VNIVERSITAT DE VALÈNCIA

# Course Guide
# 33943 Foodstuff Chemistry

## COURSE DATA

| Data Subject | |
|---|---|
| **Code** | 33943 |
| **Name** | Foodstuff Chemistry |
| **Cycle** | Grade |
| **ECTS Credits** | 6.0 |
| **Academic year** | 2024 - 2025 |

**Study (s)**

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 1205 - Degree in Human Nutrition and Dietetics | Faculty of Pharmacy and Food Sciences | 2 | First term |
| 1211 - Double Degree in Pharmacy and Human Nutrition and Dietetics | Faculty of Pharmacy and Food Sciences | 2 | First term |

**Subject-matter**

| Degree | Subject-matter | Character |
|---|---|---|
| 1205 - Degree in Human Nutrition and Dietetics | 11 - Food chemistry | Obligatory |
| 1211 - Double Degree in Pharmacy and Human Nutrition and Dietetics | 1 - Asignaturas obligatorias del PDG Farmacia-Nutrición Humana y Dietética | Obligatory |

**Coordination**

| Name | Department |
|---|---|
| GARCIA LLATAS, GUADALUPE | 265 - Prev. Medicine, Public Health, Food Sc.,Toxic. and For. Med. |
| RODRIGUEZ CARRASCO, YELKO | 265 - Prev. Medicine, Public Health, Food Sc.,Toxic. and For. Med. |

## SUMMARY

Food Chemistry is a mandatory subject, carrying 6 ECTS in the second year, second semester of the Degree in Human Nutrition and Dietetics (HND) and of the Double Degree (Pharmacy and HND). It is part of Module 2: Food Science, which includes other subjects such as Bromatology, Fundamentals of Food Technology and Technology Cuisine.

To gain insight into the physicochemical changes that can occur in foods and act on them, producing the desired changes, the first thing we need is to know are the characteristics of their components. Food Chemistry studies the different substances that can become part of the food, their structure, characteristics, physicochemical properties and reactions that may be involved and their possible interactions with other food components. Therefore, nutrients are studied (water, carbohydrates, lipids, proteins, vitamins and minerals) and other non-nutritional substances for the human organism, such as pigments, flavourings and food additives.

Foods derived from biological systems, i.e. from two main sources, animals and plants, undergo changes along time, in some cases due to their own cellular metabolism. In addition, the transformation undergone during processing and/or storage of foods requires a detailed study for each type of food, as these stages are influenced by their specific characteristics.

In short, the subject of Food Chemistry deals with the study of:

a) Components of food: structure, physicochemical properties, reactions.

b) The changes incurred during processing and/or storage of food.

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

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

### Other requirements

Subjects of the Basic Module, essentially, Physics and Chemistry (general and organic). It is advisable to do concurrently the other courses belonging to the same module (Food Science and Fundamentals of Food Technology).

## COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

### 1205 - Degree in Human Nutrition and Dietetics

- Reconocer los elementos esenciales de la profesión del dietista-nutricionista, incluyendo los principios éticos, responsabilidades legales y el ejercicio de la profesión, aplicando el principio de justicia social a la práctica profesional y desarrollándola con respeto a las personas, sus hábitos, creencias y culturas, con perspectiva de género.
- Know, judge and know how to use and apply the sources of information related to nutrition, food, lifestyles and health.
- Recognise one's own limitations and the need to maintain and update professional competence, with particular emphasis on independent and lifelong learning of new facts, products and techniques in the field of nutrition and food, and on motivation for quality.

