COURSE DESCRIPTION

COURSE DETAILS

Title (of the course): **MACROMOLÉCULAS Y COLOIDES**
Code: 100474
Degree/Master: **GRADO DE QUÍMICA** Year: 4
Name of the module to which it belongs: APLICADO
Field: QUÍMICA (OPTATIVA 2)
Character: OPTATIVA Duration: FIRST TERM
ECTS Credits: 6.0 Classroom hours: 60
Face-to-face classroom percentage: 40.0% Study hours: 90
Online platform: Moodle

LECTURER INFORMATION

Name: GINER CASARES, JUAN JOSÉ (Coordinator)
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PREREQUISITES AND RECOMMENDATIONS

Prerequisites established in the study plan

The student must have passed 60 basic education credits and at least 30 other required credits.

Recommendations

B1 English Level

COURSE DESCRIPTION

INTENDED LEARNING OUTCOMES

	Oral and written communication in native language.
CB10	Capacity for independent learning for continued profesional development.
CE7	Thermondynamic principles and their applications in chemistry.
CE8	The kinetics of chemical change, including catalysis. Mechanical interpretation of chemical reactions.
CE14	The relationship between macroscopic properties and the properties of atoms and individual molecules: including macromolecules (natural and synthetic), polymers, colloids and other materials.
CE15	The structure and reactivity of the primary classes of biomolecules and the chemistry of the primary biological processes.
CE20	The study, properties and applications of the materials.
CE21	Capacity to demonstrate knowledge and comprehension of essential facts, concepts, principles and theories related to chemistry.
CE22	Capacity to apply said knowledge to the resolution of qualitative and quantitative problems according to previously developed models.
CE25	Competency to present, in both written and oral forms, scientific material and arguments to a specialised audience.
CE29	Ability to observe, follow and measure properties, events and chemical changes and to systematically and reliably record the corresponding documentation.
CE30	Ability to operate standard chemical instrumentation, such as that which is used for structural investigations and separations.
CE31	Interpretation of data arising from observations and measurements in the laboratory in terms of its meaning and the theories which underpin it.

OBJECTIVES

- Knowledge on the basic Physical Chemistry of Macromolecules and Colloids. Different aspects will be covered: applications, polymerization processes, thermodynamics, structural characterization, biologically relevant macromolecules and colloidal systems.
- Work laboratory practices and / or virtual laboratory activities that complement the knowledge of the chemistry of these systems.
- General objectives related with the competences of the lecture. Scientific presentations, both written and oral.

CONTENT

1. Theory contents

1. INTRODUCTION TO MACROMOLECULES AND COLLOIDS.

Introduction. Types of macromolecules. Polidispersity of macromolecules. Crystalline structure. Melting temperature and glass transition. Colloids: types and stability of colloidal systems.

2.STEP-GROWTH POLYMERIZATION.

Introduction. Equivalent reactivity of functional groups. Kinetics of linear polycondensation. Distribution of molecular weigth. Polycondensation.

3. CHAIN POLYMERIZATION.

Introduction. Full kinetic scheme of polymerization by free radicals. Simplification of the kinetic scheme. Chain length. Transfer reactions. Cationic polymerization. Kinetics and polymerization degree. Anionic polymerization. Kinetics. Tacticity. Coordination polymerization.

4. COPOLYMERS.

Introduction. Composition of copolymers. Reactivity indexes. Formation of copolymers using free radicals.

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Formation of copolymers using ions.

5. CONFORMATIONAL POLYMORPHISM.

Introduction. Length of coil. Chain with free inner rotation. Chain with restricted inner rotation. Real chains. Specific interactions. Application to proteins. Virtual bonds. Steric diagrams. Energy maps.

6. THERMODYNAMICS OF MACROMOLECULAR SOLUTIONS.

Introduction. Configuration entropy of mixture. Theory of Flory-Huggins. Solubility of macromolecules. Phase equilibrium. Excluded volume. Theory of Flory-Krigbaum. Colligative properties. Coil expansion.

7. COLLOIDAL SYSTEMS.

Physicochemistry of colloids. Colloidal dispersions. Micelles. Hydrophobic and hydrophilic colloids. Formation of colloids. Adsorption at interfaces. Surface tension. Electric properties, zeta potential and double layer.

8. EXPERIMENTAL TECHNIQUES FO CHARACTERIZATION OF MACROMOLECULES AND COLLOIDS

Introduction. Light scattering. Viscosity of colloidal dispersions. Diffusion and sedimentation. Gel permeation chromatography.

9. CLASSIFICATION OF COLLOIDS.

Colloidal stability. Coalescence. DLVO theory. Gels, suspensions, emulsions, foams.

