

Degree programme	Type	Course
Chemical Engineering	FB	2

Contact lecturer

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Group languages

You can consult this information at the [end](#) of the document.

Prerequisites

The subject does not officially require any prerequisites, but it is assumed that the student has completed and passed the Mathematics of the first year. It is required to have practice in differentiating and integrating one-variable functions.

Objectives

It is a basic subject that introduces one of the most important mathematical tools for modeling and solving real problems that appear in engineering: vector analysis. At the end of the course, the student:

- will get familiar dealing with functions of several variables and vector fields.
- will be able to deal with curves and surfaces in space and the equations that describe them.
- will understand the meaning of the basic concepts of vector analysis.
- will learn to use the vectorial analysis tools to identify and calculate physical magnitudes.
- will understand the theorems of vectorial analysis and their use in the formulation of some physical theories.

Learning outcomes

1. Identify, describe and apply basic mathematical and statistical concepts.
2. Apply the methods and basic concepts of differential and integral calculus of a variable to the description and calculation of magnitudes.

3. Apply the methods for solving differential equations to the analysis of deterministic phenomena.
4. Develop scientific thinking.
5. Work cooperatively.

Contents

Vector analysis.

1. Vector functions. Curves in space. Tangent and normal vectors.
2. Functions of several variables. Curves and level surfaces. Partial derivatives Gradients and directional derivatives. Chain rule. Tangent planes. Maximum and minimum values.
3. Multiple integration. Double integrals on elementary domains. Iterated integrals. Triple integrals Applications of the double and triple integrals. Change of variables.
4. Line and surface integrals. Vector fields. Rotational and divergence. Integral lines. Theorem of Green. Theorems of Stokes and the Divergence.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Problem solving	64.5	2.58	
Problem sessions	15	0.6	1, 2, 3, 4, 5
Seminars	5	0.2	1, 2, 3, 4, 5
Theory classes	30	1.2	
Personal study	30	1.2	1, 2, 3, 4

In the learning process it is fundamental the own work of the student, with the help of the professor.

The hours of class are distributed in:

Theory classes: The teacher introduces the basic concepts corresponding to the subject, showing examples of their application. The student will have to complement the explanations of the professors with the personal study.

Problem sessions: By completing sets of exercises, the comprehension and application of the concepts and tools introduced in the theory class is attained . The student will have lists of problems, a part of which will be solved in the problem classes. Students should work on the remaining ones as part of their autonomous work.

Seminars: to reach a deeper understanding of the subject the students work in group on more practical problems.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
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Mid-term Exam combining theory and problems	45%	2	0.08	1, 2, 3
Seminar exams	10%	1.5	0.06	1, 2, 3, 4, 5
Mid-term Exam combining theory and problems	45%	2	0.08	1, 2, 3

The continuous assessment of the course will be based on three grades:

a) Two individual written exams on theory and/or problems: one on the content of Part A, graded (P₁), and another on the content of Part B of the course syllabus, graded (P₂). The grades (P₁) and (P₂) are out of 10.

b) A grade for the seminars, (S), out of 10.

The activity for section b) is mandatory and cannot be made up.

If both partial exams are taken, the grade is calculated as follows

$$Q_1 = 0.10S + 0.45(P_1 + P_2).$$

To pass the course, the average of the two partial exam grades must be higher than 2. If

$$\frac{P_1 + P_2}{2} < 2,$$

the course grade is

$$Q_1 = 0.10S + 0.45(P_1 + P_2).$$

If the average of the two partial exam grades is greater than 2 and (Q₁) is equal to or greater than 5, the final course grade is (Q₁).

For students with an average of the two partial exams above 2 and a (Q₁) below 5 who have completed the activity in section b), there will be a make-up exam at the end of the semester covering the entire course, with a grade (R).

If you take the make-up exam, the maximum final grade for the course will be 7. The final grade will be

$$Q_2 = \min(7; 0.10S + 0.90R).$$

A few days before each exam, and via the Virtual Campus, it will be announced whether the use of a calculator is permitted on the partial exams and the make-up exam.

A grade of Highest Honors may be awarded to the top 5% of final grades, provided that the score on each of the partial exams is no lower than 9 and the final grade is higher than 9.4. These assessment conditions will be the same for all students enrolled in the course, regardless of whether it is their first enrollment or if they have already taken it in previous years. The final decision on awarding the Summa Cum Laude will be made by the faculty.

For each assessment activity, the location, date, and time of the review, during which the student can review the activity with the instructor, will be indicated. In this context, appeals regarding the activity's grade may be submitted, which will be evaluated by the instructor responsible for the course. If the student does not attend this review, the activity will not be reviewed afterward.

The dates for seminar activities and midterm exams will be posted on the Virtual Campus and may be subject to scheduling changes to accommodate potential disruptions. Any changes will be communicated through the Virtual Campus, as this is the standard mechanism for information exchange between faculty and students.

Rescheduling of Assessments

The rescheduling of assessments will be governed by section 6.1 of the "Criterion and Instructions for Academic Assessment at the School of Engineering." The request must be processed through the School's Academic Management, which will forward it to the course instructor, if applicable.

Use of Artificial Intelligence Technologies

In this course, the use of artificial intelligence (AI) technologies is not permitted in any graded activity or any of its phases. Any activity that includes AI-generated content will be considered an act of academic dishonesty and may result in a partial or full penalty on the activity's grade, or more severe sanctions in more serious cases.

Irregularities in Assessment Activities

Without prejudice to other disciplinary measures that may be deemed appropriate and in accordance with applicable academic regulations, any irregularities committed by a student that may lead to a change in the grade for any assessment activity will be graded a zero (0).

For example, plagiarizing, copying, allowing copying, or having communication devices, such as cell phones or smartwatches, during an assessment will result in a zero (0) for that assessment. Assessments graded zero in this manner are not recoverable.

If any of these assessment activities is required to pass the course, the course will be automatically failed, with no opportunity to make up the work during the same academic year. The numerical grade recorded on the transcript will be the lower of 3.0 and the weighted average of the grades, in the event that the student has committed irregularities in an assessment activity. Therefore, it will not be possible to pass the course through compensation.

The assessment of transversal skills is integrated into the rubric for the problems on the partial exams. The score for the rubric sections corresponding to transversal skills will account for between 5% and 10% of the

score for the respective problem.

This course does not provide differentiated treatment for students who have failed the course.

This course does not use the single assessment system.

The English version of this teaching guide is a translation of the Catalan version made with DeepL. In case of any discrepancy between the two versions, the Catalan version shall prevail.

Bibliography

Main:

S. L. Salas, E. Hille. Cálculo de una y varias variables. Ed. Reverté, 1994.

Cálculo Vectorial.J.E. Marsden y A.J.Tromba, Addison Wesley Longman

Software

None is needed.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	21	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	211	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	211	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	212	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	212	Catalan	first semester	morning-mixed