- Realizar la comunicación de manera efectiva, tanto de forma oral como escrita, con las personas, los profesionales de la salud o la industria y los medios de comunicación, sabiendo utilizar las tecnologías de la información y la comunicación especialmente las relacionadas con nutrición y hábitos de vida.
- Identify and classify food and food products. Know how to analyse them and determine their composition, properties, nutritional value, bioavailability, organoleptic and sensorial characteristics and alternations resulting from technological and culinary processing.
- Adquirir la formación básica para la actividad investigadora, siendo capaces de formulas hipótesis, recoger e interpretar la información para la resolución de problemas siguiendo el método científico, y comprendiendo la importancia y las limitaciones del pensamiento científico en materia sanitaria y nutricional.
- Desarrollar la profesión con respeto a otros profesionales de la salud, adquiriendo habilidades para trabajar en equipo.
- Be familiar with discipline-specific terminology.
- Know the physicochemical properties, chemical reactions and technological functions of the components of food.
- Determine the influence of physical and chemical factors on the components of food.
- Know how to apply the knowledge acquired to the preparation and preservation of food.
- Acquire the knowledge and skill needed to elucidate the causes of organoleptic and/or nutritional modifications of components and/or food.
- Acquire knowledge to design and/or improve food.

## LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

- To master the terminology of the subject

- To understand the effects of technological processes on the chemical properties of food components.

- To apply the knowledge acquired in the handling and storage of food.

- To evaluate possible causes of sensory and/or nutritional changes of the components and/or food.

- To apply the knowledge to design and/or improve food

- To know, critically assess, manage and apply the most relevant basic and specialized bibliographic sources, as well as some on-line sources of dissemination of subjects related to food chemistry.

- To acquire the ability to synthesize and organize the information obtained from various sources properly.

- To be able to express adequately, both orally and in writing, the knowledge gained and put it in context with previously acquired knowledge.

- To know how to apply scientific rigor in laboratory assays and in problem-solving.

- To adopt the skill to prepare reports of studies related to the subject.

## DESCRIPTION OF CONTENTS

### 1. Main components in foods: structure, physical-chemical properties, reactions in foods.

Item 1. Food Chemistry. Concept. Relationship with other subjects. Literature.
Item 2. Water. Physical constants and structures of water and pure ice. Water-solute interactions. Water activity and alterations in foods.
Item 3. Carbohydrates. Classification. Starch and modified starches.
Item 4. Browning in foods I. Classification. Caramelisation and ascorbic acid degradation.
Item 5. Browning in foods II. Maillard reaction.
Item 6. Components of dietary fibre. Other functional properties of carbohydrates.
Item 7. Lipids. Physical properties of fatty acids and fats.
Item 8. Lipid alterations. Classification. Lipid oxidation. Other lipid alterations. Frying process.
Item 9. Modifications of fats and oils. Functional properties of lipids.
Item 10. Proteins. Modifications of proteins during processing and storage. Functional properties.
Item 11. Enzymes. Classification and action in foods. Enzymatic browning.

### 2. Minor components in foods: structure, physical-chemical properties, reactions in foods.

Item 12. Minerals and anti-nutritional factors. Modification of mineral content during food processing. Anti-nutritional factors: nature, mechanism of action and mitigation.
Item 13. Hydrosoluble vitamins. Structure and stability.
Item 14. Liposoluble vitamins. Structures and stability.
Item 15. Pigments and aroma compounds in foods. Pigments: structures and stability. Aroma compounds: concept, impact compounds and aroma compounds generated in enzymatic and non-enzymatic reactions. Off-flavours. Food flavouring.
Item 16. Food additives. Concept and classification. Description of additives.

### 3. Food of animal and plant origin: changes undergone during processing and/or storage.

Item 17. Meat. Post-mortem changes. Effects of thermal treatment. Meat products.
Item 18. Fish. Post-mortem changes. Changes during processing.
Item 19. Milk. Effects of thermal treatment. Dairy products. Changes during their elaboration.
Item 20. Cereals. Changes during storage of grain and flour. Changes during baking and storage of bread.
Item 21. Fruits and vegetable. Changes during ripening, storage and processing.
Item 22. Fermented beverages. Changes during their elaboration. Alterations.

## 4. Laboratory sessions

Lab sessions are conducted to: a) identify or quantify the content of a component in food; b) assess the modification of food by processing and/or storage; c) observe the effect of certain properties of food components.
These include:
- Modification of the myoglobin colour of meat.
- Assessment of water retention capacity in meat.
- Evaluation of the effect of heating on soluble proteins in dairy products.
- Evaluation of fermentation in dairy products:
a) Determination of lactose
b) Determination of acidity
- Assessment of frying oil quality:
a) Colorimetric assay
b) Measurement of capacitance
- Evaluation of flour strength. Pelshenke index. Effect of glutathione.
- Determination of Brix degrees in juices.
- Evaluation of fruit maturity index.
- Determination of hydroxymethylfurfural in honey.
- Determination of tartrazine in a commercialized food colouring.

