school level mathematics. It is highly recommended to review books used in high school mathematics, in particular calculus-oriented material.

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)
CON18. Understand the basic concepts of: linear algebra, geometry, differential geometry, differential and integral calculus, differential equations and partial differen-tial equations, numerical methods, numerical algorithms, statistics, and optimization.
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)
HAB03. Ability to solve mathematical problems that may arise in engineering. Proficiency in applying knowledge of linear algebra, geometry, differential geometry, differential and integral calculus, differential equations and partial differential equations, numerical methods, numerical algorithms, statistics, and optimization.
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

Part I. Functions, limits, and continuity

Chapter 1. Real and complex numbers

1.1 Properties of real and natural numbers
1.2 Absolute value and the triangle inequality
1.3 Complex numbers

Chapter 2. Real-valued functions

2.1 Elementary functions
2.2 Properties of real-valued functions

Chapter 3. Limits

3.1 Formal definition and lateral limits
3.2 Properties of limits
3.3 Asymptotic behavior of functions

Chapter 4. Continuity

4.1 Continuity in a point and in an interval
4.2 Properties of continuous functions

Part II. Differential calculus in one variable

Chapter 5. Differentiability

5.1 Differentiability in a point
5.2 Differentiability in an interval: the derivative function

Chapter 6. Derivative of a function

6.1 Properties of derivative functions
6.2 Fundamental theorems: Rolle's theorem and the mean value theorem

Chapter 7. Analysis of functions and their graphical representation

7.1 Monotonicity and convexity of a function
7.2 Graphical representation of a function

Chapter 8. The Taylor polynomial

8.1 Polynomial approximation of functions
8.2 Taylor's theorem
8.3 Applications of Taylor's theorem

Part III. Integral calculus in one variable

Chapter 9. The Riemann integral

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9.1 The definite integral
9.2 Properties of the definite integral and of integrable functions
9.3 The fundamental theorem of calculus

Chapter 10. Integration techniques and applications

10.1 Integration techniques
10.2 Improper integrals
10.3 Applications of integral calculus

Part IV. Numerical sequences and series

Chapter 11. Numerical sequences

11.1 Limit of a sequence
11.2 Convergence criteria for sequences

Chapter 12. Numerical series

12.1 Sum of a series
12.2 Arithmetic and geometric series
12.3 Convergence criteria for positive series
12.4 Convergence criteria for alternating series

IV.B.-Training activities

Type	**Title**
Resolution of exercises, problems, case studies	Exercises and problem solving
Theoretical sessions	Lectures
Realización de Pruebas	Written exams
Other activities	Tutorials (individual or in group)

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V.-Student workload	
Theoretical sessions	30
Resolution of exercises, problems, case studies, etc.	26
Practical sessions in experimental, technological and clinical laboratories, fieldwork, etc.	0
Tests and/or exams	4
Academic tutorials	48
Related activities: conferences, seminars, etc.	0
Preparation of theoretical sessions and self-study	23
Preparation of practical tasks, exercises, case studies, projects, etc.	28
Preparation for tests and/or exams	21
Total student workload	180

VI.-Methodology and academic programme

Type	Period	Content
Theoretical sessions	Week 1 to Week 15	Lectures
Resolution of exercises, problems, case studies	Week 1 to Week 15	Exercises and problem solving
Academic tutorials	Week 1 to Week 15	Tutorials (individual or in group)
Tests and/or exams	Week 6 to Week 10	Class Test I
Tests and/or exams	Week 12 to Week 15	Class Test II
Tests and/or exams	Week 16 to Week 18	Final Exam

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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 assessment system:

Assessment System	Re-evaluable	Weight	Activity	Minimum Mark (of 10)	Tentative Contents	Timing
SE2	Yes	20%	Class Test I	0,5	Chapters 1-6	Weeks 6-10
SE2	Yes	20%	Class Test II	0,5	Chapters 7-12	Weeks 12-15
SE2	Yes	60%	Final Exam	4	Chapters 1-12	Official Exam Period

Ordinary Assessment:
The ordinary assessment consists of three written tests, which together will account for 100% of the final mark. The first two examinations take place during the lecture period, are worth each 20%, and cover partial contents of the course. Date and exact scope of the exam will be announced in advance.
The final exam takes place in the official exam period of the corresponding semester and covers the entire content of the course.
To pass the course, students must obtain a final mark of 5 or higher (out of 10) and meet the minimum mark on each exam.
Extraordinary Assessment:
Students who did not pass the ordinary assessment, or who did not take it, have the opportunity to take the extraordinary assessment. The extraordinary assessment consists of a single written examination (resit exam) worth 100% which evaluates the entire contents of the course.
Advance Assessment:
Students who apply for an advance assessment will undergo a single written examination worth 100% which evaluates the entire contents of the course.

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
English: J. Stewart, Calculus, Cengage Learning, 2011 (7th ed). T.M. Apostol, Calculus (Vol. 1), Wiley, 2011 (2nd ed). M. Spivak, Calculus, Publish or Perish, 1994 (3rd ed). H. Anton, I. Bivens, S. Davis, Calculus: Late Transcendentals, Wiley, 2020. https://ocw.mit.edu/courses/18-01-single-variable-calculus-fall-2005/resources/ocw01f05sums/ Spanish: T.M. Apostol, Calculus (Vol. 1), Reverté, 2006 (2ª ed). M. Spivak, Cálculo Infinitesimal, Reverté, 2005 (3ª ed). D. Pestana et al., Curso práctico de cálculo y precálculo, Ariel, 2000. A. García López et al, Cálculo I. Teoría y problemas de análisis matemático en una variable, Clagsa, 2007 (3ª ed). J. De Burgos, Calculo infinitesimal de una variable, McGraw-Hill, 2006 (2ª ed).
Consultation bibliography

IX.-Professors	
Name and surname	MICHAEL CHRISTIAN KARIM STICH
E-mail address	michael.stich@urjc.es
Department	Matemática Aplicada, Ciencia e Ingeniería de los Materiales y Tecnología Electrónica
Campus	Fuenlabrada
Category	Titular de Universidad
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	4
No. of positive evaluations by Docentia	1

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