Academic Year 2021/22

School of Industrial and Information Engineering

Degree Programme of:

Agricultural Engineering
Laurea Magistrale (Equivalent To Master Of Science)

Cremona Campus
1. General Information

<table>
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<tr>
<td>Dean of the School</td>
<td>Antonio Capone</td>
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<tr>
<td>Coordinator of the Study programme</td>
<td>Gianni Ferretti</td>
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<td>Website of the School</td>
<td><a href="http://www.ingindinf.polimi.it">http://www.ingindinf.polimi.it</a></td>
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Student Office (Study programme) - Cremona

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Student Office - Cremona

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2. General presentation of the study programme

The growing technological complexity that characterizes modern agro-industrial production and supply chain requires professionals with strong engineering knowledge and systems skills. The need for a strong multidisciplinary connotation to manage technological innovation in agriculture and animal production, also and above all to increase the level of sustainability and ensure food safety is more evident than in other fields. The adoption of the most advanced technologies, considered in the Agriculture 4.0 framework, is necessary for the national agricultural production system to gain competitiveness in terms of yield, and to cope with the growing problems deriving from climate change, first of all the scarcity of the water resource, and for environmentally friendly management of crops and livestock.

The Agricultural Engineering study programme is characterized by a focus on the agricultural supply chain and the agro-industrial production, on technological aspects relating to agro-industrial systems and to safety, on automation and mechanical technologies, on agricultural sciences and precision agriculture, information systems, environmental and chemical technologies. The Master's Degree Course in Agricultural Engineering therefore trains engineers operating in the agro-industrial sector who possess a systems vision, i.e. an approach to the study and implementation of application solutions based on an overall vision of the technological aspects of agro-industrial productions and on the ability to model and manage the interactions between the various components. To do this, the graduate will use advanced and transversal engineering skills on the system as a whole, supported by basic knowledge of the agricultural sector, which allows him to guide strategic choices in the sector of agro-industrial primary production.

Graduates in Agricultural Engineering will interact competently with the various relevant players in the supply chain, understand and organize technical, managerial and economic activities also in sectors relating to specializations other than the original. It is also believed that this system vision, supported by technical and scientific skills and knowledge, is indispensable in favouring access to natural resources and management of production processes that guarantee sustainability. From this point of view, the figure of a postgraduate with a transversal training, a system vision of issues related to the agro-industrial chain and a particular attention to safety, represents a great opportunity for the sector, for the Country in general and for the reference basin of the Cremona Campus in particular.

In practical terms, as examples of applications of Agricultural Engineering, it is possible to cite the evaluation and implementation of the technologies available to ensure the sustainability, safety and traceability of agro-industrial productions, the design and integration of automation, monitoring and agricultural robotics, the use of Big Data analysis and Artificial Intelligence applications, in order to improve yields and control over safety requirements, the design of intelligent irrigation systems, able to optimize the use of water resources and above all to guarantee their availability, also and above all in the face of the serious problems posed by climate change, the optimal management from the economic point of view of farms and the connected supply chain.
3. Learning objectives

The Master's Degree Programme in Agricultural Engineering trains specialist engineers capable of dealing with the complexity of the agro-industrial production systems and with the interdependence of critical elements related to the safety and sustainability of the agri-food systems such as:

- planning and management of production and supply chain systems;
- emerging technologies to support agro-industrial production and environmental sustainability;
- interaction with the environment and the territory.

Graduates will apply transversal engineering skills on the system as a whole, allowing them to finalize strategic choices with the support of more specialized figures, which they do not replace.

The Graduate will be able to understand and solve the typical problems of industrial engineering, contextualized in the agricultural and agro-industrial production systems, through knowledge relating to the technological and management aspects of the agricultural supply chain, from production to storage and distribution phases, focusing on the issues of traceability and safety of production. Graduates will integrate and support these skills with a methodological approach typical of information engineering, through the application of techniques and methods of analysing large amounts of data (Big Data Analytics), methods and applications of Artificial Intelligence, and the most advanced monitoring, automation and control techniques, evaluating their applicability in the management of production systems and in the improvement of processes from the point of view of safety and economic and environmental sustainability.

