COURSE DATA

Data Subject	
Code	34188
Name	Mathematics II
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Faculty of Chemistry	1	Second term

Subject-matter

Degree	Subject-matter	Character
1110 - Degree in Chemistry	3 - Matemáticas	Basic Training

Coordination

Name	Department
YAÑEZ AVENDAÑO, DIONISIO FELIX	363 - Mathematics

SUMMARY

Mathematics II, taught in year 1 of the Degree in Chemistry, is designed as an instrumental subject to provide theoretical knowledge and practical techniques on data processing, both numerical and statistical, and statistical and numerical methods to be used in a multitude of contexts in scientific activities in general and in chemistry in particular.

The focus is on solving chemical problems using laboratory data, which will allow students to obtain valid conclusions from the data obtained in laboratory experiments.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

There are no prerequisites.

OUTCOMES

1108 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Show inductive and deductive reasoning ability.
- Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation.
- Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.
- Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate.
- Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.
- Solve qualitative and quantitative problems following previously developed models.
- Evaluate, interpret and synthesise chemical data and information.
- Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them.
- Relate theory and experimentation.
- Relate chemistry with other disciplines.
- Prepare reports, surveys and industrial and environmental projects in the field of chemistry.
- Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.

LEARNING OUTCOMES

The previous section includes the competences contained in the document VERIFICA. This subject addresses part of the learning results of the subject Mathematics II that allow to acquire both specific knowledge of chemistry, cognitive skills and general skills recommended by the EUROPEAN CHEMISTRY THEMATIC NETWORK (ECTN) by the Chemistry Eurobachelor® Label. The following table lists the learning outcomes acquired in the subject Mathematics II related to the competences of the degree in Chemistry.

COMPETENCES AND COGNITIVE SKILLS	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject Mathematics II that contemplate the learning outcomes EUROBACHELOR®
Ability to calculate and process data, related to information and chemistry data.	**C1:** Solve qualitative and quantitative problems following previously developed models..(CE14). **C2:** Recognise and analyse new problems and plan strategies to solve them..(CE15).

GENERAL COMPETENCES	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject Mathematics II that contemplate the learning outcomes EUROBACHELOR®
Ability to apply practical knowledge to solve	**C1:** Solve problems effectively..(CG4).

problems related to qualitative and quantitative information.	**C2:** Solve qualitative and quantitative problems following previously developed models..(CE14). **C3:** Relate theory and experimentation..(CE22). **C4:** Recognise and evaluate chemical processes in daily life..(CE23). **C5:** Understand the qualitative and quantitative aspects of chemical problems..(CE24).
Calculation and arithmetic capabilities, including aspects such as analysis error, estimates of orders of magnitude, and correct use of the units.	**C1:** Develop capacity for analysis, synthesis and critical thinking.. (CG1). **C2:** Show inductive and deductive reasoning ability..(CG2). **C3:** Solve problems effectively..CG4).
Ability to adapt to new situations and make decisions.	**C1:** Demonstrate the ability to adapt to new situations..(CG9). **C2:** Recognise and analyse new problems and plan strategies to solve them..(CE15). **C3:** Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration..(CB3).
Skills related to information technology such as word processing, spreadsheet, recording and storage of data, internet use related to the subjects.	**C1:** Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate..(CG6). **C2:** Have basic skills in the use of information and communication technology and properly manage the information obtained.(CT2).

At the end of the course, the student must be able to:

• Know how to apply the mathematical principles necessary for deducing the relationships between the different physicochemical variables and functions presented in the subject areas of Chemistry and Chemical Engineering.

• Estimate the final error of a magnitude value and its reliability margin, after a process of experimental direct or indirect measuring.

• Estimate the value of physical and chemical parameters and their margins of error through the experimental measuring of other variables related to them through linear and non-linear functions. Be able to choose the best fitting algorithm in accordance with the values of the variables and functions involved in the process.

• Manage information in an effective manner.

• Use information and communication technologies in an effective manner.

• Demonstrate the ability to organise and plan.

• Solve problems by means of computer software with programming tools.

• Carry out the tasks assigned as a member of a team effectively and from a gender perspective.

• Demonstrate the ability to relate chemistry with other disciplines and to interpret quantitative data.

• Write and present one’s work correctly in the native language.

DESCRIPTION OF CONTENTS

1. Statistical Sampling Theory

Random sampling. Binomial, Poisson, normal and deducted distributions. Statistical distributions. Treatment of errors. Confidence intervals. Contrast of hypothesis.

2. Fit and Regression

Least squares method. Linear correlation. Linear regression. Confidence intervals for regression. Predictions. Nonlinear fits.

3. Polinomial interpolation

Existence and uniqueness of the interpolating polynomial. Lagrange interpolation. Newton interpolation: divided differences. Other techniques of interpolation.

4. Numerical integration

Newton-Cotes formulas for numerical integration. Trapezoidal and Simpson rules. Numerical integration of differential equations: Euler method, improved Euler method and Runge-Kutta methods.

5. Practice 1

Use of general software for mathematical calculation and introduction to descriptive statistics. Statistical inference: confidence intervals and hypothesis testing.

6. Practice 2

Adjustment and regression. Parameters of regression. Confidence intervals of parameters and fittings. Nonlinear fittings. Graphical representations of data and fittings.

7. Practice 3

Numerical interpolation. Programming methods of interpolation. Obtaining of results.

8. Practice 4

Numerical integration. Programming methods of integration. Obtaining of results. Numerical methods for ordinary differential equations.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	41,00	100
Computer classroom practice	12,00	100
Tutorials	7,00	100
Development of group work	15,00	0
Study and independent work	30,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	15,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Contents will be delivered in theory and practical classes, and also in tutorials and seminars as specified in the workload section. The theory classes will introduce statistical and numerical methods, with special emphasis on their application to practical cases.

