

ACADEMIC
YEAR
2026/
2027

Guía Docente:

MATHEMATICS I



FACULTAD DE
CIENCIAS QUÍMICAS

1. IDENTIFICATION

Degree Program	Bachelor's Degree in Chemical Engineering			Course Code	801530
Course name	Mathematics I			ECTS	9
Subject	Mathematics				
Module	Basic				
Course Type	Basic	Curso	First	Semester	Annual
Responsible Department	Mathematical Analysis and Applied Mathematics				

Lecturers in Charge

Group A

Activity	Lecturer	Email	Office
T ^a /S/Tut.			
T ^a /S/Tut.			

Group B

Activity	Lecturer	Email	Office
T ^a /S/Tut.			

2. OBJECTIVES

General Objective

This subject is the student's first university-level contact with the language of science: mathematics. Therefore, the general objective is to train the student to acquire competencies in the calligraphy, orthography, and syntax of this language (what we might call mathematical techniques) while simultaneously acquiring the knowledge specified in the syllabus.

Specific Objectives

- Understanding and mastery of differentiation and integration techniques for functions of one and several variable.
- Knowledge of function approximation through power series.
- Knowledge of the classical theorems of vector analysis.

3. PRIOR KNOWLEDGE AND RECOMMENDATIONS

Prior knowledge

The knowledge described in the official syllabi of the Mathematics I and Mathematics II subjects of the Spanish Bachillerato (pre-university education).

Recommendations

If the student does not have the previously mentioned prior knowledge, it is recommended to acquire it before starting this course. It is advisable for the student to have a basic level of English that allows them to handle bibliography in English, conduct information searches, and communicate in writing and orally in that language.

4. CONTENTS

Brief description

Differential and integral calculus in one variable. Differential calculus in several variables. Series. Integration in several variables and vector calculus..

Program

First Semester:

1. Differential Calculus of One Variable

- Review of limits and continuity of functions of one variable.
- Definition of derivative. Geometric interpretation and properties. Tangent line.
- Differentiation rules. Differentiation of inverse functions. Chain rule. Implicit differentiation. L'Hôpital's rule.
- Taylor polynomial and Lagrange remainder.
- Monotonicity and concavity. Critical points. Classification of critical points.
- Graphing functions of one variable.

2. Integral Calculus of One Variable

- Definition of integral. Geometric interpretation and properties. Area under a curve.
- Calculation of antiderivatives. Integration by parts, substitution, rational functions.
- Fundamental theorem of calculus. Barrow's rule.
- Applications of the integral.
- Improper integrals.

3. Power Series

- Sequences and numerical series of arbitrary terms. Convergence criteria for series.
- Power series. Interval of convergence. Expansion of a function as a power series. Taylor series.

4. Differential Calculus of Several Variables

- Functions of several variables. Level curves. Graphing functions of two variables.
- Partial derivatives. The exact differential. The gradient vector and the tangent plane. The Hessian matrix; classification of critical points. Constrained maxima and minima; Lagrange multipliers.

Second Semester:**5. Integral Calculus in Several Variables**

- Multiple integrals. Fubini's theorem.
- Change of variables. Jacobian matrix.
- Polar, cylindrical, and spherical coordinates.

6. Line Integrals

- Line integrals of scalar and vector fields.
- Curl, gradient, and divergence.
- Conservative fields. Calculation of the potential function.
- Green's theorem.

7. Surface Integrals

- Surface integrals of scalar and vector fields.
- Stokes' theorem.
- Gauss' theorem.

5. COMPETENCIES**Generals**

CG1	Use concepts from basic and technological subjects that enable autonomous learning of new methods and theories and to the ability to address new situations.
CG5	Perform calculations, measurements, valuations, expert assessments, studies and reports in the relevant field of knowledge.

Specifics

CE1-M1	Calculate antiderivatives and partial derivatives.
CE1-M2	Calculate extrema of functions of several variables. Solve constrained optimisation problems.
CE1-M3	Use series convergence criteria effectively and calculate the sum of selected relevant series.
CE1-M4	Formulate integration problems in several variables and calculate these integrals.

Transversals

CT1	Demonstrate capacity for analysis and synthesis
CT6	Use computer tools and software.
CT7	Work in a team, demonstrating interpersonal skills.
CT10	Integrate acquired knowledge and apply it to solving real problems.
CT11	Learn autonomously.

6. WORKLOAD AND DISTRIBUTION BY ACTIVITY

Mathematics I is a subject in the Basic Module of the Bachelor's Degree in Chemical Engineering, with 9 credits taught over the first academic year. According to ECTS criteria, the student's dedication to this subject will be 225 hours per year, distributed as follows:

Activity	Contact (hours)	Independent study (hours)	Credits
Lectures/Practice classes	75	125	8
Office hours/Directed assignments	4	6	0,4
Preparation assignments and exams	9	6	0,6
Total	88	137	9

7. METHODOLOGY

During lecture sessions, the course content will be presented to students in accordance with the attached syllabus.

Problem-solving sessions will be held in which exercises and problems will be worked through on the board to help students acquire the essential theoretical and practical content.

A list of problems/exercises will be posted on the virtual campus for students to attempt on their own.

Directed activities: Practical directed assignments will be assigned.

Office hours: Each student attends four one-hour tutorials. The second and fourth sessions will include illustrative use of computer software.

