

Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos

GUÍA DOCENTE DE LA ASIGNATURA

G2007 - Calculus

Grado en Ingeniería Civil
Básica. Curso 1

Programa Cornell
Obligatoria. Curso 1

Curso Académico 2022-2023

1. DATOS IDENTIFICATIVOS

Título/s	Grado en Ingeniería Civil Programa Cornell		Tipología y Curso	Básica. Curso 1 Obligatoria. Curso 1
Centro	Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos			
Módulo / materia	FORMACIÓN BÁSICA MATEMÁTICAS BÁSICAS PARA LA INGENIERÍA			
Código y denominación	G2007 - Calculus			
Créditos ECTS	6	Cuatrimestre	Cuatrimestral (1)	
Web				
Idioma de impartición	Inglés		Forma de impartición	Presencial

Departamento	DPTO. MATEMATICA APLICADA Y CIENCIAS DE LA COMPUTACION			
Profesor responsable	JOAQUIN BEDIA JIMENEZ			
E-mail	joaquin.bedia@unican.es			
Número despacho	E.T.S. de Ingenieros de Caminos, Canales y Puertos. Planta: + 1. DESPACHO (1047)			
Otros profesores				

2. CONOCIMIENTOS PREVIOS

The previous knowledge required will be that acquired during high school, for which an adequate training in mathematics is assumed. It is recommended a profile of scientific-technical high schools or a higher degree training in engineering and/or technology.

3. COMPETENCIAS GENÉRICAS Y ESPECÍFICAS DEL PLAN DE ESTUDIOS TRABAJADAS

Competencias Genéricas
Capacitación científico- técnica para el ejercicio de la profesión de Ingeniero Técnico de Obras Públicas y conocimiento de las funciones de asesoría, análisis, diseño, cálculo, proyecto, construcción, mantenimiento, conservación y explotación.
Competencias Específicas
Capacidad para la resolución de los problemas matemáticos que puedan plantearse en la ingeniería. Aptitud para aplicar los conocimientos sobre: álgebra lineal; geometría; geometría diferencial; cálculo diferencial e integral; ecuaciones diferenciales y en derivadas parciales; métodos numéricos; algorítmica numérica; estadística y optimización.
Conocimientos básicos sobre el uso y programación de los ordenadores, sistemas operativos, bases de datos y programas informáticos con aplicación en ingeniería.
Competencias Básicas
Que los estudiantes hayan demostrado poseer y comprender conocimientos en un área de estudio que parte de la base de la educación secundaria general, y se suele encontrar a un nivel que, si bien se apoya en libros de texto avanzados, incluye también algunos aspectos que implican conocimientos procedentes de la vanguardia de su campo de estudio

3.1 RESULTADOS DE APRENDIZAJE

- Know and manipulate elementary univariate functions. Understand and use the concepts of limit and continuity at a point of a function. Calculate derivatives of real functions with ease and apply them to solve optimization problems. Find the derivative of an implicitly defined function. Study the derivability of functions at a point and within an interval. Knowledge and ability to work with deal with numerical sequences, numerical series and power series. Use Taylor expansions to approximate real functions. Know how to implement numerical local approximations of a function using Taylor polynomials , providing an error estimate.
- Know and manipulate real multivariate functions and vector fields. Calculate partial derivatives, directional derivatives and gradients. Calculate the plane that is tangent to a surface at a point. Compute higher order partial derivatives and Hessian matrices. Formulate and solve maximum and minimum problems using differential calculus .
- Use the most usual techniques of analytical integration of univariate functions and know how to calculate arc lengths, planar areas and volumes of revolution using univariate integral calculus. Know how to apply formulas for changing variables to polar coordinates. Learn to parameterize common curves. Compute line integrals over scalar and vector fields.
- Learn to use a symbolic calculation program to complete the assimilation of the concepts studied in the theoretical classes of each unit; solve exercises; recognize the importance of software as a tool for the efficient resolution of complex problems .

4. OBJETIVOS

In the context of the syllabus of Civil Engineering, the Calculus course serves as an introduction to an important part of the main mathematical tools that students will need throughout their studies. The objectives are: to start with the language and mathematical reasoning; acquire habits of intellectual work; get started on the potential of calculus as modeling tool; acquire an operational handling of mathematical functions and their main properties; know, understand and manage the basic elements of differential and integral calculus in one and more variables and their applications to problems in physics and engineering ; recognition of specific software and programming tools as key to learning and solving complex problems; instill in the student the habit of continued study and autonomous work, both individually and in groups.