10. CONFORMATIONAL TRANSITIONS IN PROTEINS AND NUCLEIC ACIDS.

Introduction. Conformational transitions in proteins. Cooperativity. Thermodynamic analysis. Conformational transitions in nucleic acids. DNA melting. Thermodynamics of polyelectrolytes.

2. Practical contents

- Synthesis and characterization of macromolecules. Distribution of molecular weigth values.
- Crossing of polymers. Physical properties. Reversibility.
- Characterization of micelles.
- Foams. Bubbles. Plateau lines.

SUSTAINABLE DEVELOPMENT GOALS RELATED TO THE CONTENT

Good health and well-being
Affordable and clean energy
Responsible consumption and production

METHODOLOGY

General clarifications on the methodology (optional)

The same methodology rules will apply for all students, reagrdless this subject has been taken for first time or as subject repetition.

Methodological adaptations for part-time students and students with disabilities and special educational needs

Part-time students will be interviewed in each individual case. The modifications in the methodology will be designed to better match each situation.

The methodological strategies and evaluation system contemplated in this Teaching Guide will be adapted according to the needs presented by students with disabilities and special educational needs in the cases that are required.

COURSE DESCRIPTION

Face-to-face activities

Activity	Large group	Medium group	Small group	Total
Assessment activities	3	-	-	3
Group work (cooperative)	-	15	-	15
Lab practice	-	-	12	12
Lectures	30	-	-	30
Total hours:	***33***	***15***	***12***	***60***

Off-site activities

Activity	Total
Exercises	20
Group work	20
Self-study	50
Total hours	***90***

WORK MATERIALS FOR STUDENTS

Dossier
Exercises and activities
Lessons summary

Clarifications

Notebook for practical work at the chemistry lab.
Numerical problems (moodle).
Moodle exercises and seminars (moodle).
Additional resources (moodle).

EVALUATION

Intended learning	Practice Book	Problem solving	Real and/or simulated tasks
CB10	X		X
CB3	X	X	
CE14	X	X	X
CE15	X	X	X

COURSE DESCRIPTION

Intended learning	Practice Book	Problem solving	Real and/or simulated tasks
CE20	X		X
CE21	X		
CE22		X	X
CE25	X	X	
CE29	X	X	X
CE30	X		X
CE31	X		X
CE7	X	X	
CE8		X	X
Total (100%)	***30%***	***30%***	***40%***
Minimum grade	***4***	***4***	***4***

(*)Minimum mark (out of 10) needed for the assessment tool to be weighted in the course final mark. In any case, final mark must be 5,0 or higher to pass the course.

Method of assessment of attendance:

Attendance at seminars (problem solving) and practices is compulsory to pass the course.

General clarifications on instruments for evaluation:

A grade of 4 must be obtained in each evaluation instrument.

Clarifications on the methodology for part-time students and students with disabilities and special educational needs:

Part-time students will be considered separately as a function of each case.

Clarifications on the evaluation of the first extraordinary call and extra-ordinary call for completion studies:

For the evaluations of extraordinary calls, the tasks carried out by the students during the past year and that imply the overcoming of the competences of the subject will be taken into account. This extends to all the assessment instruments of the subject.

Qualifying criteria for obtaining honors:

According to article 80.3 of the Regulations of the University of Córdoba, the mention of \"Matricula de Honor\" may be awarded to students who have obtained a grade equal to or greater than 9.0

BIBLIOGRAPHY

1. Basic Bibliography

1. Bibliografía básica:
-A. Horta Zubiaga. (1982) (2000). Macromoléculas, vol 1 y 2. UNED

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-J. Areizaga, M.M. Cortázar, J.M. Elorza, J.J. Iruin. (2002). Polímeros. Ed. Síntesis
-R.B. Seymour, C.E. Carraher. (1995). Introducción ala Químicade los Polímeros. Ed. Reverté
-I. Katime. (1994). Química Física Macromolecular. UNED.
-R. Rodriguez Amaro, J.M. Rodriguez Mellado. (2008) Unidades didácticas de Química Macromolecular.
-S.C. Walwork, D.J.W. Grant. (1987) Química Física para estudiantes de Farmacia y Biología, Cap. 12: Coloides. Ed. Alhambra.
-P.C. Hiemenz, R. Rajagopalan. (1997) Principles of Colloid and Surface Chemistry. Marcel Dekker

2. Further reading

None

COORDINATION CRITERIA

Tasks deadlines
Tasks performance

SCHEDULE

Period	Assessment activities	Group work (cooperative)	Lab practice	Lectures
1# Fortnight	0,0	0,0	0,0	4,0
2# Fortnight	0,0	3,0	0,0	4,0
3# Fortnight	0,0	3,0	0,0	4,0
4# Fortnight	0,0	3,0	0,0	4,0
5# Fortnight	0,0	0,0	6,0	4,0
6# Fortnight	0,0	0,0	6,0	4,0
7# Fortnight	0,0	3,0	0,0	4,0
8# Fortnight	3,0	3,0	0,0	2,0
Total hours:	***3,0***	***15,0***	***12,0***	***30,0***

The methodological strategies and the evaluation system contemplated in this Course Description will be adapted according to the needs presented by students with disabilities and special educational needs in the cases that are required.