The theory lectures must be participatory, with the presentation of examples by the lecturer and the proposal of others to be developed by students.

Practical classes will take place in a lab so that students learn how to use the computer tools that are appropriate to implement the theoretical concepts into practical cases. In the practical classes the lecturer will propose some exercises to assess the knowledge acquired by students.

Tutorials will be devoted to solving doubts and to clarify the concepts that students require for their effective acquisition of knowledge. Examples and problems may also be used to complete the theoretical and practical training offered and to discuss and debate on the various possible ways to solve a given problem.

In seminars the lecturer will present supplementary aspects, either theoretical or applied, related to the contents and skills introduced in the course.

EVALUATION

A written test will be held to assess the knowledge assimilated in theoretical lectures, contributing 50% of the final mark. Practical skills will be assessed by adding the marks obtained in practical classes (either by direct assessment of practicals or by assessing the projects submitted during the course and before the first examination sitting), up to a maximum of 4 points (which can be carried forward for the second examination sitting), and the mark obtained in a computer-based test, held in the computer room, to evaluate the practical and applied knowledge acquired by students (up to a maximum of 6 points). The practical component contributes 40% of the final mark.

An additional point can be awarded at the discretion of the lecturer for attendance, participation in class, resolution of problems and achievement of learning objectives.

The second examination sitting will involve retaking the written theory test and the individual computer-based test (only the test failed at first attempt or both).

A minimum of 4 points (out of 10) both in the theory and in the practical components is required for results to be considered towards the final mark. Below 4, the subject will be marked as failed.

REFERENCES

Basic

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- AUBANELL, A.; BENSENY, A.; DELSHAMS, A. Útiles básicos de cálculo numérico. Labor, 1993. ISBN 8433551566
- BURDEN, R.; FAIRES, D.; Análisis Numérico. Thomson Learning, 2002. ISBN 9789706861344
- CANAVOS, George C. Probabilidad y Estadística. Aplicaciones y Métodos. McGraw- Hill, México, 1988. ISBN 9684518560
- COLOMER, Mª Angels. Curs dEstadística. Ed. Universitat de Lleida, 1997. ISBN 8489727503
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- DEMIDOVICH, B.P. Cálculo Numérico Fundamental. Ed. Paraninfo. 1977. ISBN 842830887X
- DOUGLAS, J.; BURDEN, R. Métodos Numéricos. Thomson. 2004. ISBN 8497322800

Additional

- AMAT, S.; ARÀNDIGA, F.; ARNAU, J.V.; DONAT, R.; MULET, P.; PERIS, R. Aproximació Numèrica. PUV, 2002. ISBN 843705513X
- MOORE, David S. Estadística Aplicada Básica. Ed. Antoni Bosch, 2010. ISBN 9788495348043

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

Contents

1.- The contents initially indicated in the teaching guide are maintained.

Workload and temporary teaching planning

Regarding the workload:

1.- The different activities described in the Teaching Guide are maintained with the intended dedication.

Regarding the temporary teaching planning:

2.- The material to follow the theory/tutoring/classroom-seminar classes allows to continue the temporary teaching planning both in days and schedule, whether the teaching is face-to-face in the classroom or not, although in some of the activities the student has the freedom to follow the non-face-to-face sessions according to his own planning.

Teaching Methodology

Theory subjects:

Situation of minimal attendance: In theory classes and tutorials the occupation will be, at most, 30% of their usual occupation. Teaching will be online. Students who have a laboratory session before or after theory classes, and the time to travel is longer than the time established in the schedules, will be able to follow the class in person in the classroom assigned in the schedules. When there are students in this situation, classes will be taught by synchronous videoconference in the group classroom.

Maximum face-to-face situation: In theory classes and tutorials, the occupation will respect the sanitary restrictions that limit the capacity of the classrooms. Depending on the capacity of the classroom and the number of students enrolled, it may be necessary that part of the students have to follow the classes synchronously. If this situation arises, the students will attend the group classroom in weekly rotating shifts (preferably in alphabetical order), so as to ensure that the percentage of attendance of all the students enrolled in the subject is the same.

Confinement situation: If for health reasons it is not possible to continue with hybrid teaching, totally or partially affecting the classes of the subject, these will be replaced by synchronous non-face-to-face sessions following the established schedules and using the virtual classroom tools.

Computer classroom subjects:

If the number of students enrolled exceeds the classroom capacity, students will attend the classroom in rotating weekly shifts (preferably in alphabetical order), guaranteeing, in any case, that the attendance percentage of all enrolled students in the subject it is the same.

The methodology used for non-face-to-face classes shall be:

1. Synchronously using virtual classroom tools (preferably Teams)

3. Resolution of exercises and questionnaires

In all subjects

If there is a closure of the facilities for health reasons that totally or partially affects the classes of the course, they will be replaced by non-face-to-face sessions following the established schedules and using the tools of the virtual classroom.

In the case of students confined to home due to COVID, they will be ensured on-line teaching through Teams.

Evaluation

1. The possibility of exam-only evaluation is eliminated.

2. The evaluation system described in the Teaching Guide of the subject in which the various evaluable activities have been specified as well as their contribution to the final grade of the subject is maintained.

If there is a closure of the facilities for health reasons affecting the development of any face-to-face evaluable activity of the subject, it will be replaced by a test of a similar nature that will be carried out in virtual mode using the computer tools licensed by the University of Valencia. The contribution of each evaluable activity to the final grade of the subject will remain unchanged, as set out in this guide.

References

2.- The literature recommended in the Teaching Guide is maintained since it is accessible, and it is complemented by notes, slides and problems uploaded to the Virtual Classroom as material of the course.