Part of the recommended bibliography and support materials deposited on the virtual campus for this subject will be in English.

8. BIBLIOGRAPHY

- S. RODRÍGUEZ SALAZAR: *"Matemáticas para estudiantes de Químicas"*, Síntesis, 2007.
- R. FERREIRA, S. RODRÍGUEZ SALAZAR: *"Ecuaciones Diferenciales y Cálculo Vectorial"*, Garceta, 2013.
- F. AYRES, *"Cálculo diferencial e Integral"*, Serie Schaum. McGraw Hill, 1989.
- R. E. LARSON, R.P. HOSTETLER, B. H. EDWARDS, *"Cálculo y Geometría Analítica"*, McGraw Hill, 1995.
- J. E. MARSDEN, A. J. TROMBA, *"Cálculo Vectorial"*, Addison-Wesley Iberoamericana, 1991.
- G.B. THOMAS, R.L. FINNEY, *"Cálculo varias variables"*, Addison-Wesley, 1999 (9ª ed.)
- M. RAHMANI-ANDEBILI: *"Calculus I: practice problems, methods, and solutions"*, Springer International Publishing, 2023
- R.T. SMITH, R.B. MINTON: *"Calculus: Concepts and Connections"*, McGraw-Hill, 2006
- E. STEINER: *"The Chemistry Maths Book"*, Oxford Univ.Press, 2008 (2ªed.)

Some web pages from prestigious institutions with reading or audiovisual material will be included. The specific pages will be determined at the time, to ensure they are current.

9. ASSESSMENT

Continuous assessment will be carried out as follows:

- In order to access the overall subject assessment, the student must have participated in at least 70% of in-person activities.
- The grades of the tests taken throughout the course are class grades that are maintained until the regular examination period.
- Students who have failed the course may sit the extraordinary examination, which will count for 100%.

❖ WRITTEN EXAMS (70%) and IN CLASS TESTS (30%)

- During the course, 4 tests of approximately one hour each will be held, each counting for 15% of the semester grade.
- In January and May, a partial exam will be held. The grade for each semester will be the maximum of: (a) the partial exam grade, or (b) 30% of the test average plus 70% of the partial exam grade.
- Students who pass both semesters will receive a weighted average as their final grade, with 60% weight for the first semester and 40% weight for the second semester, following the temporal distribution of the course.
- In June, a final exam will be held, counting either 70% (with the remaining 30% from in-class tests) or 100%, whichever benefits the student most. It is not necessary to pass each part separately. Students who failed one semester during the course may sit only that partial, but must pass it at the final exam to pass the subject. Their grade will be the weighted average with the already-passed semester. If they fail again but the weighted average is at least 5, the final grade will be 4.5.
- Students who fail the June examination may sit the extraordinary examination, which counts 100% and covers the entire course syllabus. In-class test grades do not count, and it is not necessary to pass each part separately.

The grades of the four tests and the partial exams will be communicated to students with sufficient advance notice before the final exam, so they can adequately plan their study of this or other subjects.

In particular, partial exam grades will be communicated within a maximum period of 20 days, except for the second partial, where the period may be shorter to accommodate the final exam schedule.

In all cases, a minimum period of seven days will be observed between the publication of grades and the date of the final exam.

ACTIVITY SCHEDULE - TIMETABLE

TOPIC	ACTIVITY	HOURS	START	END
1. Cálculo diferencial e integral de una variable	Lectures	12	Week 1	Week 7
	Practice classes	9		
2. Power Series	Lectures	6	Week 8	Week 10
	Practice classes	3		
3. Differential Calculus (several variables)	Lectures	9	Week 11	Week 15
	Practice classes	6		
4. Integral Calculus (several variables)	Lectures	12	Week 16	Week 24
	Practice classes	6		
5. Vector Calculus	Lectures	8	Week 25	Week 30
	Practice classes	4		
	Directed activities/ Scheduled tutorials*	4	Variable	
	Written exams	9	As set by the Faculty	

* The scheduling of tutorials depends on the overall planning of all subjects in the year.

SUMMARY OF ACTIVITIES

TEACHING ACTIVITY	ASSOCIATED COMPETENCIES	INSTRUCTOR ACTIVITY	STUDENT ACTIVITY	ASSESSMENT METHOD	P	NP	TOTAL	C
Lectures	CG5, CE1, CT1, CT11	Presentations of syllabus topics.	Listen. Understand. Raise questions. Take notes for later study.	Tests and final exams.	47	137		70% + 20%
Practice classes	CG5, CE1, CT1, CT11	Applications of theory to solving exercises and problems	Solve proposed problems. Ask questions. Present solutions on the board.	Tests and final exams.	28			
Directed activities	CG1, CE1, CT6, CT7, CT10	Preparation and grading of directed.	Completion of directed activities/assignments.	Tests and final exams.	2			10%
Office hours (tutorials)	CG5, CE1, CT1, CT11	Help the student direct their study.	Consult the instructor about conceptual and methodological difficulties encountered while studying.	Mandatory attendance on assigned days.	2			
Exams	All	Set, supervise, and grade exams. Assign student grades.	Prepare and take the exam.	Tests and final exams.	9			

C: Contact hours (in-person activities)

NC: Non-contact hours (independent study)

GRADE: Contribution to final grade