Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2025/26

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GITECI30 - Bachelor`s Degree in Industrial Technology Engineering **Year** First year

COURSE

25971 - Calculus **Credits, ECTS:** 12

COURSE DESCRIPTION

This subject comprehends the basic mathematical tools needed in order to understand basic principles in many other subjects of the corresponding degree.
The first topics covered in the subject deal with real functions of one and several variables. Then sequences, series and power series are presented along the different convergence criteria used for each of them. Several methods are presented in order to calculate the sum of a given series and power series.
Furthermore integration is throughly covered in the final section of the subject. From the definition of the Riemann integral and the basic techniques of integration, the concept is applied to many important and useful calculations such as areas and volumes among many others. Multiple integration allow us to extend the applications to vector fields in order to calculate circulations and fluxes needed to fully understand many important phenomena in physics and electromagnetism.
The final chapter of the subject will introduce Ordinary Differential Equations.
No prerequisites are needed to attend the subject but it is quite advisable a solid command of some basic pre-calculus concepts such as trigonometry, basic functions, geometry and equation solving, all of them covered in Bachiller.
The subject is studied along Linear Algebra in the first year of the "Grado en Ingeniería en Tecnología Industrial". Both of them will be the foundation of the rest of mathematical subjects that will be studied the following years:
- Ampliación de Matemáticas
- Ampliación de Ecuaciones Diferenciales
- Ampliación de Métodos Numéricos

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The competences addressed in the subject will enable the student to solve most of mathematical models used in the engineering field (competence M01CM01).
The expected learning results are:
1.- Clear exposition of fundamental concepts of Calculus (CM01).
2.- Reasoned and clear "step by step" solving of mathematical models addressing real engineering situations in a variety of representations along with the correct interpretation of results (CM01).
3.- Oral and written presentation of studies in which the previously acquired knowledge is applied to general and practical cases in the field of industrial engineering (CM01).

Theoretical and Practical Contents

PART 1:
CHAPTER 0: PRE-CALCULUS
CHAPTER 1: SEQUENCES
CHAPTER 2: SERIES
CHAPTER 3: POWER SERIES
CHAPTER 4: POWER SERIES EXPANSION

PART 2:
CHAPTER 5: FUNCTIONS OF SEVERAL VARIABLES. LIMITS AND CONTINUITY.
CHAPTER 6: PARTIAL DERIVATIVES AND DIFFERENTIAL OF A FUNCTION WITH SEVERAL VARIABLES.
CHAPTER 7: DIRECTIONAL DERIVATIVE AND GRADIENT OF A FUNCTION WITH SEVERAL VARIABLES.
CHAPTER 8 VECTOR FIELDS
CHAPTER 9: COMPOSITE FUNCTIONS.
CHAPTER 10: IMPLICIT FUNCTIONS.
CHAPTER 11: EXTREMA.
CHAPTER 12: PARAMETRIC INTEGRALS.

PART 3:
CHAPTER 13: CURVES AND SURFACES.
CHAPTER 14: DOBLE INTEGRALS.
CHAPTER 15: TRIPLE INTEGRALS.
CHAPTER 16: LINE INTEGRALS.
CHAPTER 17: SURFACE INTEGRALS
CHAPTER 18: MULTIPLE INTEGRATION WITH VECTOR FIELDS.
CHAPTER 19: INTRODUCTION TO ORDINARY DIFFERENTIAL EQUATIONS.

SEMINARS
CHAPTER 1: BASIC FUNCTIONS.
CHAPTER 2: LIMITS.
CHAPTER 3: CONTINUITY.
CHAPTER 4: DERIVATIVE AND DIFFERENTIAL.
CHAPTER 5: DEFINITE INTEGRAL.
CHAPTER 6: INTEGRATION METHODS.
CHAPTER 7: APPLICATIONS OF DEFINITE INTEGRALS.
CHAPTER 8: IMPROPER INTEGRALS.

TEACHING METHODS

Seminars will be oriented to empower proactive and autonomous work around activities based on the use of all the resources available nowadays including modern texts and www. Teachers could use active methodologies, in the classroom and/or during office hours, oriented to develop and improve cross-disciplinary skills.

