Teaching Guide				
Identifying Data				2023/24
Subject (*)	Nanotechnology in Food Industry		Code	610G04044
Study programme	Grao en Nanociencia e Nanotecnoloxía			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Fourth	Optional	4.5
Language	SpanishGalicianEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	BioloxíaQuímica			
Coordinador	Saavedra Bouza, Almudena	E-mail	almudena.saavedra@udc.es	
Lecturers	De Castro De Antonio, María Eugenia Del Castillo Busto, Estela Muniategui Lorenzo, Soledad Saavedra Bouza, Almudena	E-mail	m.decastro@udc.es estela.delcastillo@udc.es soledad.muniategui@udc.es almudena.saavedra@udc.es	
Web				
General description	Nanotechnology in the world of food has its application in areas such as food quality and safety, new product development and packaging. The formation of nanoparticles, nanoemulsions and nanocapsules will improve the nutritional value of products and improve their absorption in the organism, thus increasing the bioavailability and dispersion of the nutrients of interest. Nanotechnology in Food Industry is essential to acquire the basic knowledge and to know the different techniques used in the food industry at the nanometric scale, as well as to acquire the knowledge of food safety and quality.			

Study programme competences / results	
Code	Study programme competences / results
A2	CE2 - Aplicar los conceptos, principios, teorías y hechos fundamentales relacionados con la Nanociencia y Nanotecnología a la resolución de problemas de naturaleza cuantitativa o cualitativa.
A3	CE3 - Reconocer y analizar problemas físicos, químicos, matemáticos, biológicos en el ámbito de la Nanociencia y Nanotecnología, así como plantear respuestas o trabajos adecuados para su resolución, incluyendo el uso de fuentes bibliográficas.
A9	CE9 - Evaluar correctamente los riesgos sanitarios y de impacto ambiental asociados a la Nanociencia y la Nanotecnología.
A10	CE10 - Comprender la legislación en el ámbito del conocimiento y la aplicación de la Nanociencia y Nanotecnología. Aplicar principios éticos en este marco.
B1	CB1 - Que los estudiantes hayan demostrado poseer y comprender conocimientos en un área de estudio que parte de la base de la educación secundaria general, y se suele encontrar a un nivel que, si bien se apoya en libros de texto avanzados, incluye también algunos aspectos que implican conocimientos procedentes de la vanguardia de su campo de estudio
B2	CB2 - Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio
B3	CB3 - Que los estudiantes tengan la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética
B4	CB4 - Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado
B6	CG1 - Aprender a aprender
B7	CG2 - Resolver problemas de forma efectiva.
B8	CG3 - Aplicar un pensamiento crítico, lógico y creativo.
B11	CG6 - Comportarse con ética y responsabilidad social como ciudadano/a y como profesional.
C3	CT3 - Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida
C5	CT5 - Entender la importancia de la cultura emprendedora y conocer los medios al alcance de las personas emprendedoras
C7	CT7 - Desarrollar la capacidad de trabajar en equipos interdisciplinares o transdisciplinares, para ofrecer propuestas que contribuyan a un desarrollo sostenible ambiental, económico, político y social.

C8	CT8 - Valorar la importancia que tiene la investigación, la innovación y el desarrollo tecnológico en el avance socioeconómico y cultural de la sociedad
C9	CT9 - Tener la capacidad de gestionar tiempos y recursos: desarrollar planes, priorizar actividades, identificar las críticas, establecer plazos y cumplirlos

Learning outcomes			
Learning outcomes	Study programme competences / results		
Identify the main nanotechnology techniques applied to food industry.	A2 A3	B1 B2 B3 B6 B7	C3
Recognize the possibilities of nanotechnology in food industry.	A2 A3	B1 B2 B3 B4 B6 B7 B8	C3 C5 C7 C8
Identify food quality and safety as key factors for the application of nanotechnology in food industry.	A3 A9 A10	B2 B3 B4 B7 B8	C3 C5 C7 C8
Applying nanotechnology to food industry	A2 A3 A9 A10	B7 B8	C3 C7 C8 C9
Recognize and apply ethical and legal principles within the field of study.	A10	B11	C5 C7 C8

