COURSE DATA

Data Subject	
Code	36462
Name	Polímeros y Coloides
Cycle	Grade
ECTS Credits	6.0
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Faculty of Chemistry	4	Second term

Subject-matter

Degree	Subject-matter	Character
1110 - Degree in Chemistry	15 - Physical Chemistry Applied	Optional

Coordination

Name	Department
GOMEZ CLARI, CLARA M	315 - Physical Chemistry

SUMMARY

The course “Polymers and Colloids” is an optional subject of 6.0 ECTS credits, taught during the second semester of the 4th year in the bachelor studies. The course aims to integrate in the chemical training of the student basic concepts related to polymeric and colloidal materials.

From a didactic point of view, the contents of the course have been distributed in three blocks: polymers, colloids, and applications. The first block focuses on polymeric materials from a general point of view. The second block deals with colloidal systems, with a special emphasis on polymer colloids. The different didactic units of these first two blocks cover (i) the synthesis of the materials, (ii) the physico-chemical aspects related to polymer and colloid systems, and (iii) the characterization techniques. The third and last block, shorter in extension, has a single didactic unit and aims to give concrete examples of applications of polymers and colloids.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

OUTCOMES

1110 - 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.
- Solve problems effectively.
- 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.
- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units.
- Demonstrate knowledge of the characteristics and behaviour of the different states of matter and the theories used to describe them.
- Demonstrate knowledge of the main types of chemical reaction and their main characteristics.
- Show knowledge of the metrology of chemical processes including quality management.
- Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.
- Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes.
- Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry.
- Solve qualitative and quantitative problems following previously developed models.

- Evaluate, interpret and synthesise chemical data and information.
- Handle the instrumentation used in the different areas of chemistry.
- Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them.
- Relate theory and experimentation.
- Recognise and evaluate chemical processes in daily life.
- Understand the qualitative and quantitative aspects of chemical problems.
- Develop sustainable and environmentally friendly methods.
- Relate chemistry with other disciplines.
- 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.
- Have basic skills in the use of information and communication technology and properly manage the information obtained.

LEARNING OUTCOMES

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

SPECIFIC KNOWLEDGE OF CHEMISTRY	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject POLYMERS AND COLLOIDS that contemplate the learning

	outcomes EUROBACHELOR®
Major aspects of chemical terminology, nomenclature, conventions and units.	Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units..(CE1)
The major types of chemical reaction and the main characteristics associated with them.	Demonstrate knowledge of the main types of chemical reaction and their main characteristics.(CE4)
The principles and procedures used in chemical analysis and the characterisation of chemical compounds.	Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds.(CE8) Show knowledge of the metrology of chemical processes including quality management..(CE10) Handle the instrumentation used in the different areas of chemistry.(CE19). Understand the qualitative and quantitative aspects of chemical problems..(CE24). Develop sustainable and environmentally friendly methods.(CE25)
The principal techniques of structural investigations, including spectroscopy	Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications..(CE7). Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes..(CE12). Handle the instrumentation used in the different areas of chemistry.(CE19). Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds.(CE8)
The characteristics of the different states of matter and the theories used to describe them.	Demonstrate knowledge of the characteristics and behaviour of the different states of matter and the

	theories used to describe them..(CE3).
The relation between bulk properties and the properties of individual atoms and molecules, including macromolecules (both natural and man-made), polymers and other related materials.	Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.CE11).

COMPETENCES AND COGNITIVE SKILLS	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject POLYMERS AND COLLOIDS that contemplate the learning outcomes EUROBACHELOR®
Ability to demonstrate knowledge and understanding of the facts, concepts, principles and fundamental theories related to the topics mentioned above.	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry..(CE13).
Ability to apply this knowledge and understanding to the solution of common qualitative and quantitative problems.	Solve qualitative and quantitative problems following previously developed models..(CE14). Recognise and analyse new problems and plan strategies to solve them..(CE15). Understand the qualitative and quantitative aspects of chemical problems..(CE24).
Competences for the evaluation, interpretation and synthesis of information and chemical data.	Evaluate, interpret and synthesise chemical data and information..(CE16). Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them..(CE20).
Ability to recognize and implement science	Show knowledge of the metrology of chemical processes including quality management..(CE10)

