# Bachelor Degree in Rural and Agri-Food Engineering

**Duration**: 4 years

**Language**: Spanish

**Modality**: personal attendance

**Speciality**:

- Agricultural and Livestock Farming
- Agricultural and Food Industries
- Horticulture, Fruit-farming and Gardening

**Dissertation – ECTS**: 12

**Internship – ECTS**: 5

**Contact**: infoeps@unizar.es

**Goals / Objectives**:

The Degree in Rural and Agri-Food Engineering sets up the student to undertake a profession regulated in Spain with specific professional attributions.

A Graduate in Rural and Agri-Food Engineering from the University of Zaragoza will be a professional capable of learning, developing and applying science and technology in the areas of specialisation listed below, while ensuring the best social, economic, and environmental conditions.

- Agricultural and Livestock Farming
- Agricultural and Food Industries
- Horticulture, Fruit-farming and Gardening

**Subjects of plan**:

The Degree in Rural and Agri-Food Engineering corresponds to level 2 of the Spanish Qualifications Framework for Higher Education (MECES) and to level 6 of the European Qualifications Framework (EQF). It consists of 240 European credits (ECTS) split into 4

academic years (60 credits per academic year), with two semesters per academic year (8 semesters).

Of the total of 240 credits that the student must take, 72 are core (Cr), 72 compulsory-general (Cmg), 60 compulsory-specific to each specialty (Cms), 22 optional (Op), which include 5 credits of external internships and 12 correspond to the Undergraduate Dissertation.

The core and general compulsory subjects are the same for all three specialisations and will be carried out during the first five semesters. The specific compulsory subjects are different for each of the three areas and are taken from the 5$^{th}$ to the7$^{th}$ semester. However, these subjects are electives for the others two specialisations. The electives are to be taken during the last semester of the degree studies and are available to all specialisations. The students have to select four of them from a list of nine. The Undergraduate dissertation, which is compulsory, is done during the last two semesters of the degree studies. 2 ECTS are to verify that level B-1 of a foreign language is met (English, French, German or Italian).

In addition, there is the possibility of recognition of credits for participation in university cultural, sports, student representation, solidarity and cooperation activities up to a maximum of 6 ECTS credits, as contemplated in the Regulation on recognition and transfer of credits in the University of Zaragoza, approved by the Government Council of the UZ on July 9, 2009.

The syllabus is structured in semester subjects.

| Year | Semester | Subject | Type | ECTS | | Year | Semester | Subject | Type | ECTS |
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| 1 | 1 | 28900 Mathematics I | Cr | 6 | | 1 | 2 | 28905 Mathematics II | Cr | 6 |
| 1 | 1 | 28901 Physics I | Cr | 6 | | 1 | 2 | 28906 Physics II | Cr | 6 |
| 1 | 1 | 28902 Chemistry I | Cr | 6 | | 1 | 2 | 28907 Chemistry II | Cr | 6 |
| 1 | 1 | 28903 Computer science | Cr | 6 | | 1 | 2 | 28908 Graphic expression | Cr | 6 |
| 1 | 1 | 28904 Geology, soil science and climatology | Cr | 6 | | 1 | 2 | 28909 Biology | Cr | 6 |
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| 2 | 1 | 28910 Statistics | Cr | 6 | | 2 | 2 | 28911 Botany | Cmg | 6 |
| 2 | 1 | 28912 Animal science I | Cmg | 3 | | 2 | 2 | 28915 Fundamentals of business administration | Cr | 6 |
| 2 | 1 | 28913 Engines and machines | Cmg | 9 | | 2 | 2 | 28916 Plant science / Plant | Cmg | 6 |