The following chapters will be will be discussed during the corresponding seminars:
o Basic Functions.
o Funciones Real-Valued Functions of a Real Variable. Limits
o Continuity of Real-Valued Functions of a Real Variable.
o Derivative and Differential of Real-Valued Functions of a Real Variable.
o Integration Methods.
o Riemann Definite Integral and Applications.
o Improper Integrals.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	75	15	30						
Horas de Actividad No Presencial del Alumno/a	112,5	22,5	45						

Legend:
M: Lecture-based
S: Seminar
GA: Applied classroom-based groups
GL: Applied laboratory-based groups
GO: Applied computer-based groups
GCL: Applied clinical-based groups
TA: Workshop
TI: Industrial workshop
GCA: Applied fieldwork groups

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 85%
- Seminars 15%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

REGULAR EXAMS
The final grade will be obtained from the following:
o Seminars (15% of the final grade).
o 1st written exam (25% of the final grade): approximately week 10.
o 2nd written exam (30% of the final grade): approximately week 7 of the second semester

o 3rd written exam (30% of the final grade): Official exams period, in May

In order to pass the regular call, students must fulfill two conditions:
- Obtaining at least 3 points over 10 in the third written exam.
- Obtaining a mean grade of, at least, 5 points over 10 in all the 3 written exams and different seminar tests.

In case of the mean grade in all the 3 written exams and different seminar tests is 5 of higher but student obtains less than 3 obtains points over 10 in the third written exam, the final grade of the regular call will be 4.5 (fail).

RELINQUISHING THE CONTINUOUS EVALUATION: Any Student willing to relinquish his continuous evaluation should write an email to the corresponding teacher within the first 18 weeks of the semester. Then, within the official exams period, the student will have the right to a final exam covering the whole syllabus of the subject.
RELINQUISHING THE REGULAR CALL:
1- WITHOUT HAVING RELINQUISHED THE CONTINUOUS EVALUATION: The student must write an email to the corresponding teacher at least a month before the end of the course. In case of not attending the May exam students will

appear as ABSENT for the regular call.
2- PREVIOUSLY HAVING RELINQUISHED THE CONTINUOUS EVALUATION:
All the students (having relinquished their continuous evaluation or not) not attending the May exam corresponding to the regular call will appear as ABSENT for that regular call.
Students are not allowed to use books, class notes or any kind of electronic devices (computers, smartphones and specifically calculators) during the exam.
Any other special cases will be addressed according to the corresponding official normative of the university.

MODIFICATIONS IN CASE OF HAVING TO RESORT TO ONLINE EVALUATION:
In such case all the exams and tests will be carried out online through the available tools implemented in EGELA, Moodle, online collaborative platforms (such as Teams, BlackBoardCollaborate, etc.), etc.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Evaluation will consist of a single written exam about the whole subject whose weight will be 100% of the final grade. 5 points will be required to pass the subject.
Students are not allowed to use books, class notes or any kind of electronic devices (computers, smartphones and specifically calculators) during the exam.
Any other special cases will be addressed according to the corresponding official normative of the university.

MANDATORY MATERIALS

BIBLIOGRAPHY

Basic bibliography

BASIC bibliography

- "Calculus", Larson, Hostetler, Edwards. Houghton Mifflin Company.

- "Exámenes Resueltos de Cálculo Infinitesimal 1996-2005". Servicio editorial UPV/EHU.

Detailed bibliography

EXTENDED bibliography

- "Calculus", Apostol. Ed Reverte
- "The Elements of Real Analysis" Bartle, R.G. Ed. Jhon Wiley and Sons.
- "Matemáticas Avanzadas para Ingeniería". Kreyszing. Ed. Limusa.
- "Matemáticas Avanzadas para Estudiantes de Ingeniería". Kaplan, Ed. Addison Wesley.
- "Problemas de Cálculo Infinitesimal e Integral". Bronte R.
- "Cálculo Infinitesimal de una Variable". Burgos J. Ed. Mc. Graw-Hill.
- "Cálculo Infinitesimal de varias Variable". Burgos J. Ed. Mc. Graw-Hill
- "Introducción al Análisis Matemático" Bartle RG, Ed Limusa

Journals

Web sites of interest

http://www.ehu.eus

OBSERVATIONS