5. MODALIDADES ORGANIZATIVAS Y MÉTODOS DOCENTES	
ACTIVIDADES	HORAS DE LA ASIGNATURA
ACTIVIDADES PRESENCIALES	
HORAS DE CLASE (A)	
- Teoría (TE)	30
- Prácticas en Aula (PA)	24
- Prácticas de Laboratorio Experimental(PLE)	
- Prácticas de Laboratorio en Ordenador (PLO)	6
- Prácticas Clínicas (CL)	
Subtotal horas de clase	60
ACTIVIDADES DE SEGUIMIENTO (B)	
- Tutorías (TU)	8
- Evaluación (EV)	8
Subtotal actividades de seguimiento	16
Total actividades presenciales (A+B)	76
ACTIVIDADES NO PRESENCIALES	
Trabajo en grupo (TG)	10
Trabajo autónomo (TA)	64
Tutorías No Presenciales (TU-NP)	
Evaluación No Presencial (EV-NP)	
Total actividades no presenciales	74
HORAS TOTALES	150

6. ORGANIZACIÓN DOCENTE													
CONTENIDOS		TE	PA	PLE	PLO	CL	TU	EV	TG	TA	TU- NP	EV- NP	Semana
1	<p>BLOCK I: REAL AND COMPLEX NUMBERS. SEQUENCES AND NUMERICAL SERIES. REAL UNIVARIATE FUNCTIONS. LIMITS. CONTINUITY AND DERIVABILITY.</p> <p>UNIT 1. REAL AND COMPLEX NUMBERS. NUMERICAL SEQUENCES, SERIES AND POWER SERIES.</p> <p>1.1. real numbers. Axiomatics of real numbers 1.2. Geometric representation and other key concepts about the real line 1.3. Complex numbers. Definition 1.4. Geometric representation of complex numbers 1.5. Operations with complex numbers 1.6. Numerical sequences and numerical series. Definitions 1.7. Convergence criteria for numerical series</p> <p>UNIT 2. REAL UNIVARIATE FUNCTIONS</p> <p>2.1. Concept. Definitions. Operations with functions 2.2. Elementary functions 2.3. even and odd functions; periodicity; symmetry; dimension 2.4. Limit of a function at a point. Definition and Properties 2.5. Indeterminate forms 2.6. Continuous function at a point and within an interval. Types of discontinuities 2.7. Theorems about continuous functions 2.8. Differentiable functions at a point and within an interval. Properties 2.9. Rolle and Mean Value Theorems. 2.10. Application of the derivative to the calculation of limits: L'Hôpital's rule 2.11. Representing functions as power series. Taylor and Mac-Laurin formulas. Local approximation of functions.</p>	14,00	12,00	0,00	2,00	0,00	2,00	3,00	2,00	18,00	0,00	0,00	1-6
2	<p>BLOCK II: INTEGRAL CALCULUS OF FUNCTIONS OF ONE VARIABLE</p> <p>UNIT 3. INTEGRAL CALCULUS</p> <p>3.1. Calculation of primitives. Definitions and properties 3.2. Integration Methods 3.3. Riemann integral. Interpretation and Properties 3.4. Mean value theorem. Fundamental Theorem of Calculus. Barrow's rule 3.5. Improper integrals 3.6. Parameterization of curves. Polar coordinates. 3.7. Applications of integrals to the calculation of planar areas, volumes of revolution, surfaces of revolution and lengths of curves, in Cartesian, parametric and polar coordinates.</p>	8,00	6,00	0,00	2,00	0,00	3,00	3,00	4,00	22,00	0,00	0,00	7-10

3	BLOCK III. REAL FUNCTIONS OF SEVERAL VARIABLES UNIT 4. REAL FUNCTIONS OF SEVERAL VARIABLES. VECTOR FIELDS 4.1. First notions about functions of several variables 4.2. Limits of functions of two variables 4.3. Limits of vector functions 4.4. Continuity of functions of several variables 4.5. Partial derivatives. Introduction. Definition. geometric interpretation. 4.6. Continuity and partial derivatives. Partial derivatives of higher orders 4.7. Differential. Differentiability and continuity. Sufficient condition for differentiability. 4.8. Gradient. Definition. Gradient vector and directional derivative. Gradient and contour lines. 4.9. Extremes. Optimization. Lagrange multipliers. 4.10. Line integral. Definition. Properties. Applications.	8,00	6,00	0,00	2,00	0,00	3,00	2,00	4,00	24,00	0,00	0,00	11-15
TOTAL DE HORAS		30,00	24,00	0,00	6,00	0,00	8,00	8,00	10,00	64,00	0,00	0,00	
Esta organización tiene carácter orientativo.													

TE	Horas de teoría
PA	Horas de prácticas en aula
PLE	Horas de prácticas de laboratorio experimental
PLO	Horas de prácticas de laboratorio en ordenador
CL	Horas de prácticas clínicas
TU	Horas de tutoría
EV	Horas de evaluación
TG	Horas de trabajo en grupo
TA	Horas de trabajo autónomo
TU-NP	Tutorías No Presenciales
EV-NP	Evaluación No Presencial