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| 2 | 1 | 28914 Topography, cartography and photogrammetry | Cmg | 6 | | 2 | 2 | 28917 Ecology and management of agro-industrial byproducts | Cmg | 6 |
| 2 | 1 | 28919 Electrical engineering and rural electrification | Cmg | 6 | | 2 | 2 | 28918 Strength of materials and structural analysis | Cmg | 6 |
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| 3 | 1 | 28920 Biotechnology | Cmg | 6 | | 3 | 2 | 28925 Production of monogastric animals | Cms ALF | 6 |
| 3 | 1 | 28921 Hydraulics | Cmg | 6 | | 3 | 2 | 28926 Herbaceous crops | Cms ALF | 6 |
| 3 | 1 | 28922 Agricultural economics | Cmg | 6 | | 3 | 2 | 28927 Fruit growing | Cms ALF | 6 |
| 3 | 1 | 28923 Projects | Cmg | 6 | | 3 | 2 | 28928 Livestock farming facilities and equipment | Cms ALF | 6 |
| 3 | 1 | 28924 Animal Science II | Cms ALF | 6 | | 3 | 2 | 28929 Farming: Construction | Cms ALF | 6 |
| 3 | 1 | 28936 Unit Operations I | Cms AFI | 6 | | 3 | 2 | 28937 Unit Operations II | Cms AFI | 6 |
| 3 | 1 | 28930 Horticultural production | Cms HFG | 6 | | 3 | 2 | 28938 Fundamentals of food technology | Cms AFI | 6 |
| | | | | | | 3 | 2 | 28939 Quality management for the agri-food industry | Cms AFI | 6 |
| | | | | | | 3 | 2 | 28940 Biochemical engineering for the agri-food industry | Cms AFI | 6 |
| | | | | | | 3 | 2 | 28941 Agri-Industrial construction | Cms AFI | 6 |
| | | | | | | 3 | 2 | 28931 Fruit production I | Cms HFG | 6 |
| | | | | | | 3 | 2 | 28932 Plant breeding in horticulture | Cms HFG | 6 |
| | | | | | | 3 | 2 | 28934 Ornamental crops | Cms HFG | 6 |
| | | | | | | 3 | 2 | 28947 Sustainable development and the environment | Cms HFG | 6 |
| | | | | | | 3 | 2 | 28948 Engineering of green areas | Cms HFG | 6 |
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| 4 | 1 | 28942 Ruminant production | Cms ALF | 6 | | 4 | 2 | Modern language B1* | Cmg | 2 |
| 4 | 1 | 28943 Plant breeding | Cms ALF | 6 | | 4 | 2 | Optional subject 1 | Op | |
| 4 | 1 | 28944 Crop protection | Cms ALF | 6 | | 4 | 2 | Optional subject 2 | Op | |
| 4 | 1 | 28945 Irrigation and drainage systems | Cms ALF | 6 | | 4 | 2 | Optional subject 3 | Op | |
| 4 | 1 | 28950 Agri-food Industry: Design and optimisation | Cms AFI | 6 | | 4 | 2 | Optional subject 4 | Op | |
| 4 | 1 | 28951 Processing technologies in the food industries | Cms AFI | 6 | | | | | | |
| 4 | 1 | 28952 Utilities and process control | Cms AFI | 6 | | | | | | |
| 4 | 1 | 28953 Agri-food industry installations | Cms AFI | 6 | | | | | | |
| 4 | 1 | 28933 Protection of fruit and vegetable crops | Cms HFG | 6 | | | | | | |
| 4 | 1 | 28935 Irrigation and drainage systems in horticulture and fruit farming | Cms HFG | 6 | | | | | | |
| 4 | 1 | 28946 Fruit production II | Cms HFG | 6 | | | | | | |
| 4 | 1 | 28949 Gardening and landscaping | Cms HFG | 6 | | | | | | |
| 4 | 1-2 | Undergraduate dissertation | | | | | | | Ds | 12 |

Cr: core; Cmg: compulsory-general, Cms; Compulsory-specific to each specialty (ALF: Specialisation Agricultural and Livestock Farming, AFI: Specialisation Agricultural and Food Industries, HFG: Specialisation Horticulture, Fruit-farming and Gardening); Op: optional; Ds: dissertation.

*Students must verify that level B-1 of a foreign language (English, French, German, Italian) is met.

| Optional subjects |
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| 28955 English for rural and agri-food engineering (6 ECTS) |
| 28956 Agricultural chemical analysis (6 ECTS) |
| 28957 Post-harvest technology (6 ECTS) |
| 28958 Irrigation networks (6 ECTS) |
| 28959 Integrated production and agroecology (5 ECTS) |
| 28960 Building installations (5 ECTS) |
| 28961 Energy uses of products and wastes (5 ECTS) |
| 28965 Applied soil science (5 ECTS) |
| 28966 Internships (5 ECTS) |

## **Study programs**:

### BRIEF DESCRIPTORS OF COURSES

| Year | Semester | Subject | Type | ECTS | Aims |
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| 1 | 1 | 28900<br>Mathematics I | Cr | 6 | It is intended, with the teaching of this subject, to provide mathematical tools that serve as a basis to build and / or study certain mathematical models related to agro-food concepts and the rural environment. |
| 1 | 1 | 28901<br>Physics I | Cr | 6 | It is intended, with the teaching of this course, to provide scientific explanations to the physical phenomena directly related to agri-food engineering and the rural environment to be able to analyze them later.<br>Physics is one of the basic sciences that underpin engineering and, as such, it serves as an essential base for entering into its different fields. No scientific advances would be possible without technological advances and vice versa.<br>Our goal is to find arguments to explain how nature works and the devices designed to make this operation profitable.<br>This subject has been designed in the context of the Degree in Agro-Food Engineering and Rural Environment, is a basic training of the Engineering Branch and is scheduled in First Year / First semester.<br>The answers to questions such as:<br>• Why is a recessed beam kept in balance?<br>• What do articulated structures have in common for bridges, cranes, electric poles, canopies ...?<br>• How useful are the wedges in engineering?<br>• How are the physical properties of the bodies of revolution used in engineering determined? |

