

Academic Year/course: 2022/23

## 30821 - Food Bio-technology

### Syllabus Information

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**Academic Year:** 2022/23

**Subject:** 30821 - Food Bio-technology

**Faculty / School:** 105 - Facultad de Veterinaria

**Degree:** 568 - Degree in Food Science and Technology

**ECTS:** 6.0

**Year:** 3

**Semester:** First semester

**Subject Type:** Compulsory

**Module:**

## 1. General information

### 1.1. Aims of the course

The degree intends, among other objectives, to render qualified technicians available to the agri-food industry for the management of both quality control and production departments. The Food Biotechnology course is part of the Food Processing and Engineering module, in which all stages of food processing are studied, from obtaining raw materials to the finished product ready for consumption. Within this context, this subject's general objective is that the student acquires knowledge about the fundamentals of the most important applications of Biotechnology in the process of food production, processing and control. Special attention is paid to the use of microorganisms and enzymes in the food industry, and to the innovations in processes and products that are being introduced in the agri-food industry as a result of new biotechnological approaches.

The approaches and objectives of the subject are aligned with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>), in such a way that the acquisition of the learning outcomes of the subject provides training and competence to contribute to some extent to its achievement:

Goal 2: Zero hunger.

Goal 3: Health and well-being.

Goal 9: Industry, innovation and infrastructures.

Goal 12: Responsible production and consumption.

### 1.2. Context and importance of this course in the degree

Passing this subject will enable students to follow the subjects dedicated to the study of Science and Technology of specific food groups, located in the 7th semester, and to pass the Integration Module located in the 8th semester

## 2. Learning goals

### 2.2. Learning goals

In order to pass this subject, the student must demonstrate that:

1. Describes the applications and current state of Biotechnology in the food field and is able to assess the advantages and limitations of new products obtained through biotechnological approaches.
2. Knows the fundamentals of the basic tools of genetic engineering used in the modification of organisms and in the design of diagnostic methods for application in the food industry.
3. Identifies the most widely used fermentation and microbial growth systems and is able to choose a starter culture for the production of a given food product.
4. Deduces the improvement objectives for microbial strains and enzymes of industrial interest, and differentiates the methods for their development.
5. Is able to analyze the characteristics of the most important genetically modified foods, and to explain the most relevant scientific advances in this field.
6. Obtains and characterizes microorganisms and enzymes of interest for use in food production.

7. Is capable of preparing a work on a relevant topic of the subject, based on information sources in Spanish and English

### 3. Assessment (1st and 2nd call)

#### 3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

**The student must demonstrate that she/he has achieved the expected learning outcomes through the following assessment activities:**

**Test 1:** Written exam with short answer theory-practice questions. Passing this test will accredit the achievement of learning outcomes 1, 2, 3, 4, 5 and 7. The grade will be from 0 to 10.

**Test 2:** Resolution and written presentation of issues related to the practical program. Passing this test will accredit the achievement of learning outcomes 2, 3, 6 and 7. The grade will be from 0 to 10.

**Test 3:** Written presentation of an individual autonomous work consisting of the design of a new food, microbial strain or enzyme for application in the food industry, using biotechnological approaches. Passing this test will accredit the achievement of learning outcomes 1, 2, 3, 4, 5, and 7. The grade will be from 0 to 10. This test is considered voluntary.

The student will be able to choose between two options to be evaluated: through two tests (test 1 and test 2) or through three tests (tests 1, 2 and 3). In the first option, test 1 will account for 90% of the final grade and test 2, 10%. In the second option, test 1 will account for 70% of the final grade, test 2 for 10% and test 3 for 20%.

The evaluation test 1 will take place on the dates indicated in the exam calendar drawn up by the center, and tests 2 and 3 will be additionally called during the course of the academic year.

Each evaluation test will be graded from 0 to 10. In order to pass the subject and demonstrate that the student has achieved the expected learning outcomes, the grade obtained in each of the evaluation activities must be equal to or greater than 5. If the student achieves a grade higher than 5 in any of the tests, even if the overall grade is less than 5, the grade achieved in these evaluation tests will be maintained until the 2<sup>nd</sup> call.