and the practice of measurement.	Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them..(CE20).
Competences to present and argue scientific issues orally and in writing to a specialized audience.	Relate chemistry with other disciplines.(CE26). Prepare reports, surveys and industrial and environmental projects in the field of chemistry..(CE27). Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate. (CG6). Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences..(CB4).
Ability to calculate and process data, related to information and chemistry data.	Solve qualitative and quantitative problems following previously developed models..(CE14). 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 POLYMERS AND COLLOIDS that contemplate the learning outcomes EUROBACHELOR®
Ability to apply practical knowledge to solve problems related to qualitative and quantitative information.	Solve problems effectively..(CG4). Solve qualitative and quantitative problems following previously developed models..(CE14).

	Relate theory and experimentation..(CE22). Recognise and evaluate chemical processes in daily life..(CE23). 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.	Develop capacity for analysis, synthesis and critical thinking..(CG1). Show inductive and deductive reasoning ability..(CG2). Solve problems effectively..CG4).
Competences in information management, in relation to primary and secondary sources, including information retrieval through on-line searches.	Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate..(CG6). Have basic skills in the use of information and communication technology and properly manage the information obtained.(CT2).
Ability to analyse materials and synthesize concepts.	Develop capacity for analysis, synthesis and critical thinking..(CG1). Show inductive and deductive reasoning ability..(CG2). 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).
Ability to adapt to new situations and make decisions.	Demonstrate the ability to adapt to new situations..(CG9). Recognise and analyse new problems and plan strategies to solve them..(CE15). 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.	Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate..(CG6). Have basic skills in the use of information and communication technology and properly manage the information obtained.(CT2).
Planning and time management skills.	Develop capacity for analysis, synthesis and critical thinking.(CG1). Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation..(CG3). Solve problems effectively..CG4).

Interpersonal skills to interact with other people and get involved in team work.	Demonstrate ability to work in teams both in interdisciplinary teams and in an international context..(CG5). Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional. (CG7). Demonstrate the ability to adapt to new situations..(CG9).
Competences in oral and written communication, in one of the main European languages, in addition to the language of the country of origin.	Demonstrate ability to work in teams both in interdisciplinary teams and in an international context..(CG5). Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional. (CG7). Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community. (CT1). Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences..(CB4). Have basic skills in the use of information and communication technology and properly manage the information obtained.(CT2).
Study skills necessary for professional development. These will include the ability to work autonomously.	Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation..(CG3). Demonstrate ability to work in

	teams both in interdisciplinary teams and in an international context..(CG5). Learn autonomously.(CG8). Demonstrate the ability to adapt to new situations..(CG9). Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.(CB5).
Ethical commitment to the European Code of Conduct: http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf	Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.(CG10). Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional. (CG7). 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).

These learning outcomes are to allow that, at the end of the course, the student should be able to:

Unit 1

- Define polymer or macromolecule.
- Define the size of a polymer and differentiate the characteristic average molecular masses of macromolecular systems.
- Differentiate the characteristic temperatures of a polymer.
- Explain the variation of the state of a polymer as a function of temperature.

Unit 2

- Describe the types of polymerization reactions.
- Describe the polymerization kinetics.
- Explain the preparation of a polymer by chain polymerization method.
- Compare the polymerization techniques.
- Explain the preparation of a polymer by the step-polymerization method.

Unit 3

- Define glass transition temperature.
- Explain which factors the glass transition temperature depends on.
- Explain polymer crystallization.
- List which factors affect the crystallization.
- Define melting temperature.
- Cite which factors affect the melting temperature.
- Explain the variation of the state of a polymer as a function of temperature.
- Explain the behavior of a polymer under a strain as a function of temperature.

Unit 4

- Characterize polymers in solution.
- Determine average molecular weights
- Characterize polymers in solid and molten states.
- Evaluate the properties as a function of temperature.
- Evaluate the behavior based on applied force.
- Evaluate the properties of structure and morphology in polymers.