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| | | | | | • Why is the section of a beam in I the most frequent?<br>• What conditions are necessary to avoid the rollover of a vehicle in a curve or dam of a reservoir?<br>• Why are the drops kept in the leaves of the trees?<br>• Why do some insects float in the water?<br>• Why does the pressure in the tapers of a pipe decrease? How to determine the necessary power of a pump for a certain flow?<br>In this same course, practical cases will be solved that, in most cases, will respond to models of ideal behavior. With this starting point, in later courses, these cases will be analyzed with the appropriate approximation to the real behavior of the physical systems. |
| 1 | 1 | 28902<br>Chemistry I | Cr | 6 | The subject and its expected results respond to the following approaches and objectives:<br>• Provide basic knowledge about chemistry as well as the principles governing some related processes.<br>• Provide knowledge about the main balances in solution as well as the parameters influencing them.<br>• Training in the field of laboratory work.<br>• Know and handle properly the formulation and nomenclature of inorganic chemistry.<br>• Understanding the fundamental principles of applied thermodynamics to processes in the agricultural field.<br>• To differentiate the fundamental characteristics of each matter state of aggregation and to relate them with their properties, thus explaining the energetic phenomena linked to the phase changes. |
| 1 | 1 | 28903<br>Computer science | Cr | 6 | The student must be able to analyze problems, to solve them using a computer, and to use the computers efficiently. |
| 1 | 1 | 28904<br>Geology, soil science and climatology | Cr | 6 | This 6 ECTS course gives a solid theoretical and practical basis in the genesis, properties and productivity of soils and their relationships with geological processes and climate from an ecological and sustainable point of view.<br>The practical sessions provide the students with the knowledge to deal with and solve agricultural problems (swelling soils, fertilizers, groundwater conductivity and salinity and aquifer pollution).<br>These aims include the following Sustainable Development Goals of FAO: (1) the implementation of efficient farming techniques to fight against hunger, (2) The protection of water ecosystems by controlling the use of chemical products and fertilizers and (3) the restoration of deteriorated soils to avoid. |
| 1 | 2 | 28905<br>Mathematics II | Cr | 6 | It is intended, with the teaching of this subject, to provide mathematical tools that serve as a basis to construct and / or study certain mathematical models related to the Degree. |
| 1 | 2 | 28906<br>Physics II | Cr | 6 | It is intended, with the teaching of this course, to provide scientific explanations to the physical phenomena directly related to agri-food engineering and the rural environment to be able to analyze them later.<br>In this same course, practical cases will be solved that, in most cases, will respond to models of ideal behavior. With this starting point, in later courses, these cases will be analyzed with the appropriate approximation to the real behavior of the physical systems.<br>Our aim is to provide scientific explanations to the physical phenomena directly related to agri-food engineering and the rural environment in order to analyze them later. That is, find arguments to explain how nature works and the devices designed to make the operation of the same profitable.<br>In this course, practical cases will be solved that, in most cases, will respond to models of ideal behavior. With this starting point, in later courses, these cases will be analyzed with the appropriate approximation to the real behavior of the physical systems.<br>The answers to questions such as: |

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| | | | | | • What are the main mechanisms of heat transfer and how are they produced?<br>• How to determine the flow of heat through conduction through a double-glazed window?<br>• How does a heat engine work? And a refrigerator?<br>• How is the power dissipated in an electrical resistance calculated? |
| 1 | 2 | 28907<br>Chemistry II | Cr | 6 | -To endow the students with some basic knowledge in several chemistry fields (particularly, Organic Chemistry and Organic Chemistry nomenclature), mainly focusing on those aspects which are applied to Agricultural Engineering.<br>-To provide an overview of the chemical properties of the most common agrochemicals, as well as the main issues associated with their application.<br>-To provide experimental abilities, which are essential in planning and safely executing laboratory experiments. |
| 1 | 2 | 28908<br>Graphic expression | Cr | 6 | Knowledge of Graphic Expression is needed to study the contents of other scientific and technical subjects.<br>In purely scientific subjects is required to develop a spatial vision that allows understanding of certain concepts such as Euclidean space, vector analysis, molecular structure, etc.<br>In technical subjects, using the learned scientific concepts, the result of work should include an analysis and transfer of information that will necessarily include graphic contents.<br>The course aims that the student:<br>•Appreciate the versatility of technical drawing as global interdisciplinary language to convey information.<br>•Understand the usefulness and necessity of standardization as a means to structure and simplify the transmission of graphic information.<br>•Acquire the basic skills necessary to be able to capture on a plane, on paper or computer format, a work or engineering project.<br>•Use properly the instruments of the technical drawing as well as acquire the necessary capacity to sketch with the agility and precision necessary in the transmission of graphic information.<br>•Be able to point to different references to the technical contents studied.<br>•Develop the ability to work individually and as a team. |
| 1 | 2 | 28909<br>Biology | Cr | 6 | The aims of this subject is to understand and assimilate the most important concepts, theories and models of Biology, fundamentally at the molecular, cellular, and structural organization levels of the living organisms and on the genetic, physiological, and reproductive mechanisms of crops and domesticated species. The student would acquire a global vision of the biotic environment and a basic biological formation that would allow her/him to apply this knowledge to the theoretical-practical cases of agronomic and food-engineering sciences. |
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| 2 | 1 | 28910<br>Statistics | Cr | 6 | It is intended, with the teaching of this subject, to provide tools that serve as a basis to build and / or study certain statistical models related to the Degree. |
| 2 | 1 | 28912<br>Animal science I | Cmg | 3 | |
| 2 | 1 | 28913<br>Engines and machines | Cmg | 9 | This subject provides the operation basic knowledge of engines and agrarian machines, as well as the calculation methods of the needed power and the utilisation cost of the agrarian machines. |
| 2 | 1 | 28914<br>Topography, cartography and photogrammetry | Cmg | 6 | The cartography and topography allows us to know and manage the territory. It is an essential tool to design and manage the activities that the engineer must undertake on the territory.<br>This subject aims to answer a series of questions such as:<br>1. How are the surface of the earth represented?<br>2. What cartographic systems exist to represent the surface of the earth? |