The Master's Degree Program adopts teaching methods that meet the Dublin descriptors adopted at European level. Understanding skills and independent judgment will be assessed through written and oral examinations and the drafting of individual or group works. The ability to apply the acquired knowledge and understanding will be assessed through the drafting of reports based on the participation in experimental laboratories and project activities, included in the programme of study. Periodic presentations of the activities carried out for the assessment of communication skills are scheduled. Finally, the ability to learn will be assessed during the individual activities planned for the preparation of the end point assessment.
3. Organization of the study programme and further studies

4.1 Structure of the study programme and Qualifications

For students graduated in a first-level degree, the Degree Program in Agricultural Engineering foresees the award of the Master's Degree (2nd level) after the achievement of 120 ECTS over two years of study.

For those who wish to continue their education and develop an important research experience, also abroad, at the end of the programme it is possible to further their studies by enrolling on a PhD programme.

For high performing students who enroll in the Master's Degree, there is the possibility of being admitted to:

- The “Alta Scuola Politecnica”, an advanced training program managed by Politecnico di Milano and Politecnico di Torino. For more information: http://www.asp-poli.it/.
- Alliance4Tech, a free mobility programme between the three campuses of the Politecnico di Milano, CentraleSupelec in Paris and TU Berlin. For more information: www.alliance4tech.eu.

4.2 Further Studies

The qualification gives access to the Research Doctorate, to the second level Specialization Course and to the second level University Master.

The most 'natural' outlet for further studies is represented by the Research Doctorate: at the Politecnico di Milano there are several doctoral courses that cover the topics covered in the Master's Degree in Agricultural Engineering http://www.dottorato.polimi.it.

The Master's Degree in Food Engineering also allows access to the second level Specialization Course and the second level University Master.

Finally, the School of Management of the Politecnico di Milano, through the MIP consortium, offers graduate students the opportunity to undertake master's courses and advanced training courses. For further details: https://www.som.polimi.it/corsi/.
5. Professional opportunities and work market

5.1 Professional status of the degree

A graduate in Agricultural Engineering can practice the profession, after passing the examination of State Registration Section A of the Order of Engineers in the student's hometown.

5.2 Careers options and profiles

Thanks to his solid and transversal training, the Agricultural Engineer can find employment mainly:

- in the agricultural production chain industry;
- in engineering companies that design, develop and implement processes, plants and technologies to support production, distribution and marketing related to agriculture and agro-industry;
- in research centers and public and private laboratories;
- in technical structures of the Public Administration and in consultancy offices for the environment, safety, agricultural and livestock production.

The course allows you to qualify for the following regulated professions:

- civil and environmental engineer;
- information engineer;
- industrial engineer.

5.3 Qualification profile

Role of the graduate in the world of work

The Agricultural Engineer is characterized by being a designer and manager of agricultural and agro-industrial production systems that are sustainable at an economic, environmental and social level.

The Agricultural Engineer takes part in the first phase of the agro-food industry chain and performs various functions in these field, such as:

- Expert in the implementation and management of production and service plants on field and at the farm, to optimize yields, animal welfare and to minimize consumption, the production of residues and the impact on the territory.
- Designer of terrestrial and aerial agricultural robotics applications (drones) for crop monitoring and for targeted interventions on field (for example for biological pest control or for the optimization of the use of pesticides), both by remote and autonomous control.
- Designer of systems for the collection and processing of large amounts of heterogeneous data, coming for example from meteorological stations, satellites, field sensors and agricultural vehicles.
- Expert in the integration of sensor networks for the measurement of various parameters, such as the climatic conditions, the state of health of plants, the vital parameters of animals.
- Designer, in collaboration with agronomists, of solutions for supporting decisions relating to irrigation phases (also and above all in order to optimize
the use of water resources), predictive maintenance policies for fleets of agricultural vehicles, application of pesticides.

