Universitat Autònoma de Barcelona

2022/2023

Calculus

Code: 103303
ECTS Credits: 7

Degree	Type	Year	Semester
2501922 Nanoscience and Nanotechnology	FB	1	1

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Joan Torregrosa Arus
Ignasi Guillén Mola

Prerequisites

None

Objectives and Contextualisation

The topics "Calculus" (first quarter, first year), "Foundations of mathematics"(second quarter, first year) and "Mathematical tools"(first quarter, second year) are the mathematical courses within the degree in Nanoscience and Nanotechnology at UAB. These courses are of a basic nature whose main aim is to provide students with the mathematical tools and concepts required to properly model and analyze concepts in physics, chemistry etc. This one, "Calculus", of 7 ECTS, covers the differential and integral calculus in one and several variables, infinite series, basic ordinary differentail equations (exact, separate variables) and finally the basic concepts of vector analysis.

Competences

- Apply the concepts, principles, theories and fundamental facts of nanoscience and nanotechnology to solve problems of a quantitative or qualitative nature in the field of nanoscience and nanotechnology.
- Communicate orally and in writing in one's own language.
- Demonstrate knowledge of the concepts, principles, theories and fundamental facts related with nanoscience and nanotechnology.
- Interpret the data obtained by means of experimental measures, including the use of computer tools, identify and understand their meanings in relation to appropriate chemical, physical or biological theories.
- Learn autonomously.
- Manage the organisation and planning of tasks.
- Obtain, manage, analyse, synthesise and present information, including the use of digital and computerised media.

- Reason in a critical manner
- Resolve problems and make decisions.

Learning Outcomes

1. Abstract the essential variables of the phenomena studied, relate them to each other and deduce properties.
2. Communicate orally and in writing in one's own language.
3. Correctly use specific computer programs and data processors to accurately determine magnitudes of measurement and estimate the associated uncertainty.
4. Identify the mathematical nature of certain physical and chemical phenomena.
5. Learn autonomously.
6. Manage the organisation and planning of tasks.
7. Mathematize certain physical, chemical or biological processes and use accurate mathematical tools to obtain conclusions and interpret the results.
8. Obtain, manage, analyse, synthesise and present information, including the use of digital and computerised media.
9. Propose and resolve differential equations that are used to obtain results related with processes relative to the field of nanotechnology.
10. Propose mathematical models that describe physical and chemical phenomena.
11. Reason in a critical manner
12. Resolve problems and make decisions.
13. Show the necessary calculation skills to work correctly with formulas, chemical equations or physics models.
14. Use calculation and simulation tools to substantiate explanatory hypotheses of experimental measures.
15. Use graphic and numeric methods to explore, summarise and describe data.
16. Use statistical programs and apply statistical data treatment methods to the interpretation of the results.

Content

Unless the requirements enforced by the health authorities demand a prioritization or reduction, the contents are the following:

0. Survey of basic concepts of diffrential and integral calculus in one variable.

1. Ordinary differential equations. Separate variables, exact differential equations.

2. Taylor's formula

3. Series, power series and improper integrals.

4. Differential calculus in several variables.

5. Integral calculus in several variables.

6. Vector Analysis.

Methodology

There are three type of activities that the student is supposed to attend

Lectures: mainly theoretical. Here the contents of the course syllabus will be presented, and applied to solving problems of a physical nature.

Problem solving sessions. Here problems listed in exercise sheets will be solved under the supervision of a teaching assistant.

Seminars. Here the student will learn how to use specific math software, such as Maple,Maxima or Derive, to implement calculations, and to obtain graphic representations of concepts explained in the lectures.