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| | | | | | 3. How are the data taken for data collection from the earth's surface?<br>4. What are the topographical instruments that are used in the taking of topographic data?<br>5. What instruments and techniques are best suited to each case? |
| 2 | 1 | 28919<br>Electrical engineering and rural electrification | Cmg | 6 | This course and its expected outcomes meet the following approaches and goals:<br>***Approaches:***<br>• Describe the electromagnetic fundamentals that electrotechnical applications are based on.<br>• Define and interpret the quantities and units of measurement involved in a low-voltage installation.<br>• Use and characterize the switching, safety and power-system protection devices.<br>• Design and justify the calculations necessary to: (a) project low-voltage lines for electric-power distribution; (b) project indoor and outdoor lighting facilities; and (c) apply in an appropriate manner the switchgear maneuver, safety and protection elements; always in relation to the agriculture, agribusiness, green areas and sports facilities fields of study.<br>• Propose, design and solve low-voltage electrical projects for farms, food-processing industries, green areas and sports facilities.<br>***Goals:***<br>• Understand and be able to interpret the electromagnetic phenomena that low-voltage electrical installations are based on.<br>• Be able to evaluate the performance and justify the choice of the elements involved in a low-voltage electrical installation in the agricultural, agribusiness, green areas and sports facilities fields of study.<br>• Be able to draw up low-voltage electrical projects for farms, food-processing industries, green areas and sports facilities.<br>***SDGs alignment:***<br>Aforementioned goals are aligned with the following UN Sustainable Development Goals (SDGs):<br>• *SDG 7*: Ensure access to affordable, reliable, sustainable and modern energy.<br>• *SDG 9*: Build resilient infrastructure, promote sustainable industrialization and foster innovation.<br>and, in particular, with the following targets:<br>• *Target 7.1*: By 2030, ensure universal access to affordable, reliable and modern energy services<br>• *Target 7.3*: By 2030, double the global rate of improvement in energy efficiency<br>• *Target 7.A*: By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology<br>• *Target 9.4*: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities. |
| 2 | 2 | 28911<br>Botany | Cmg | 6 | |
| 2 | 2 | 28915<br>Fundamentals of business administration | Cr | 6 | The subject Fundamentals of Business Administration has the main objective of allowing students from the Degree in Rural and Agri-Food Engineering to get to know the firm's main functioning guidelines as a fundamental economic agent in the market economy scenario. |