- Designer of systems for guaranteeing the traceability and quality of products and for improving the efficiency and safety of supply chain processes.
- Experts in the management of issues relating to the Supply Chain, risk assessment and planning and management of agro-industrial production.

**Skills associated with the role**

The Agricultural Engineer is characterized by a strong basic scientific and technical-applicative preparation, enabling the ability to face and solve the technological challenges relevant to modern agriculture and agro-industrial production and its supply chain.

The Agricultural Engineer is characterized by a solid background in engineering subjects (mechanics, automation, product, process and management) and by a strong methodological connotation in dealing with the profession. The training of this professional figure combines modern engineering knowledge with basic knowledge of agricultural sciences.

The Agricultural Engineer is able to:

- analyze and model the social, economic and environmental effects of agricultural production methods, agro-industrial policies and regulation;
- understand the effect of the most relevant chemical, biological and biochemical processes on agricultural activities, plants, animals, environment (water, air, soil) - and on the management of inputs and outputs of agricultural processes (fertilizers, pesticides, by-products), with the goal of integrating them with maximum effectiveness and/or efficiency with production processes;
- address problems related to the development of production processes, from the management of production to the distribution of products, through the main models of sustainability (circularity, farm to fork, ..);
- support the implementation of precision agriculture and agriculture 4.0 applications through a correct exploitation and combination of the main innovations, such as robotics, automation, remote sensing, satellite and geospatial systems, sensors and internet of things, Big Data analytics and artificial intelligence, blockchain, autonomous vehicles (drones, tractors, tools, etc.);
- identify and implement environmental protection and safety strategies for agricultural systems at all levels (soil, water, air, people, ..), through feasibility and economic analyses, design and implementation of control systems, selection of materials, technologies and structures, constantly in line with the demanding environmental and social needs and with the objectives of sustainable development;
- model the transport phenomena that allow to identify and determine the best solutions (energy, chemical) capable of supporting innovative production solutions, such as indoor farming, hydroponics, aeroponics;
- support with engineering tools the integration of agricultural production with the downstream processing, storage and distribution phases, in order to obtain the best product enhancement;
- identify innovative solutions for storage, transport and conservation, also through the use of materials, processes and technologies, capable of guaranteeing food quality and safety;
• manage agro-industrial production activities through adequate management control systems, analytical accounting, project management, business planning and main management models of logistics and operations processes;
• address the main issues related to a rational use of resources and the necessary integration of natural and anthropogenic cycles, with particular reference to water and nutrients, for example through the design of innovative irrigation systems, recovery of water and nutrients from waste water and residues derived from crops and animal breeding.
• deal with the mechanical, physical, chemical and biochemical characterization of the soil for agricultural purposes and integrate agricultural mechanics techniques in an optimal way in the production process.

6. Enrolment

6.1 Access requirements

First cycle degree (level 6 EQF) or comparable qualification.

The admission to the Master of Science degree undergoes an evaluation process aimed to determine the eligibility of the applicant. Such process, in compliance with the existing regulation (D.M. 22/10/2004 n. 270 art. 6 par. 2 and D.M. 16/3/2007, art.6 par. 1), is based upon curriculum requirements and an assessment of the applicant’s previous academic record.

The final decision about the admission to the Master of Science degree shall be taken by an Admission Commission set up by the Programme of Study Board, according to the academic career of the applicant. The Commission may take into account a valid documentation showing clear exceptional conditions, justifying the non-compliance with the below-mentioned criteria and showing that the student has an adequate background. Such a documentation shall be attached to the admission application.

If the applicant is admitted, compulsory additional subjects (see Paragraph 6.2) can be communicated and clearly stated in the offer together with the admission and before enrolment, in order to provide students with the necessary information for a transparent and rational choice.

Requirements concerning the English language proficiency levels are presented in Paragraph 7.4.