Although the 3 evaluation tests will take place on the dates indicated in the exam calendar published by the Faculty of Veterinary, tests 2 and 3 will be additionally convened during the course of the school period.

### 4. Methodology, learning tasks, syllabus and resources

#### 4.1. Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as theory sessions, laboratory sessions, assignments, and tutorials.

The course is divided into 7 parts, with a total of 38 h lectures, 2 hours of seminars, and 20 hours of practical activities (5 sessions of 4 hours each). The seminars will deal with specific biotechnological applications and will be given by invited professionals. Students are expected to participate actively in all the activities throughout the semester.

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

Further information regarding the course will be provided on the first day of class.

#### 4.2. Learning tasks

**This is a 6 ECTS course organized as follows:**

**I: INTRODUCTION. 0.1 ECTS.**

- Lectures: 1 h.

**II: FUNDAMENTAL CONCEPTS OF GENETIC ENGINEERING. 1.2 ECTS.**

- Lectures: 8 h.
- Practice sessions: 4 hours. Bioinformatics. GMO?s detection.

**III: ENZYMES IN FOOD INDUSTRY. 1.2 ECTS.**

- Lectures: 8 h.
- Practice sessions: 4 h. Enzyme activity kinetics.

**IV: FERMENTATION TECHNOLOGY. 1.2 ECTS.**

- Lectures: 8 h.
- Practice sessions: 4 h. Microbial growth, determination of biomass and optical density.

**V: APPLICATIONS OF FERMENTATIONS IN FOOD INDUSTRY. 1.4 ECTS.**

- Lectures: 6 h.
- Practice sessions: 8 h.  $\beta$ -galactosidase production in *Kluyveromyces lactis*. Starter cultures.

**VI: GENETICALLY MODIFIED ORGANISMS FOR THE PRODUCTION OF FOODS WITH IMPROVED PROPERTIES. 0.5 ECTS.**

- Lectures: 5 horas.

**VII: OTHER APPLICATIONS. 0.4 ECTS.**

- Lectures: 2 h.
- Seminars: 2 h. Development of kits for pathogen detection in foods.

### 4.3. Syllabus

The course will address the following topics:

**I: INTRODUCTION** Food Biotechnology: definition, historic perspective, current situation. Social perception.

**II: FUNDAMENTAL CONCEPTS OF GENETIC ENGINEERING.** DNA manipulation. PCR. Mutagenesis. Cloning strategies. Expression vectors, prokaryotic and eukaryotic hosts. Genetic modification of microorganisms, plants and animals. Recombinant products.

**III: ENZYMES IN FOOD INDUSTRY.** Relevance and applications of enzymes in food industry. Strategies for the production and purification of enzymes at the industrial level. Improvement of enzymatic activity.

**IV: FERMENTATION TECHNOLOGY.** Fermentative processes. Products of industrial relevance: biomass, primary and secondary metabolites. Microbial metabolism regulation. Microbial growth in batch, fed-batch and continuous systems. Bioreactors: types, process parameters, control systems. Downstream processing. Scale-up.

**V: APPLICATIONS OF FERMENTATIONS IN FOOD INDUSTRY.** Starter cultures. General strategies for the improvement of starter cultures. Lactic and alcoholic fermentation: microorganisms, applications, improvement objectives, advances. Biomass, additives and ingredients production. Other products: soy fermented products, vinegar and others.

**VI: GENETICALLY MODIFIED ORGANISMS FOR THE PRODUCTION OF FOODS WITH IMPROVED PROPERTIES.** Use of GMO's for the production of foods with improved properties. Modification of texture, nutritional value, flavor, color and functional properties.

**VII: OTHER APPLICATIONS.** Biosensors and other analytical applications.

### 4.4. Course planning and calendar

Schedules of lectures and seminars will coincide with the officially established calendar and will be available at: <http://veterinaria.unizar.es/gradocta/>

The places, calendar and groups for training and practical sessions will be established in coordination with the rest of modules at the beginning of the academic year. The Coordinator will create the groups of students for these activities to avoid overlapping with other subjects.