Unit 5

- Differentiate colloidal and non-colloidal systems according to the IUPAC definition
- Classify colloidal systems according to the different possible criteria.
- List and describe the different methods of colloid preparation.
- Explain the techniques of preparation of inorganic colloids.
- Describe the main aspects of the processes of nucleation and growth in colloids.

Unit 6

- Define the concept of surfactant and classify the different types.
- Explain the adsorption of surfactants in interfaces using thermodynamic concepts.
- Define the concepts of micelle and critical micellar concentration.
- Describe the concept of number of aggregation and relate it to the possible aggregation structures in colloidal systems.
- Evaluate the suitability of a surfactant as an emulsifier of a given system according to its HLB index value.
- Explain the fundamental thermodynamic aspects of interfaces in colloidal systems.
- Describe the double layer models for charged interfaces applied to colloidal systems.
- Explain processes of interaction between particles, taking into account the concepts of electrostatic and steric stabilization.
- Explain and apply the DVLO theory in the evaluation of colloidal stability.

Unit 7

- Differentiate the types of emulsion (emulsion, miniemulsion and microemulsion) according to their thermodynamic and kinetic characteristics.
- List the most common methods of homogenization in emulsions and describe the fundamental aspects of each one.
- Differentiate the types of polymerization in heterophase systems and describe the main characteristics of each.
- Cite examples of polymerization in systems with spontaneous emulsification.
- Explain the technique of preparing polymer colloids by solvent evaporation.

Unit 8

- Describe and evaluate the limitations of the usual techniques of characterization of particle size in colloidal systems.
- Describe and evaluate the limitations of the usual characterization techniques of morphological and structural characterization of colloidal systems
- Predict the stability of a colloidal system according to zeta potential values and evaluate the limitations of the prediction.
- Demonstrate ability to select the appropriate method to the type of chemical problem and know the expected errors.

Unit 9

- Demonstrate the ability to correlate the knowledge acquired in chemistry and through bibliographic information to the physicochemical processes that occur in the laboratory and at industrial level.
- Demonstrate capacity, based on the application of physicochemical knowledge, to innovate in productive processes.
- Demonstrate the ability to solve real problems that require a multidisciplinary and theoretical practical study, combining several physicochemical techniques.
- Demonstrate the ability to explain through physicochemical theoretical phenomena real situations that take place during the synthesis and characterization of materials, both in the laboratory and in

industrial processes.

DESCRIPTION OF CONTENTS

1. Polymers and polymer systems

1.1. Historical development
1.2. Basic concepts and definitions

2. Polymerization reactions

2.1. Introduction
2.2. Chain polymerization
2.2.1. Radical polymerization
2.2.2. Anionic polymerization
2.2.3. Cationic polymerization
2.3. Step polymerization
2.4. Polymerization techniques

3. Properties of polymers in solid state

3.1. General characteristics
3.2. Vitreous transition
3.3. Crystallization
3.4. Fusion
3.5. Mechanical behavior
3.6. Dynamomechanical behavior

4. Polymer characterization

4.1. Characterization of polymers in solution. Determination of molecular weights and dimensions
4.2. Characterization of polymers in solid state
4.2.1. Thermal analysis
4.2.1.1. Differential scanning calorimetry
4.2.1.2. Temperature-modulated differential scanning calorimetry
4.2.1.3. Thermogravimetric analysis
4.2.2. Characterization of the dynamomechanical behavior
4.3. Characterization of the mechanical behavior
4.3. Rheology of molten polymers and solutions
4.4. Other characterization techniques: spectroscopic techniques (FTIR, UV-Vis, Raman, NMR), X-ray techniques, microscopy techniques (SEM, TEM, AFM), conductivity measurements

5. Colloid Systems

5.1. Definition of colloid
5.2. Historical aspects of the development of the colloid and interface science
5.3. Classification of colloidal systems
5.4. Methods of preparation of colloidal systems
5.5 Inorganic colloids
5.6. Nucleation and growth