Application for admission

A Bachelor of Science Degree (BSc, Laurea Triennale) is required for the evaluation of the career, or a higher degree (MSc, Laurea Magistrale). The evaluation can be carried out also for students enrolled in Politecnico di Milano (BSc), if they are candidates in the next Graduation session, and for students enrolled in BSc of other Italian Universities, if they will graduate after the deadline for enrolment, but in any case by:

• November 30, 2021 (for admission to the Master's Degree in the first semester 2021/2022).
March 31, 2022 (for admission to the Master's Degree in the second semester 2021/2022).

If a student is admitted without having already obtained the admission qualification, enrollment in the Master's Degree course will be allowed under the condition: the student will be required to achieve the first level degree within the terms indicated above and also, if coming from a university other than Politecnico di Milano, to communicate the graduation.

Academic career requirements for admission
Admission requirements concerning the academic career considered by the Commission are as follows:

a) graduation at the Bachelor of Science no later than 31 March of the sixth year after the first enrolment (for example if the first enrolment at an Italian University was in September 2014, the degree should be obtained before 31 March 2020); such requirement does not apply for the candidates having a MSc;

b) certification of the English language proficiency (see Paragraph 7.4);

c) fulfilment of educational requirements that do not involve curricular supplements (see Paragraph 6.2).

Graduates in one of the degree courses in Civil and Environmental Engineering (L07), Information Engineering (L08), Industrial Engineering (L09) and Agricultural and Forestry Sciences and Technologies (L25) of Politecnico di Milano or from other Italian universities that meet the requirements listed above are admitted to the Master's Degree subject to a positive evaluation by the admissions commission.

If the prerequisite a) is not satisfied, the candidate will not be admitted to the Master's Degree, except in the presence of proven documentation that highlights real elements of exceptionality.

If the candidate does not comply with the prerequisites b) and/or c), he can be admitted to the Master's Degree - and therefore enroll - only after having obtained them, demonstrating knowledge of the English language and/or satisfying the curricular supplements that the Commission has identified and communicated to the candidate.

For candidates with other BSc awarded by Politecnico di Milano or by other universities, in addition to meeting the above requirements, admission is subject to examination by the Admission Commission.
6.2 Description of the knowledge required of incoming students

Curricular requirements for admission
To be enrolled to the MSc in Agricultural Engineering, the applicant must possess precise curricular requirements, i.e. knowledge and learning attainment at a level appropriate as preparation for the aforementioned programme applied to.

The evaluation of the level of personal preparation of the student is carried out by a special Evaluation Commission, made up of members of the Programme of Study Board. In particular, the Evaluation Commission evaluates the curriculum of previous studies and the marks obtained in the courses relating to basic and characterizing SSDs. The need for curricular additions resulting from the lack of "consistency" with this training project will be assessed in an unquestionable form by the Evaluation Commission. In cases of exclusion, the Commission will adequately justify the decision.

To be enrolled to the MSc in Agricultural Engineering it is necessary to have a degree Industrial Engineering (class L09), Information Engineering (class L08), Civil and Environmental Engineering (class L07), Agricultural and Forestry Sciences and Technologies (class L25). Alternatively, it is necessary to have a degree of at least three years duration, i.e. achieved through the acquisition of at least 180 CFU, of which:

- at least 20 CFU related to training activities in SSDs MAT/01, MAT/02, MAT/03, MAT/04, MAT/05, MAT/06, MAT/07, MAT/08, MAT/09, FIS/01, FIS/02, FIS/03, FIS/04, FIS/05, FIS/06, FIS/07, FIS/08, CHIM/01, CHIM/02, CHIM/03, CHIM/04, CHIM/05, CHIM/06, CHIM/07, CHIM/08, CHIM/09, CHIM/10, CHIM/11, CHIM/12;
- at least 20 CFU related to training activities in SSDs ICAR/02, ING-INF/03, ING-INF/04, ING-INF/05, ING-IND/10, ING-IND/14, ING-IND/16, ING-IND/17, ING-IND/22, ING-IND/25, ING-IND/27, ING-IND/31, ING-IND/35.