# WORKLOAD

| ACTIVITY | Hours | % To be attended |
|---|---|---|
| Theory classes | 38,00 | 100 |
| Laboratory practices | 15,00 | 100 |
| Seminars | 2,00 | 100 |
| Tutorials | 2,00 | 100 |
| Development of group work | 10,00 | 0 |
| Development of individual work | 4,00 | 0 |
| Study and independent work | 60,00 | 0 |
| Readings supplementary material | 2,00 | 0 |
| Preparation of evaluation activities | 10,00 | 0 |
| Resolution of case studies | 4,00 | 0 |
| **TOTAL** | **147,00** | |

## TEACHING METHODOLOGY

**Theoretical classes**: explanatory sessions and/or demonstration of contents, with a total of 38 hours/term. Classes are taught using audio-visual technical equipment and materials available on the online platform beforehand. At the end of each item, ICT tools might be used by the teacher in order to reinforce the most relevant aspects. Additionally, throughout the semester, students will be provided of activities and resources in order to facilitate the study of the subject available in open-access educative platforms.

**Seminars**: students gain insight through interaction and activities. The coordinated seminars will take place on topics provided by the teacher and related to the course, and must follow the guidelines on coordinated seminars available at the web page of the Degree. The coordinated seminars could be presented in a session organized by the Degree coordination. In the case of Double Degree (Pharmacy and HND) the seminars will not be coordinated. The development of the seminar will be monitored through tutorials, to be agreed upon between the teacher and the students.

**Practical lessons (laboratory):** there will be four hands-on lab sessions, i.e. three of four hours and one of three hours. Practice exercises will be done in pairs.

At the end of each lab session, students must fill in, in pairs, the report available on the online platform, and it must be delivered daily through this platform.

Additionally, students will be provided of links to open-access multimedia resources (i.e. videos recorded by the faculty, ITC tools, etc.) related to the practical lessons in order to facilitate the study and understanding.

**Tutorials**: students can attend tutorials either individually or in a group. Two tutorials of one hour each will take place. Several activities, literature reading, and short questions will be dealt per groups and delivered on the online platform at the end of each session. Additionally, students' queries about the subject will be discussed and solved, and subject concepts and terminology will be reinforced through activities available in open-access educative platforms.

**Continuous assessment activities**: there will be two types of activities: schemes or conceptual maps on key topics of the subject (4 deliverables) and completion of 2 tests that will be distributed throughout the semester. The topics of these activities raised by the teachers will be part of the contents theoretical and practical of the subject. If necessary, students could be provided with the basic bibliography and resources to work on the knowledge they are intended to acquire.

**Individual or group work and study:** individual and in-group learning capacity will be developed.

During the activities, both theoretical and practical, examples of the applications of the subject's contents in relation to the Sustainable Development Goals (SDG) will be indicated. By doing this, it is intended to provide knowledge, skills and motivation to the students in order to understand and address these SDGs, while promoting reflection and criticism.

## EVALUATION

The acquisition of knowledge, competence and skills will be assessed continuously throughout the semester.

Measurable parameters considered are:

a) **Written test** which will assess the degree of general knowledge of theoretical and practical concepts and procedures presented for each item.

b) **Completion of questionnaires** (continuous assessment activities, lab sessions and tutorials) and **elaboration of seminars**.

c) **Resolution of a practical case** related to the lab sessions.

d) The activities of laboratory sessions, tutorials and seminars are of mandatory attendance, and, therefore, **are not recoverable**.