6. Interfaces in colloid systems

6.1. Surfactants
6.1.1. Definition and classification
6.1.2. Adsorption of surfactants and thermodynamic aspects
6.1.3. Formation of micelles and other aggregation structures
6.1.4. Practical criteria for choosing surfactants: hydrophiliclipophilic balance (HLB)
6.2. Thermodynamics of the interface in colloidal systems
6.3. Chrage in colloidal systems
6.3.1. Model of the double layer
6.3.2. Interaction between particles
6.4. Stabilization of colloids
6.4.1. Electrostatic stabilization
6.4.2. Steric stabilization
6.4.3. DLVO theory

7. Polymer colloids and heterophase polymerization

7.1. Emulsion, miniemulsion, and microemulsion
7.1.1. Emulsification methods in emulsions
7.2. Polymerizations in heterophase systems
7.3. Polymerizations in systems with spontaneous emulsification
7.4. Preparation of polymer colloids by solvent evaporation techniques

8. Colloid characterization

8.1. Size characterization
8.2. Morphological and structural characterization
8.3. Characterization of the stability of colloidal systems
8.4. Characterization of other physical parameters

9. Applications of colloid and polymer systems

9.1. Examples of current applications of polymers
9.2. Examples of current applications of colloidal systems

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	51,00	100
Tutorials	9,00	100
Development of individual work	30,00	0
Study and independent work	32,00	0
Preparing lectures	14,00	0
Preparation of practical classes and problem	14,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The development of the subject is done through three types of on-site teaching sessions: theory classes, tutorials, and seminars.

In the theory classes, the fundamental concepts of each unit of the teaching guide will be explained, indicating the relevant literature for the consolidation of the topic. In addition, students will have teaching materials provided by the teaching team, which can serve as a starting point for the student's work, but never as the only study material. After exposing the theoretical concepts, practical activities corresponding to the theme will be carried out.

In the tutorial sessions, the students will work on practical activities proposed by the teacher, a part of them available in advance to allow their autonomous resolution and facilitate the active participation. The tutorials will be interactive to allow the resolution of the doubts of the students.

Finally, theoretical-practical seminars are planned for deepening of aspects of certain topics, highlighted by their interest or actuality. The seminars may be taught or moderated by the teacher or by other professionals relevant to the topic covered and involve the participation of the students by completion of critical exercises, debates, or presentations, and practical activities of different character. The exact date of the seminars, within the official time schedule of the subject, will be announced during the first days of the course.

EVALUATION

The evaluation of the student’s learning will take into account all aspects exposed in the methodology section of this teaching guide. The evaluation will be carried out via two modalities: a continuous-assestment modality and a only-exam modality. In principle, all students remain assigned to the continuous-assestment modality, but they may request the change to the only-exam modality in written form to the teacher(s) of the subject within the first 30 days from the beginning of the course.

Continuous-assessment modality. This modality takes into account the student's **continuous assessment**, which will weigh **40%**in the final grade. Delivery of activities, active participation in tutorials and seminars (16 hours in total), and continuous assessment tests will be taken into account in the continuous evaluation. Continuous assessment tests will be carried out during tutorial and seminar sessions. The participation of the student in the sessions of group tutorials and seminars is mandatory. To compensate the non-assistance to a mandatory session, always for a documented justified reason, the teaching staff may propose the completion of alternative activities. In any case, continuous assessment tests conducted during tutorial and seminar session cannot be retaken. Missing 5 or more hours of tutorials and seminars will automatically imply the grade “not passed” in the continuous assessment with 0%. The remaining **60%** of the grade will be the result of a final exam with theoretical and/or practical exercicises. To pass the subject the student must obtain a total grade equal to or greater than 5 (over 10). It will also be necessary to reach a minimum score of 40% of the total of the section in each of the sections considered in the evaluation.

Only-exam modality. In the only-exam modality, the final grade corresponds exclusively to the exam. To pass the subject the student must obtain a total grade equal to or greater than 5 (over 10).

The evaluation system will be the same in the two calls. If applicable, the continuous assessment grade is maintained for the second call.