The same criteria also apply to those who are in possession of a university-level qualification, even obtained abroad, deemed suitable by the Master's Programme of Study Board, for which it is possible to identify the scientific-disciplinary sectors and the number of credits earned in each sector. If identification is not possible, the academic career will be assessed by the Programme of Study Board.

As regards the verification of personal preparation for admission to the Master's Degree, this is governed by criteria that take into account the personal merit acquired by the candidate during their degree course and the adequacy of their preparation to face the disciplines covered in the Master's Degree, with an appropriate mastery of general scientific methods and contents in the basic scientific disciplines and in the engineering disciplines, preparatory to the characterizing ones foreseen by the Master's Degree class to which they belong (DM 16/03/2007; LM26). In particular, the marks obtained in the courses relating to basic or characterizing SSDs of the degree classes L09, L08, L07 and L25 will be assessed. The assessment of the level of personal preparation of the student is carried out by a special commission made up of members of the Programme of Study Board of the Master's Degree in Agricultural Engineering.
Any curricular supplements in terms of CFU must be acquired before checking individual preparation, as enrolment with additional training obligations is not allowed.

**Curricular supplements and enrolment in individual courses**

In the case of curricular integrations, in the time interval between graduation and enrolment on the MSc in Agricultural Engineering, for the purpose of the Master's Degree, the student can, by enrolling on “individual courses”:

- acquire ECTS that can be recognized within the 120 ECTS necessary to achieve the award of Master of Science;
- acquire the frequency of teaching of the Master's degree - see above;
- acquire ECTS for curricular integrations established by a specific Admission Commission to the Master of Science; these are ECTS "in addition" to the 120 ECTS necessary to achieve the award of Master of Science.

The following constraints are underlined:

- the total number of ECTS (passing courses and/or acquisition of frequencies) that can be recognized in the context of the 120 ECTS necessary for the achievement of the award of Master of Science cannot be higher than 32. Additional credits, if any, acquired over 32 ECTS can be used as additional courses;
- in any case the number of ECTS acquired through “individual courses” cannot exceed 80 ECTS, including curricular integrations within this limit;
- failure to meet the conditions related to the curricular integrations requested within 18 months from the date on which the appointed Commission has deliberated them and communicated to the applicant entails the definitive loss of the right to admission.

Detailed information on admission and enrolment is available on the Politecnico di Milano website.

**6.3 Deadlines for admission and number of places available**

Detailed information on deadlines and available places can be found in the enrolment guide.

Guide to accessing the Master's Degree: [https://www.poliorientami.polimi.it/come-si-accede/](https://www.poliorientami.polimi.it/come-si-accede/)

**6.4 Indication of orientation and tutoring activities**

The School of Industrial and Information Engineering offers guidance and tutoring activities. Details are regularly updated on the School's website.

Site of the School of Industrial and Information Engineering: [https://www.ingindinf.polimi.it/it](https://www.ingindinf.polimi.it/it)
7. Contents of the study Program

7.1 Programme requirements

The achievement of the Master's Degree in Agricultural Engineering requires the student to acquire 120 credits (CFU), of which at least 55 related to core subjects and 20 related to related disciplines.

In particular, for the core subjects, divided as follows:

- Disciplinary field civil, environmental and territorial safety and protection engineering
  - ICAR/02 - Hydraulic and Maritime Constructions and Hydrology - minimum 5 ECTS
- Disciplinary field security and information protection engineering
  - ING-INF/03 Telecommunications, ING-INF/04 – Automatic control, ING-INF/05 - Information processing systems - minimum 20 ECTS
- Disciplinary field safety and industrial protection engineering
- Disciplinary filed legal-economic area
  - ING-IND/35 - Economic-management engineering minimum 10 ECTS

In particular, for the related disciplines, divided as follows:

- ING-IND/05 Aerospace plants and systems, ING-IND/09 - Systems for energy and the environment, ING-IND/12 Mechanical and thermal measurements, ING-IND/13 Mechanics applied to machines, ING-IND/34 - Industrial bioengineering, CHIM/07 - Chemical foundations of technologies – minimum 5 ECTS
- ICAR/03 - Sanitary-environmental engineering - minimum 5 ECTS

The thesis work completes the acquisition of the credits necessary for the achievement of the Master's Degree (15 ECTS).