7. MÉTODOS DE LA EVALUACIÓN

Descripción	Tipología	Eval. Final	Recuper.	%
Lab practice reports	Evaluación en laboratorio	No	No	12,00
Calif. mínima	0,00			
Duración	2 hours x 2 sessions			
Fecha realización	To be determined throughout the course			
Condiciones recuperación				
Observaciones	Continuous evaluation through lab reports made in pairs or small groups during the lab sessions. The students will practice autonomously following the script of the practice that is provided for each session. Previous preparation by the student is required using the available examples in Moodle. The lab session will be dedicated to the resolution of a problem related to theory using the specific software, as well as to the elaboration of a report presenting and discussing the results. These reports will follow a template given by the teacher. Attendance to the session is required for evaluation. The final grade for this activity will be the average of all individual lab session marks throughout the course.			
Continuous assessment	Otros	No	No	28,00
Calif. mínima	0,00			
Duración	Exercises and activities of variable duration			
Fecha realización	To be determined, regularly throughout the course			
Condiciones recuperación				
Observaciones	Brief exercises or assessment activities (15-20 minutes), to be carried out individually or in small groups to review or deepen previously teach contents. To be done throughout the semester on a regular basis (6-8 exercises approx.). The final grade for this activity will be the average of all the qualifications obtained during the course.			
Partial examination of Block I	Examen escrito	No	Sí	15,00
Calif. mínima	0,00			
Duración	90 minutes			
Fecha realización	Around week 7			
Condiciones recuperación	It can be resit in the Final Exam			
Observaciones	Individual assessment of contents of Block 1			
Partial examination of Block II	Examen escrito	No	Sí	15,00
Calif. mínima	0,00			
Duración	90 minutes			
Fecha realización	Around week 14			
Condiciones recuperación	It can be resit in the Final Exam			
Observaciones	Individual assessment of contents of Block 2			
Partial Examination of Block III	Examen escrito	Sí	Sí	30,00
Calif. mínima	3,00			
Duración	90 minutes			
Fecha realización	According to official schedule			
Condiciones recuperación	In the extraordinary call			

Observaciones	<p>This individual written test will serve to assess the skills acquired during Block III. In addition, it will allow the resit of previous partial examinations 1 and 2 if these are failed. If the previous partials have been passed, only the last part will be done, which will cover the contents after the second partial, avoiding overlaps.</p>
TOTAL 100,00	
Observaciones	
<p>The final mark of the extraordinary call, will be the weighted average of the different evaluation items described in the teaching guide, carried out during the course. Students who attend the extraordinary call, will take a single exam, corresponding to the 60% recoverable, which will include the whole course syllabus, regardless of whether any of its parts was previously approved during the ordinary evaluation.</p> <p>The non-adaptation to the format in tests with an established format (templates for practice reports, space reserved for answers in written exams, etc.), will be penalized. Likewise, the following will be penalized (among others):</p> <ul style="list-style-type: none"> - Answers that are not duly justified. - An inappropriate use of terminology and mathematical notation. - Messy work that is hard to read, excessive crossing out, etc. - Too many spelling/grammar mistakes. - Procedures that demonstrate the lack of basic mathematical skills. <p>Only for duly justified reasons (e.g. healthcare restrictions) the assessment tests may be remotely undertaken, with prior authorization from the Academic Authority.</p>	
Criterios de evaluación para estudiantes a tiempo parcial	
<p>The course can be followed from the University of Cantabria Moodle platform. Part-time students must fulfill the same evaluation requirements than full-time students. However, in this case, the continuous evaluation assignments proposed throughout the course may be carried out individually, and may be delivered in electronic format. Optionally, and in addition to computer practices, part-time students (and only them) may take a single written exam that encompasses the contents of the three thematic blocks, with a weight of 60% of the overall grade, to be held on the date of the final exam.</p>	

8. BIBLIOGRAFÍA Y MATERIALES DIDÁCTICOS

BÁSICA
<p>Larson, L. y Edwards, B. H. Cálculo I y II. 9ª ed. Mc Graw Hill. ISBN: 978-970-10-5710-0. http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=263113. See also electronic book version: https://catalogo.unican.es/cgi-bin/abnetopac/O7448/IDd1bea231/NT1</p> <p>Electronic material available in Moodle (exercises, slides, videos, software scripts etc.)</p>
Complementaria
<p>Marsden, J.E & Tromba, A.J. Cálculo Vectorial. Quinta edición. Pearson, Addison - Wesley, 2004. ISBN: 84-7829-069-9 / 978-84-7829-069-7. http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=220433</p> <p>Apostol, T., Calculus. Vols. 1, 2 Ed. Reverté, 1991. ISBN: 84-291-5001-3. http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=7199</p>

9. SOFTWARE

PROGRAMA / APLICACIÓN	CENTRO	PLANTA	SALA	HORARIO
Maxima (https://maxima.sourceforge.io/)	ETSI Caminos Canales y Puertos			

10. COMPETENCIAS LINGÜÍSTICAS

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|--|--|
| <input checked="" type="checkbox"/> Comprensión escrita | <input checked="" type="checkbox"/> Comprensión oral |
| <input checked="" type="checkbox"/> Expresión escrita | <input checked="" type="checkbox"/> Expresión oral |
| <input checked="" type="checkbox"/> Asignatura íntegramente desarrollada en inglés | |

Observaciones