REFERENCES

Basic

- 1. R. J. Young, P. A. Lovell. Introduction to Polymers. 2nd edition, Chapman & Hall: London, 1991. ISBN: 0-412-30640-9.
- 2. A. Horta. Macromoléculas. UNED: Madrid, 1982.
- 3. M.A. Llorente, A. Horta. Técnicas de caracterización de polímeros. UNED: Madrid, 1991.
- 4. G. Challa. Polymer Chemistry. Ellis Horwood,:1993.
- 5. J.M.G. Cowie. Polymers: Chemistry and Physics of Modern Materials. Blachie: London, 1991.
- 6. I. Katime, C. Cesteros: Química Física Macromolecular. II. Disoluciones y estado sólido. Servicio Editorial del Pais Vasco. ISBN: 84-8373-467-2.
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- 8. I. Katime. Química Física Macromolecular. Servicio Editorial del Pais Vasco: Bilbao, 1994. ISBN: 84-7585-583-0.

- 9. J. Areizaga, M. M. Cortázar, J. M. Elorza, J. J. Iruin. Polímeros. Editorial Síntesis. ISBN: 84-9756-026-4.
- 10. Ciencia y tecnología de materiales poliméricos, vol. I-II. Instituto de Ciencia y Tecnología de Polímeros: Madrid, 2004.
- 11. T. Cosgrove (ed.). Colloid Science: Principles, Methods and Applications. 2nd ed. Wiley: West Sussex, 2010.
- 12. R. J. Hunter. Foundations of Colloid Science. 2nd ed. Oxford University Press: Oxford, 2001.
- 13. D. H. Everett. Basic Principles of Colloid Science. Royal Society of Chemistry: London, 1988.
- 14. S. Jafari D. J. McClements. Nanoemulsions: Formulation, Applications, and Characterization. Academic Press-Elsevier: London, 2018.

Additional

- 1. Initiation à la chimie et à la physico-chimie macromoleculaires, Groupe Français detudes et dapplications des polymers, 3era edicion, estrasburgo, 1983.
- 2. I. Katime. Problemas Química Física Macromolecular. Servicio Editorial del Pais Vasco: Bilbao, 1994. ISBN: 84-7585-592-X.
  3. Hans-Dieter Dörfler. Grenzflächen und kolloid-disperse. Systeme. Physik und Chemie. Springer: Berlin, 2002.
- 3. Hans-Dieter Dörfler. Grenzflächen und kolloid-disperse. Systeme. Physik und Chemie. Springer: Berlin, 2002.

ADDENDUM COVID-19

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

1. Contenidos

Se mantienen los contenidos inicialmente recogidos en la guía docente.

2. Volumen de trabajo y planificación temporal de la docencia

Se mantiene lo indicado en la guía docente. El cambio de la modalidad presencial a la modalidad en línea no ha modificado el número de sesiones ni el volumen de trabajo. Tanto las sesiones de teoría como las tutorías y los seminarios se mantienen en las horas previstas a través de videoconferencia en el aula virtual.

3. Metodología docente

Se han sustituido las clases presenciales por videoconferencias síncronas mediante el espacio habilitado en el aula virtual de la asignatura (herramienta Blackboard Collaborate). La docencia en línea se ha impartido en el mismo horario que se impartía la docencia presencial en el aula.

Se han subido en el aula virtual todos los materiales correspondientes a las distintas sesiones (diapositivas y materiales complementarios). Se ha diseñado un cuestionario que los alumnos tienen que cumplimentar para afianzar los conocimientos adquiridos. Se ha habilitado un espacio de foro virtual específico para atender las dudas que puedan surgir a lo largo del curso.

La asistencia a las tutorías y seminarios sigue siendo obligatoria para aquellos que siguen la vía de evaluación continua, si bien se ha dado la posibilidad a los estudiantes de cambiarse a la modalidad no presencial si lo consideraban oportuno.

Las tutorías personales se mantienen de manera virtual, tanto a través del correo electrónico de los profesores como a través de videoconferencias cuando ello es necesario.