CONTINGENCY PLAN: CASE SCENARIO A

Case scenario A will correspond to a diminished on-site academic activity due to social distancing measures affecting the permitted capacity of classrooms.

COURSE DESCRIPTION

METHODOLOGY

General clarifications on the methodology on case scenario A

A multimodal (hybrid) teaching system will be adopted, combining both on-site and remote classes via videoconference (synchronous) that will be held in the timetable approved by the corresponding Faculty or School. The time distribution of teaching activities (both on-site and remote) will be decided by the aforementioned Faculties and Schools bearing in mind the permitted capacity of classrooms and social distancing measures as established at that time.

The same methodology rules will apply for all students, reagrdless this subject has been taken for first time or as subject repetition.

EVALUATION

Intended learnig	Practice Book	Problem solving	Real and/or simulated tasks
CB10	X		X
CB3	X	X	
CE14	X	X	X
CE15	X	X	X
CE20	X		X
CE21	X		
CE22		X	X
CE25	X	X	
CE29	X	X	X
CE30	X		X
CE31	X		X
CE7	X	X	
CE8		X	X
Total (100%)	***30%***	***30%***	***40%***
Minimum grade	***4***	***4***	***4***

(*)Minimum mark (out of 10) needed for the assessment tool to be weighted in the course final mark. In any case, final mark must be 5,0 or higher to pass the course.

Method of assessment of attendance (Scenario A):

Attendance at seminars (problem solving) and practices is compulsory to pass the course.

COURSE DESCRIPTION

General clarifications on instruments for evaluation (Scenario A):

A grade of 4 must be obtained in each evaluation instrument.
The assessment and weighting instruments of the extraordinary call for the 2021-2022 academic year for students of second enrollment or higher do not proceed since there have not been or are no repeating students in this optional subject since the beginning of the degree. However, if there were any student in an extraordinary situation (adaptation, etc.), for the extraordinary call, the assessment and weighting instruments would be those indicated in the 2020-21 Guide.

Clarifications on the methodology for part-time students and students with disabilities and special educational needs (Scenario A):

Part-time students will be considered separately as a function of each case.

CONTINGENCY PLAN: CASE SCENARIO B

Case scenario B will bring about a suspension of all on-site academic activities as a consequence of health measures.

METHODOLOGY

General clarifications on the methodology on case scenario B

On-site teaching activities will be held via videoconference (synchronous) in the timetable approved by the corresponding Faculty or School. Alternative activities will be proposed for reduced groups in order to guarantee the acquisition of course competences.

The same methodology rules will apply for all students, reagrdless this subject has been taken for first time or as subject repetition.

COURSE DESCRIPTION

EVALUATION

Intended learnig	Practice Book	Problem solving	Real and/or simulated tasks
CB10	X		X
CB3	X	X	
CE14	X	X	X
CE15	X	X	X
CE20	X		X
CE21	X		
CE22		X	X
CE25	X	X	
CE29	X	X	X
CE30	X		X
CE31	X		X
CE7	X	X	
CE8		X	X
Total (100%)	***30%***	***30%***	***40%***
Minimum grade	***4***	***4***	***4***

(*)Minimum mark (out of 10) needed for the assessment tool to be weighted in the course final mark. In any case, final mark must be 5,0 or higher to pass the course.

Moodle Tools	Cuaderno de prácticas	Pruebas de ejecución de tareas reales y/o simuladas	Resolución de problemas
Asistencia	X	X	X
Chat	X	X	X
Tarea	X	X	X
Videoconferencia	X	X	X

Method of assessment of attendance (Scenario B):

Telematic attendance at seminars (problem solving) and practices is compulsory to pass the course.

COURSE DESCRIPTION

General clarifications on instruments for evaluation (Scenario B):

A grade of 4 must be obtained in each evaluation instrument.

Clarifications on the methodology for part-time students and students with disabilities and special educational needs (Scenario B):

Part-time students will be considered separately as a function of each case.