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| 2 | 2 | 28916<br>Plant science / Plant production | Cmg | 6 | The main aim is that the students know and understand the principles and bases of crop production, in order to use them in the development of their professional activity. Also they should understand production systems at farm level, applying the most appropriate technologies to the environment. |
| 2 | 2 | 28917<br>Ecology and management of agro-industrial byproducts | Cmg | 6 | This subject aims to make students aware of the abiotic and biotic factors and their interactions which explain the abundance and distribution of organisms and the functioning of the following levels of organization of life: populations, communities, ecosystems, landscape-territory and biosphere.<br>This will allow them to:<br>a) address the resolution of environmental problems with based on the functioning of natural systems;<br>b) be aware of Global Change and the bases provided by the science of ecology to mitigate it;<br>c) face scientific problems in the field of ecology through the rigorous application of the scientific method.<br>In the section of Management of Agroindustrial Byproducts this subject aims for students to know the main byproducts and waste generated in agricultural, livestock, forestry and agri-food industry activities, as well as the main exploitation and management operations. This will allow them to apply the basic principles of engineering in the field of minimization techniques in agri-food industries and by-products treatment technologies. It is also intended that they develop criteria to propose the most appropriate management scheme for a given by-product.<br>These approaches and objectives are aligned with the Sustainable Development Goals, SDGs of the 2030 Agenda (https://www.un.org/sustainabledevelopment/es/) speciffically to certain targets.<br>• Goal 13: Take urgent action to combat climate change and its impacts – Target 13.1, Target 13.3<br>• Goal 15: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss – Target 15.1, Target 15.4 |
| 2 | 2 | 28918<br>Strength of materials and structural analysis | Cmg | 6 | This subject provides the bases of solids behavior in elastic range, as well as the interaction between several elements and its external links. |
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| 3 | 1 | 28920<br>Biotechnology | Cmg | 6 | |
| 3 | 1 | 28921<br>Hydraulics | Cmg | 6 | Understanding and applying the basic principles of Hydraulics in both free surface flow and pressurised flow.<br>Designing and analysing basic hydraulic installations, in both free surface flow and pressurised flow.<br>Basic use of hydraulic simulation software. |
| 3 | 1 | 28922<br>Agricultural economics | Cmg | 6 | The subject and its expected results respond to the following approaches and objectives:<br>Familiarize the student with the principles and methods of economic analysis necessary to measure the importance of economic quantities in the technical processes present in the agricultural and agri-food activity, so that the student learns to consider the economic problems and to solve them on its own incorporating the methods of economic analysis into his daily intellectual reasoning, thus adopting an active and not only receptive attitude.<br>Thus, the subject must provide students with methods for establishing the monetary equivalent (agricultural valuation) of those agricultural goods that lack more precise market references, methods of determining costs of crops, plantations, livestock and agri-food industries, of the methods of economic-financial analysis of agro-alimentary investments, and to teach them the mechanisms that govern the markets of the agri-food products from an application point of view. |

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| 3 | 1 | 28923<br>Projects | Cmg | 6 | |
| 3 | 1 | 28924<br>Animal Science II | Cms<br>ALF | 6 | |
| 3 | 1 | 28936<br>Unit Operations I | Cms<br>AFI | 6 | • Understand the fundamental concepts of each unit operation<br>• Analysis unit operations using simple physical models that reproduce the operation action<br>• Know the calculation methods necessary to solve the equations generated when applying physical models to the different unit operations<br>• Achieve a global vision to capture the basic principles common to a group of unit operations, which will contribute to a broader understanding of all operation<br>• The basic knowledge of the equipment for each unit operation. Operation and application of equipment<br>• Knowing the particularities of the raw material that is transformed is a food substance prints the unit operations<br>• Knowing how to choose the most suitable unit operation to achieve a certain transformation. |
| 3 | 1 | 28930<br>Horticultural production | Cms<br>HFG | 6 | |
| 3 | 2 | 28925<br>Production of monogastric animals | Cms<br>ALF | 6 | |
| 3 | 2 | 28926<br>Herbaceous crops | Cms<br>ALF | 6 | The main aim is that the students know and understand the production techniques of extensive herbaceous crops (cereals, legumes, industrial and fodder). Also they will be able to integrate this knowledge in the management of herbaceous crop systems. |
| 3 | 2 | 28927<br>Fruit growing | Cms<br>ALF | 6 | |
| 3 | 2 | 28928<br>Livestock farming facilities and equipment | Cms<br>ALF | 6 | This course and its expected outcomes meet the following goals:<br>• Acquire criteria to establish the bases for the design of livestock housing.<br>• Determine the environmental, physiological and available space requirements of the main livestock species.<br>• Establish the different aspects of environmental control in livestock housing.<br>• Technically describe and gauge the necessary facilities for ventilation, heating and cooling in livestock housing.<br>• Technically describe and gauge the necessary equipment for milking and for the distribution of food and water.<br>***SDGs alignment:***<br>Aforementioned goals are aligned with the following UN Sustainable Development Goals (SDGs):<br>• Goal 2: Zero Hunger<br>• Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation<br>• Goal 12: Ensure sustainable consumption and production patterns<br>and, in particular, with the following targets:<br>• Target 2.4. By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality. |