The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	45	1.8	1, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15
Practising a toolbox	8	0.32	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15
Problem sessions	15	0.6	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15
Type: Supervised			
Submission of toolbox exercises	6	0.24	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15
Type: Autonomous			
Sudying theoretical concepts and solving problems	84	3.36	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15

Assessment

Traducció del català realitzada per "Google Translate"

A continuous evaluation will be carried out by means of:

a) There will be an exam (First Partial = EP1) in the middle of the semester in which the work done until that moment will be evaluated. The mark of this exam will provide 40% of the final grade. All students who take this exam can no longer be graded as NON-EVALUABLE. A student who has not taken this exam will be listed as NON-EVALUABLE for academic purposes and will not have the right to retake it (except for a duly justified reason, in which case the retake exam will be allowed).

b) At the end of the semester there will be a second partial exam (called EP2) in which the knowledge of the subjects that have not been evaluated in the first partial will be evaluated. The mark of this exam will provide another 40% of the final grade. A student who has not taken this exam will not be entitled to retake it (except for a duly justified reason, in which case the resit exam will be allowed).

c) There will be an evaluation corresponding to the practical sessions, with LLPR qualification, which will be worth 20% of the final grade. This part of the note will not be recoverable.

If the average (EP1 + EP2) / 2 is less than 3.5 the student must go to the resit exam, which is an overall exam of the whole subject. If the average is higher than 3.5, a rating C1 = (0.4) EP1 + (0.4) EP2 + (0.2) LLPR is generated. If C1 is 5 or higher, the final grade is C1. If not, the student must go to the resit exam and in this case the final grade will be 0.8 R + 0.2 LPRI, where R is the grade of the resit exam.

5% of the students will be able to obtain the qualification of Honorary Enrollment. They will necessarily have to have a grade equal to or higher than 9. The final decision on the MH grade will be made by the teacher.

In the partial exams and in the one of recovery it will not be allowed to use calculator.

For each evaluation activity, a place,date and time of review will be indicated in which the student will be able to review the activity with the teaching staff. In this context, claims may be made on the grade of the activity, which will be evaluated by the teacher responsible for the subject. If the student does not appear for this review, this activity will not be reviewed later. Dates of problem deliveries and midterm exams will be posted on the Virtual Campus (CV) and may be subject to possible scheduling changes for reasons of adaptation to possible incidents; these changes will always be reported to the CV as the CV is understood to be the usual mechanism for exchanging information between teacher and students.

Without prejudice to other disciplinary measures deemed appropriate and in accordance with current academic regulations, irregularities committed by a student that may lead to a variation in the grade will be graded with a zero (0). For example, plagiarizing, copying, copying, having communication devices (such as cell phones, smart watches, etc.) in an evaluation activity will involve suspending that evaluation activity with a zero (0). Assessment activities qualified in this way and by this procedure will not be recoverable. If it is necessary to pass any of these assessment activities to pass the course, this course will be suspended directly, without the opportunity to retake it in the same course. The numerical mark of the transcript will be the lower value between 3.0 and the weighted average of the marks in case the student has committed irregularities in an act of evaluation (and therefore it will not be possible to pass it by compensation).

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
First mid-term test	40%	3	0.12	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15
Resit exam	80%	4	0.16	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15
Second mid-term test	40%	3	0.12	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15
Submisson of toolbox exercises	20%	7	0.28	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15

Bibliography

The following books are recommended:

1. M. Brokate, P.Manchanda,A.H.Siddiqi, Calculus for Scientists and Engineers, http://link.springer.com/openurl?genre=book&isbn=978-981-13-8464-6

2. A.I. Khuri, Advanced Calculus with Applications in Statistics, https://onlinelibrary.wiley.com/doi/book/10.1002/0471394882

3. P. Dyke, Two and three dimensional Calculus with applications in science and engineering, https://onlinelibrary.wiley.com/doi/book/10.1002/9781119483731

Other useful references are:

S.L. Salas, E. Hille, G. Etgen, *Calculus*, Vol. 1 i 2, Ed. Reverté, 2002

J. Rogawski, Cálculo. Una y varias variables, Vol. 1 i 2, Ed. Reverté, 2012.

R. G. Bartle, D. R. Shebert, *Introducción al Análisis Matemático*, Ed. Limusa

J. M. Ortega, *Introducció a l'Anàlisi Matemàtica*, Ed. UAB

E. W. Swokowski, *Cálculo con geometría analítica*, 2 ed. Iberoamérica

J.E.Marsden-A.J.Tromba, Calculo Vectorial, Addison Wesley

Software

To decide