Contents	
Topic	Sub-topic
1. Nanomaterials in food industry. Types and uses.	Importance of nanotechnology in food industry. Types of nanomaterials used in food industry. Uses and applications of nanomaterials in food industry.
2. Food contact materials. Active and intelligent packaging.	Concept of materials in contact with food. Functions and characteristics of active and intelligent packaging. Benefits and applications of active and intelligent packaging in food industry.
3. Functional nanofoods.	Current concept of functional nanofoods. Development and applications of functional nanofoods. Advantages and disadvantages.
4. Food microencapsulation.	Concept of microencapsulation. Substances to be encapsulated, agents used and techniques.
5. Emulsions.	Concept of emulsions. Emulsions formation and applications. Nanoemulsions.
6. Hydrogels.	Hydrogel concept. Hydrogels formation and applications. Micro and nanogels.
7. Foams.	Foam concept. Foams formation and applications. Nanofoams.

8. Food quality and safety.	Guidelines on risk assessment of nanomaterials applied in the food and feed chain. Standards and regulations related to quality and safety of nanomaterials in food industry. Control procedures and methods to guarantee the safety of nanomaterials in the food chain.
9. Ethical and legal aspects.	Ethical considerations related to nanotechnology in food industry. Directives and regulations in European framework for the application of nanotechnologies in food. Legal implications and responsibility of manufacturers in the use of nanotechnology in food industry.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A2 A3 A10 B2 B3 B4 B11 C5	18	34.2	52.2
Seminar	A2 A3 A9 A10 B1 B2 B3 B4 B6 B7 B8 B11 C3 C7 C9	7	16.8	23.8
Mixed objective/subjective test	A2 A3 A10 B3 B7 B8	3	0	3
Laboratory practice	A2 A3 A9 A10 B1 B2 B3 B4 B6 B7 B8 B11 C3 C7 C8 C9	10	21.5	31.5
Personalized attention		2	0	2
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	In the lecture sessions, the fundamental contents of each topic will be taught by the teaching staff through theoretical explanations and practical examples. To make the most of these sessions, students will have access to suitable teaching materials in advance on the Virtual Campus. Student participation will be encouraged.
Seminar	As a complement to lectures, seminars will be dedicated to the analysis and resolution of problems or practical cases related to nanotechnology in food industry. Seminars will be held in small groups, thus promoting student participation and collaborative work. Additionally, a pre-laboratory or explanatory session on laboratory practices may be conducted.
Mixed objective/subjective test	Written test to assess the degree of acquisition of knowledge and skills by students. It may combine different types of questions such as multiple choice, matching, explanation, problem-solving or calculation.
Laboratory practice	In the laboratory practice sessions, a series of activities will be conducted for the students (in small groups) learn how to handle various techniques used in food nanotechnology. An initial session will be given to introduce students to the contents and dynamics of the practical exercises. Students will have to prepare a report detailing the work done, including a critical and detailed analysis.

Personalized attention	
Methodologies	Description

Laboratory practice Seminar	The laboratory practice sessions are designed as activities in small groups in which students will participate directly. This approach provides personalized attention to students, allowing for better following-up and guidance. All students will have access to personalized tutoring sessions focused on acquiring basic knowledge, solving problems, the study of practical cases, and the resolution of doubts and clarifications. The schedule for tutoring sessions will be specified at the beginning of the course. Students with recognized part-time dedication and academic dispensation from attendance will be accommodated through tutoring hours (by appointment).

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Mixed objective/subjective test	A2 A3 A10 B3 B7 B8	Final written test where both the knowledge acquired in the lecture sessions and in the laboratory practices and seminars will be assessed.	60
Laboratory practice	A2 A3 A9 A10 B1 B2 B3 B4 B6 B7 B8 B11 C3 C7 C8 C9	Evaluation will consider both the experimental work (skill, attitude, organization, attention, understanding of the strategies and methodologies used in project execution, critical analysis of results, and discussion) and the development of the laboratory logbook.	15
Seminar	A2 A3 A9 A10 B1 B2 B3 B4 B6 B7 B8 B11 C3 C7 C9	Students' participation, use of correct scientific language, verified bibliographic information, as well as the resolution of questions, cases, and/or problems presented by the the teacher will be consider.	25

Assessment comments

Student's work will be continuously evaluated through attendance at assessable activities, participation in seminars, solving resolution questions and problems, laboratory practices and a mixed test. To make the most of the course, students must attend all face-to-face activities.