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| | | | | | • Target 9.4. By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.<br>• Target 12.4. By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.<br>• Target 12.5. By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse. |
| 3 | 2 | 28929<br>Farming: Construction | Cms<br>ALF | 6 | The aims of the course are:<br>1. Knowing how to decide which structural typology and which construction materials are the most appropriate according to the purpose of the agricultural building to be designed.<br>2. Knowing how to project the structure of a metal agricultural building.<br>3. Knowing how to project the structure of a prefabricated concrete agricultural building. |
| 3 | 2 | 28937<br>Unit Operations II | Cms<br>AFI | 6 | The aim of the course is to provide students with an in-depth knowledge on the most important unit operations involving a solid phase: drying of solids with hot air, fluidization and pneumatic transport, filtration, centrifugation, sedimentation, and membrane separation processes. These unit operations will be analyzed in the framework of a specific food industry (e.g., milk, fruit juice, beer, wine, etc.). |
| 3 | 2 | 28938<br>Fundamentals of food technology | Cms<br>AFI | 6 | The subject "Fundamentals of food technology" provides the necessary knowledge on the composition and parameters of food quality as well as the methods of analysis of these parameters, on the agents of alteration and on the fundamentals of the preparation, conservation and transformation of foods. |
| 3 | 2 | 28939<br>Quality management for the agri-food industry | Cms<br>AFI | 6 | A Graduate in Degree in Agri-Food and Rural Environmental Engineering will be a professional capable of applying science and technology in the area of Control of Quality and Food Safety. It is necessary to train professionals capable of managing the control and the quality of both, processes and food products, and certify food safety.<br>The knowledge that students acquire in the subject "Quality management for the agri-food Industry." is perfectly adjusted to this objective, and it is divided into two conceptual blocks.<br>- Knowledge of the management quality in the industry and in the analytical laboratory, applying accreditation and certification methodology.<br>- Development of quality control elements in the production process, applying control techniques and quality assurance systems to reduce production failures. |
| 3 | 2 | 28940<br>Biochemical engineering for the agri-food industry | Cms<br>AFI | 6 | It is intended to introduce students in the biotechnology industry so that, during the exercise of their future professional activity, be able to identify (and in some cases, quantify) the type of bioreactor used and the operating variables in its actual design. In turn, it is also intended that students be able to compare different bioreactor types. the effects of the operating variables and proposing corrective measures to improve the performance of a determined system.<br>To achieve the objectives set, learning activities will be programmed that will deal with the following contents:<br>microorganisms used industrially, speeds through which biotechnological processes take place, design of<br>bioreactors and effect of the operating variables. |
| 3 | 2 | 28941<br>Agri-Industrial | Cms<br>AFI | 6 | The aims of the course are:<br>1. Knowing how to decide which structural typology and which construction |

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| | | construction | | | materials are the most appropriate according to the purpose of the agro-industrial building to be designed.<br>2. Knowing how to project the structure of a metal agroindustrial building.<br>3. Knowing how to project the structure of a prefabricated concrete agro-industrial building. |
| 3 | 2 | 28931<br>Fruit production I | Cms<br>HFG | 6 | |
| 3 | 2 | 28932<br>Plant breeding in horticulture | Cms<br>HFG | 6 | |
| 3 | 2 | 28934<br>Ornamental crops | Cms<br>HFG | 6 | |
| 3 | 2 | 28947<br>Sustainable development and the environment | Cms<br>HFG | 6 | The main objective of this subject is that the student knows the basic concepts of the SD and begins to face simple practical assumptions of planning, management and conservation in this area.<br>The specific objectives of the subject are:<br>- Show an overview of the problems of Sustainable Development integrated into the Environment.<br>- Teach the variety of dimensions of rural SD: Education for Sustainable Development Protected Areas; Hunting; Forest Management; Farming.<br>- Provide a solid base for students to be able to analyze critically case studies related to Sustainable Development integrated into the Environment.<br>- Promote awareness of the need for Sustainable Development integrated into the Environment in the agricultural and rural areas.<br>- Know the area in which the Sustainable Development integrated into the Environment is inserted in society, as well as the different professional opportunities it offers.<br>These approaches and objectives are aligned with the Sustainable Development Goals, SDGs of the 2030 Agenda (https://www.un.org/sustainabledevelopment/es/) and certain specific targets, specifically:<br>Goal 2: Zero Hunger – Target 2.4<br>Goal 3: Ensure healthy lives and promote well-being for all at all ages – Target 3.9.<br>Goal 12: Ensure sustainable consumption and production patterns – Target 12.2, Target 12.4, Target 12.8<br>Goal 15: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss – Target 15.1 |
| 3 | 2 | 28948<br>Engineering of green areas | Cms<br>HFG | 6 | The aims of the course are:<br>1. Knowing how to decide which structural typology and which construction materials are the most appropriate according to the purpose of the building to be designed.<br>2. Knowing how to project the the metal structure of a building commonly used in the horticultural and gardening sector.<br>3. Knowing how to project the structure of a prefabricated concrete building commonly used in the horticultural and gardening sector. |
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| 4 | 1 | 28942<br>Ruminant production | Cms<br>ALF | 6 | |
| 4 | 1 | 28943<br>Plant breeding | Cms<br>ALF | 6 | |
| 4 | 1 | 28944<br>Crop protection | Cms<br>ALF | 6 | This course aims:<br>- To describe characteristics and life cycle of main biotic agents (pests, weeds and microorganisms) that are harmful to field crops, as well as the symptoms they cause in plants and the appropriate control strategies to limit crop losses. |