7.2 Mode of study

The Course requires full-time attendance and involves normal classroom time, topic-specific seminars with experts, and laboratory activities (experimental and computational). Visits to industrial plants are also part of the curriculum.

The “Curriculum” includes various innovative courses, tools and activities consistent with the educational objectives of the Study Course.

Integration of digital technologies. Students have access to a library of online courses, delivered through the Polimi Open Knowledge platform (POLIMI POK).
**Relationship with companies**
All students have the opportunity to be involved in a real project carried out within a company (Project based learning), since all the workshops of the Master of Science involve companies or organizations (10-15 ECTS). This allows students to be exposed to key problems that characterize real projects:

- Definition of project objectives
- Interaction with business actors
- Search for data and information
- Team working and leadership in an uncertain environment

**Other didactic initiatives**
In addition to these initiatives, various activities are offered to students specifically aimed at stimulating their individual interests and inclinations.

### 7.3 Objectives and general framework of the teaching activities for each previously approved study plan

The Agricultural Engineering graduate training course combines modern engineering knowledge and skills with basic knowledge of agricultural sciences through a training course that includes:

- **in the first year**
  - a first semester characterized by a differentiated track based on the three-year degree course of origin, to allow engineering graduates to acquire the basics of agricultural sciences and to provide graduates in agricultural sciences with the necessary integrations to continue their engineering studies;
  - a second semester dedicated to learning ICT knowledge, relating in particular to automation and robotics techniques and Big Data Analytics methods and applications, as well as knowledge of the industrial engineering area applied to precision agriculture.

- **in the second year**
  - a consolidation of knowledge in the industrial, environmental and management fields, with particular reference to innovative technologies to support the production and management of the product, the management of production and the supply chain and of the company, also from an economic point of view, and the safety and sustainability of production systems.

During the course the students therefore deepen different themes, collected by macro-areas, both from a conceptual and methodological point of view, and from an implementation and application point of view. The areas of expertise that characterize the graduate in Agricultural Engineering are related to:

- Agricultural science
- Technologies for Smart Agriculture
- Precision Agriculture
- Big Data analysis
- Environmental and Chemical Sciences and Technologies
### 1st Year courses – Track: AGA - Agricultural Engineering – A

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### 1st Year courses – Track: AGI - Agricultural Engineering – I

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### 2nd Year courses – DRAFT

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### 7.4 Foreign language

Adequate knowledge of a foreign language is an essential prerequisite for admission to the master's degree. Considering the University's teaching offer, this language is identified in the English language. The level of knowledge should be certified by the applicant upon admission according to the standard setup by the Politecnico di Milano’s Academic Policies. These are available on the Politecnico di Milano and School websites.

Information on knowledge of the English language.
[https://www.polimi.it/studenti-iscritti/lingua-inglese/](https://www.polimi.it/studenti-iscritti/lingua-inglese/)

### 7.5 Degree examination

The final degree examination is the presentation and discussion of the independent work performed by the student during the thesis period. The final exam gives students an additional opportunity for further investigation and verification of analytical, developmental and communicative abilities demonstrated by their work. The final exam consists of the discussion, in front of an examination board, of the original results obtained during the thesis work. This activity must be coordinated by a professor of Politecnico di Milano as thesis supervisor.
7.6 Knowledge and understanding, ability to apply knowledge and understanding: Detail

The student acquires the ability of facing and identifying possible solutions to solve typical problems of Agricultural Engineering, often complex as they are transversal to multiple disciplines.