The assessment will take place as follows:

**1. Acquisition of theoretical/practical concepts and their expression through written tests (65%).** The exam matters will include the topics covered in the theoretical and practical sessions and continuous assessment activities. There will be a written test with two calls with prior notice (2 h length) including open questions with short answers, true-false responses with/without justifications, multiple-choice questions, identification of chemical structures of relevant compounds, and short questions concerning the laboratory sessions (basics, purpose of used reagents, etc.). In the possible case of penalizing wrong answers, it will be indicated. The correct expression of concepts (including spelling) as well as the correct use of the terminology will be taken into account for the mark. **Students must reach 5 out of 10** to be added up with the rest of marks obtained and thus pass the subject.

**2. Resolution of a practical case related to the lab sessions (7%) (0.7 out of 10) and the student's attitude and active participation in the lab sessions (4%).**

The resolution of the practical case will be carried out during the last hour of the fourth lab session. Student attitude will be assessed through the active participation in the lab sessions and the delivery of the results' reports at the end of each session.

Assessment criteria:

• Attitude and participation during the lab sessions: Aspects like previous preparation of practical classes, active intervention in issues raised in the laboratory, the cooperative attitude, teamwork and the care and management of material will be considered.

• Application of acquired knowledge to resolve proposed questions and/or problems raised in the practical case.

• In the practical case, solving of calculations and interpretation of the data obtained will be assessed.

**Attendance of the lab sessions and the daily delivery of the results' reports are compulsory to pass the subject.**

**3. Tutorials (4%)**: the solution of questions proposed through the online platform for each session will be assessed and they will have to be delivered by means of it. The evaluation will be carried out through a Moodle questionnaire (0.2 points/tutorial session) composed by test questions.

**Attendance of tutorials is compulsory in order to pass the subject.**

**4. Seminars (10%):** written work, presentation, defence and proposed activities will be taken into account for the assessment of coordinated seminars according to the guidelines available at the web page of the Degree. The level of understanding of the contents as well as the skills for its presentation and discussion will be assessed. In the case of Double Degree (Pharmacy and HND), the proposed activities, as well as their exposition and defense will be assessed.

**Attendance of seminars is compulsory in order to pass the subject.**

**5. Continuous assessment activities (10%):** the realization of the tasks proposed in each of the continuous assessment activities related to the contents of the subject will be assessed. The evaluation will be done through a Moodle questionnaire and by means of the delivery of proposed tasks.

**Notes:**

**(i) Evidence of copying or plagiarism in any of the assessable tasks will result in failure to pass the subject and in appropriate disciplinary action being taken. Please note that, in accordance with article 13. d) of the Statute of the University Student (RD 1791/2010, of 30 December), it is the duty of students to refrain from using or participating in dishonest means in assessment tests, assignments, or university official documents. In the event of fraudulent practices, the "Action Protocol for fraudulent practices at the University of Valencia" will be applied (ACGUV 123/2020): https://www.uv.es/sgeneral/Protocols/C83sp.pdf**
**(ii) The subject will be considered as passed if the mark corresponding to the written theoretical/practical test reaches the established minimum and if a score equal or greater than 5.0 (out of 10) is numerically reached with the sum of the marks obtained in the evaluable activities of the subject.adjetivo**

**(iii) Attendance of laboratory sessions, seminars and tutorials is compulsory to pass the subject.**

**(iv) The daily delivery of the results' report is compulsory to pass the subject.**

**(v) Students who in the first call do not pass the written test, will keep their marks corresponding to seminars, tutorials and report from lab sessions until the second call of the same year.**

**(vi) Students retaking the subject will keep their attendances and marks corresponding to seminars and tutorials. The attendance and marks corresponding to the laboratory sessions will be kept for the following two years after their completion. After this period, lab sessions will have to be retaken.**

## REFERENCES

### Basic

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### Additional

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- https://www.aesan.gob.es/AECOSAN/web/home/aecosan_inicio.htm
- http://www.efsa.europa.eu/
- http://www.eufic.org/index/es/
- Objetivos de Desarrollo Sostenible - ONU: https://www.undp.org/es/sustainable-development-goals

Revistas: Alimentaria (a través de las BBDD de la UV)
Revistas: Revista española de nutrición humana y dietética. https://www.renhyd.org/index.php/renhyd