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| | | | | | - To define agrosystems' ecology as the basis of the control strategies to fight against biotic agents that limit plant production.<br>- To explain the basics of epidemiology and its application to pest, weeds and pathogens control.<br>These objectives are in agreement to some of the Sustainable Development Goals from the 2030 agenda, particularly to those related to sustainable food production (2.4) and to the rationale use of chemicals that will reduce its impact in the environment (12.4). |
| 4 | 1 | 28945<br>Irrigation and drainage systems | Cms<br>ALF | 6 | In this course, knowledge is provided for the design, calculation and management of irrigation and drainage systems.<br>The particular training objectives to be achieved upon completion of this course are the following:<br>• Knowing how to determine the water needs and irrigation schedule of crops.<br>• Knowing how to project and manage irrigation systems located on a plot.<br>• Knowing how to project and zonal and parcel drainage systems.<br>• Knowing how to dimension and project small hydraulic works (rafts, ditches, drains, collectors, etc.).<br>***SDGs alignment:***<br>Aforementioned goals are aligned with the following UN Sustainable Development Goals (SDGs):<br>• *SDG 2*: Zero Hunger<br>• *SDG 6*: Ensure access to water and sanitation for all<br>and, in particular, with the following targets:<br>• *Target 2.4*: By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.<br>• *Target 6.4*: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity. |
| 4 | 1 | 28950<br>Agri-food Industry: Design and optimisation | Cms<br>AFI | 6 | Using mathematical models and optimization techniques is crucial to properly address and solve problems related to agri-food processes. These techniques were deployed by operations research scientists to be applied in the field of industrial engineering. Queuing theory, transport networks and linear programming are examples of topics and tools of great interest for agri-food engineers. |
| 4 | 1 | 28951<br>Processing technologies in the food industries | Cms<br>AFI | 6 | The subject "Processing technologies in the food industries" has as a general objective to provide the necessary knowledge to be able to assess the quality of raw materials, as well as their suitability to, from them, produce products of animal or vegetable origin. For this, all the aspects involved in the handling, preparation, transformation and conservation of the different products as well as the necessary equipment to carry out these processes will be analyzed. |
| 4 | 1 | 28952<br>Utilities and process control | Cms<br>AFI | 6 | • Know the equipment of the auxiliary equipment of the food industry.<br>• Search the technical information (commercial catalogs and standards) to choose the equipment (pumps, compressors, boilers, etc.).<br>• Know, understand and use the principles of automation and process control.<br>• Know how to adapt the systems used in the automatic control of agroindustrial processes to the needs of the food industries.<br>• Identify the PLC as a process controller element. Solve programming examples and applications. |

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| 4 | 1 | 28953<br>Agri-food industry installations | Cms<br>AFI | 6 | The aim is to study the auxiliary systems of water and energy supplies of processes in the agri-food industry. On the one hand, the hydraulic installations of pressurized air, ventilation and fuel gas supplies are studied. On the other, heat and cold production facilities are analyzed. Another objective is the application of current regulations to the design of this type of facilities. |
| 4 | 1 | 28933<br>Protection of fruit and vegetable crops | Cms<br>HFG | 6 | This course aims:<br>- To describe characteristics and life cycle of main biotic agents (pests, weeds and microorganisms) that are harmful to fruit and vegetable crops, as well as the symptoms they cause in plants and the appropriate control strategies to limit crop losses.<br>- To define agrosystems' ecology as the basis of the control strategies to fight against biotic agents that limit plant production.<br>- To explain the basics of epidemiology and its application to pest, weeds and pathogens control.<br>These objectives are in agreement to some of the Sustainable Development Goals from the 2030 agenda, particularly to those related to sustainable food production (2.4) and to the rationale use of chemicals that will reduce its impact in the environment (12.4). |
| 4 | 1 | 28935<br>Irrigation and drainage systems in horticulture and fruit farming | Cms<br>HFG | 6 | In this course, knowledge is provided for the design, calculation and management of irrigation and drainage systems.<br>The particular training objectives to be achieved upon completion of this course are the following:<br>• Knowing how to determine the water needs and irrigation schedule of horticultural and fruit crops.<br>• Knowing how to project and manage irrigation systems located on a plot.<br>• Knowing how to project and zonal and parcel drainage systems.<br>• Knowing how to dimension and project small hydraulic works (rafts, ditches, drains, collectors, etc.).<br>***SDGs alignment:***<br>Aforementioned goals are aligned with the following UN Sustainable Development Goals (SDGs):<br>• *SDG 2*: Zero Hunger<br>• *SDG 6*: Ensure access to water and sanitation for all<br>and, in particular, with the following targets:<br>• *Target 2.4*: By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.<br>• *Target 6.4*: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity. |
| 4 | 1 | 28946<br>Fruit production II | Cms<br>HFG | 6 | |
| 4 | 1 | 28949<br>Gardening and landscaping | Cms<br>HFG | 6 | |
| 4 | 1-2 | Undergraduate dissertation | Ds | 12 | The Undergraduate Dissertation is compulsory for all the students of the degree in Environmental Sciences. The key aim of the undergraduate dissertation is to enable students to apply and develop a range of skills and competences acquired during the degree. The undergraduate dissertation requires a written report and there will be a public defense in accordance with the corresponding regulation. |

