Universitat Autònoma de Barcelona

2019/2020

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 Arús

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 ones 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 ones 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

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 or Derive, to implement calculations, and to obtain graphic representations of concepts explained in the lectures.

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	82	3.28	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15

Assessment

A continuous assessment is performed based on:

a) two mid-term exams, with grades EP1,EP2.

b) Practical sessions with R, assessed at the end of the session. Their mean is LLPR.

c) Submission of two sets of exercises, assessed through an interview. Their mean is LLEX.

Submissions described in b), c) are mandatory.

The final score is obtained in two steps. First, we compute

C1= (0,35)EP1+(0,35)EP2+(0,15)LLPR+(0,15)LLEX.

If C1 is greater than or equal to 5, the final score is C1. Otherwise, and in case the student has submitted both b) and c) above and attended at least one mid-term exam, the student may attend a resit exam whose score is denoted by RT. Then the final grade is

C2= (0,70)RT+(0,15)LLPR+(0,15)LLEX.

In case C1 is greater than or equal tpo 5, students may attend the resit exam to improve their grade, in which case the final score is (C1+C2)/2.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
First mid-term test	35%	3	0.12	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15
Resit exam	70%	4	0.16	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15
Second mid-term test	35%	3	0.12	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15
Submission of exercise sets	15%	2	0.08	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15
Submisson of toolbox exercises	15%	7	0.28	1, 5, 2, 13, 6, 4, 7, 8, 9, 10, 11, 16, 12, 3, 14, 15

Bibliography

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