4. Evaluación

Se mantienen dos vías de evaluación, como se indicaba en la guía docente inicial. La modalidad continua sigue siendo la opción por defecto y se mantiene el peso de las distintas partes. La nota final nunca será inferior a la nota obtenida en el examen. Si la nota obtenida en el examen fuese superior a la nota final obtenida en la modalidad continua, la nota final será la nota del examen.

- MODALIDAD CONTINUA: como se indicaba en la guía docente, el 40% de la nota final corresponde a las distintas actividades realizadas a lo largo del curso y el 60% corresponde a un examen final, que se realizara telemáticamente. Las actividades continuas evaluables en esta modalidad son las mismas previstas inicialmente, variando la forma en la que se han entregado o desarrollado:

a) Participación en clase (presencial o en línea), entregas en grupos de actividades no presenciales (ANP) y entrega final de un dossier de actividades, siempre a través del aula virtual: 15% de la nota.

b) Tres pruebas de evaluación continua (PAC) en las sesiones de tutorías 2, 4 y 6 (la última PAC es telemática a través del aula virtual): 10% de la nota.

c) Realización de una presentación en grupo sobre un tema acordado con los estudiantes: 10% de la nota. Con el cambio a la docencia en línea, se han dado dos alternativas a los estudiantes para realizar la presentación: por videoconferencia síncrona o por medio de un videotutorial subido con antelación. En cualquiera de las dos opciones, los estudiantes deben estar presentes en los seminarios por videoconferencia síncrona para responder a las cuestiones sobre las presentaciones que tengan los profesores.

- MODALIDAD NO CONTINUA (sólo examen final): la nota corresponde en su totalidad a un examen final telemático.

Para las dos modalidades, el examen telemático se realizará a través del aula virtual de la asignatura y constará de preguntas de diversos tipos (opción múltiple, preguntas cortas, cuestiones numéricas y preguntas a desarrollar). Cuando proceda por el tipo de pregunta, los alumnos subirán la respuesta fotografiada o escaneada en el espacio habilitado. Cada alumno recibirá enunciados diferentes, pero de complejidad similar, escogidos aleatoriamente por el sistema informático de un banco de preguntas preparado por los profesores.

Para garantizar que las pruebas virtuales de evaluación han sido realizadas por los alumnos con los medios legítimos permitidos, los profesores pueden concertar en aquellos casos que consideran oportunos una "entrevista-prueba de validación oral" por videoconferencia (o, en caso excepcional debidamente justificado, por teléfono) de una duración máxima de 20 minutos. La decisión de la realización o no de esta prueba es de los profesores. Puede tener una de estas tres calificaciones:

- VALIDA: se confirma la nota del examen

- VALIDA PARCIALMENTE: se anula alguna de las respuestas del examen y se modifica la nota de acuerdo a la revisión.

- NO VALIDA: el examen virtual no se considera válido y tiene la calificación de 0, lo que supone el suspendido de la asignatura. La no asistencia a la entrevista de validación por motivos no justificados comportará inmediatamente la calificación NO VALIDA.

La necesidad de realización de la prueba de validación será comunicada al estudiante por correo electrónico dentro de los cinco días posteriores a la realización del examen virtual y deberá ser dentro de los 10 días posterior al examen. La hora de realización de la prueba será por acuerdo entre el profesor y el estudiante. Sin embargo, en caso de no llegarse a un acuerdo, el profesor fijará el día y la hora.

La entrevista de validación será grabada para documentación y, cuando la calificación sea “VALIDA PARCIALMENTE” o "NO VALIDA", el profesor emitirá un informe justificativo por escrito.

5. Bibliografía

Además de la bibliografía inicial de la guía docente, al principio del curso presencial se recomendaron los manuales siguientes, especialmente interesantes ahora porque están disponibles electrónicamente para todos los estudiantes a través del Servicio de Bibliotecas y Documentación de la UV:

Kontogeorgis, G.M.; Kiil, S. Introduction to Applied Colloid and Surface Chemistry. Wiley, 2016. DOI: 10.1002/9781118881194

Koltzenburg, S.; Maskos, M.; Nuyken, O. Polymer Chemistry. Springer-Verlag, 2017. DOI: 10.1007/978-3-662-49279-6