Completing the laboratory practices is mandatory for passing the course. Students who do not complete ALL the practices, without proper justification, will not be able to pass the course, regardless of their weight in the evaluation.

FIRST CHANCE: to pass the subject it is necessary to obtain in each of the evaluable parts (laboratory practices, seminars and mixed test) a minimum grade of 4 (out of 10). The final grade is obtained by applying the established percentages and the previously established restrictions, being necessary a final grade equal or higher than 5 (out of 10).

The student will obtain the grade of Not Presented when he/she does not take either the laboratory practices or the mixed test.

SECOND CHANCE: in the second opportunity the mixed test will be taken, whose grade will replace the grade obtained in the first opportunity, maintaining the grades of the laboratory practicals and seminars in the first opportunity. The final grade is obtained by applying the established percentages and the previously established restrictions, being necessary a final grade equal or higher than 5 (out of 10). Students evaluated in the second opportunity will only be eligible for the honor registration if the maximum number of these for the corresponding course were not covered in their totality in the first opportunity.

ADVANCED CALL: the mixed test will be carried out, whose qualification will replace the one obtained in the last course, maintaining the grades of the rest of the evaluable activities. The final grade will be obtained taking into account the percentages of the current course.

In any case, if a minimum grade of 4/10 is not reached in each of the evaluable parts, the course will be failed, even if the final grade, calculated according to the corresponding percentages, is equal or higher than 5/10. In this case, the final grade will be 4.5/10.

HONOR ENROLLMENT: Students evaluated in the second opportunity will only be eligible for the MH if the number of MHs was not covered in its totality in the first opportunity.

SUBSEQUENT ACADEMIC COURSES: the teaching-learning process, including the evaluation refers to an academic year, therefore, it

will start again from scratch with each course.
STUDENTS
WITH RECOGNITION OF PART-TIME DEDICATION: The same evaluation criteria indicated above apply.
STUDENTS
WITH ACADEMIC DISPENSATION OF EXEMPTION FROM ATTENDANCE (according to the regulations of the UDC): the same evaluation criteria indicated above apply (except in the part of seminars where only the resolution of the questions/problems posed by the professor will be taken into account). The realization of the internship will be facilitated within the flexibility allowed by the coordination schedules and the material and human resources. This applies to both opportunities.

In the evaluation of the subject will apply all that is established in Article 14, regarding the Fraud Commission and disciplinary responsibilities, of the Rules of evaluation of degrees and masters of the UDC.

The fraudulent performance of the tests or evaluation activities, once verified, will directly imply the qualification of failure "0" in the subject in the corresponding call, thus invalidating any qualification obtained in all evaluation activities for the extraordinary call.

Sources of information	
Basic	
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Techniques of Characterisation of Nanomaterials 2/610G04030 Techniques of Characterisation of Nanomaterials 1/610G04025 Fundamentals of Biotechnology/610G04029 Structural Biochemistry/610G04019 Molecular and Metabolic Biochemistry/610G04023
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Final Year Dissertation/610G04047
Other comments
It is recommended to keep the course up to date, to prepare the laboratory practices andseminars thoroughly and to take advantage of them to clarify doubts andconcepts, thereby complementing the necessary theoretical training. Having knowledge of English and basic ICT tools isalso advised. GreenCampus Program, Faculty of Science: To contribute to an immediate sustainableenvironment and fulfill point 6 of the "Environmental Declaration of theFaculty of Science (2020)", documentary work will predominantly berequested in virtual format and computer support. If printed, plastic materialswill not be used, double-sided printing will be encouraged, recycled paper willbe used whenever possible, and printing of drafts will be minimized. Efforts will be made to identify and modify sexistbiases and attitudes, influencing the environment to promote respect andequality. Situations of gender discrimination should be identified, and actionsand measures to correct them will be proposed.

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.