Cr: core; Cmg: compulsory-general, Cms; Compulsory-specific to each specialty (ALF: Specialisation Agricultural and Livestock Farming, AFI: Specialisation Agricultural and Food Industries, HFG: Specialisation Horticulture, Fruit-farming and Gardening); Op: optional.

| Optional subjects | ECTS | Aims |
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| 28955<br>English for rural and agri-food engineering | 6 | Global and detailed understanding of spoken English (especially presentations and lectures) and efficient interaction on the course topics at the expected level.<br>Fluent, clear presentation in class of an idea from their field of study, prepared in advance, using appropriate grammar and terminology.<br>Global and detailed understanding of various types of expositive or argumentative texts written in general or scientific English about topics connected to their studies, from which the student is expected to extract or infer relevant information.<br>Writing of messages and short essays in acceptable English about a topic of their interest, with textual and lexical coherence at an intermediate level, using appropriate style and conforming to academic or technical conventions. |
| 28956<br>Agricultural chemical analysis | 6 | |
| 28957<br>Post-harvest technology | 6 | The subject "Post-harvest technology" pursues an in-depth knowledge of the structure, composition and physiology of horticultural products with the aim of knowing how to choose between different post-harvest technologies (refrigeration, modified atmospheres, elimination or generation of ethylene and decontamination strategies) those that maintain their organoleptic quality as long as possible. |
| 28958<br>Irrigation networks | 6 | To know the concepts, procedures and professional technologies that allow the design and management of water distribution networks oriented to irrigation applications (but also of interest in other agricultural and agro-industrial fields where fluid distribution networks are involved).<br>The subject covers optimized design, analysis and management of pressure distribution networks that transport water, from the primary sources, reservoirs, rivers, channels, ... to the plots where irrigation applications take place, including the pumping equipment and its regulation. |
| 28959<br>Integrated production and agroecology | 5 | The main aim is that the students know and understand the different management of agrarian systems focusing in reduction of agriculture impacts in the environment. Also they should be able to integrate this knowledge in the management of more sustainable systems. |
| 28960<br>Building installations | 5 | The aims of the course are:<br>Knowing how to Project the following installations of agricultural and agro-industrial buildings: supply and distribution of cold water, production and distribution of sanitary hot water, water evacuation and sanitation, ventilation, protection fire, emergency electrical installation. |
| 28961<br>Energy uses of products and wastes | 5 | The subject introduces important concepts about the energy industry so that students can identify the different type of biofuels, how they are produced and the effect of the main operational variables in the design to obtain it.<br>To achieve the established objectives, the programmed learning activities will have the following contents: energy problems, energy and climate change, biomass as an energy source, types of biofuels, process design and the effect of operational variables.<br>These objectives are aligned with some of the Sustainable Development Goals,<br>(https://www.un.org/sustainabledevelopment/):<br>- Goal 7: Ensure access to affordable, reliable, sustainable and modern energy (target 7.2)<br>- Goal 12: Ensure sustainable consumption and production patterns (target 12.2) |
| 28965 | 5 | |

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| Applied soil science | | |
| 28966 Internships | 5 | The external practices are optional (5 credits). Through these practices, it is intended to offer direct training appropriate to the needs of companies. The external internships are managed through Universa, the Orientation and Employment Service of the University of Zaragoza, operating through an agreement with the Aragonese Employment Institute of the Government of Aragon. Universa establishes collaborative relationships with numerous companies and institutions, in order to organise internships for students. The follow-up of the practices is done through the figure of the tutors: an academic tutor belonging to the faculty of the Degree and a professional tutor within the company or institution. |

**URL of the detailed description**:

http://eps.unizar.es/en/degree-agrifood

For courses descriptions and further information, see:

https://estudios.unizar.es/estudio/ver?id=140

For a list of active courses, see:
https://documenta.unizar.es/share/s/cW989eIQQ9yzocVaSvF6BQ

For a list of courses included in the English Friendly Program, see:
https://eps.unizar.es/subjects-asignaturasef

Teaching material for registered students is available on a Moodle platform:

https://moodle2.unizar.es

Technological College. Agri-food and Environment: https://eps.unizar.es/