The ability of the graduate in Agricultural Engineering to apply the transversal knowledge acquired makes him able to understand, both from a conceptual/methodological and implementation/applicative point of view, the problems related to the design and management of production processes in the agricultural and agro-industrial, having food safety and process safety as a reference point.

Graduates in Agricultural Engineering will also be able to address and deepen the engineering aspects related to production, such as energy optimization of production sites, reduction of water consumption, pollution control and resource recovery with a circular logic. This ability is developed during the four semesters of study through the carrying out of laboratory activities and project activities proposed within different courses. It is further developed in the final exam, where the acquired knowledge is applied to the original solution of problems related to the proposed themes. The verification of the skills acquired takes place through the discussion of individual relationships and personal or group elaborations of laboratory activities and project activities developed within the teachings.

The articulation and content of the thesis, its presentation and related discussion during the final exam are also elements of verification.

The training course, while not providing for preventively approved study plans, provides for specific training areas.

**Learning area: basic foundations of Agricultural Sciences**

**Knowledge and understanding**

The agricultural engineer acquires basic knowledge related to:

- Animal sciences.
- Agronomy.
- Applied agronomy and plant physiology.
- Organic chemistry, biochemistry and microbiology.

Thanks to this knowledge, he will be able to understand the main aspects and the impact of technologies on agricultural and agro-industrial production. In particular, he will be able to understand the effect of the most relevant chemical, biological and biochemical processes on agricultural activities - plants, animals, environment (water, air, soil) - and
on the management of inputs and outputs of agricultural processes (fertilizers, pesticides, by-products, product protection systems).

**Ability to apply knowledge and understanding**
Thanks to the skills acquired and the teaching methods, the Agricultural Engineer will be able to understand and effectively apply, from a sustainable perspective, the main production factors of agricultural and agro-food production that intervene in all production phases, from production in the field to the storage and distribution phases.

**Learning area: Basic foundations of Engineering**

**Knowledge and understanding**

The Agricultural Engineer acquires basic engineering knowledge, related to the fundamentals of automation and information technology, advanced mathematical analysis and applied physics. Thanks to this knowledge, the Agricultural Engineer is able to deepen the knowledge and specialist skills that characterize the profile in the industrial, information and environmental fields.

This knowledge is acquired during the first semester of study, mainly through lectures.

**Ability to apply knowledge and understanding**

Thanks to the engineering knowledge acquired and the teaching methods, the Agricultural Engineer will be able to effectively understand and apply the main concepts of computer science and automation, supported by advanced knowledge of mathematical analysis and applied physics.
Learning area: ICT for agricultural engineering
Knowledge and understanding

The Agricultural Engineer will acquire knowledge related to:
- Control and automation systems for agro-industrial applications.
- Agricultural robotics and autonomous vehicles.
- Big data analytics and blockchain techniques and methods.
- Artificial Intelligence methods and applications.

Thanks to this knowledge, he will be able to understand the main aspects and the impact of ICT technologies in general on agricultural and agro-industrial production. In particular, he will be able to understand the potential of the automation techniques of agro-industrial production systems and to evaluate the scope of Big Data analysis and Artificial Intelligence applications in the management of production systems and in the improvement of processes from the point of view of safety and sustainability.

Ability to apply knowledge and understanding
Thanks to this knowledge, the Agricultural Engineer will be able to design and integrate control systems and mobile robotics and manipulation applications in agro-industrial applications, both in crops and livestock, where automation and robotics now play a fundamental role in the most advanced realities. He will also be able to understand and apply methods and applications of Big Data Analytics and Artificial Intelligence, which have recently proved to be a fundamental tool for increasing yields and sustainability of crops and livestock.

Learning area: Environmental Engineering for Agriculture
Knowledge and understanding

The Agricultural Engineer will acquire knowledge related to:
- Sustainable and adaptive irrigation methods and techniques.
- Methods and techniques for controlling polluting emissions with recovery of resources.
- Methods and models for quantifying impacts and sustainability.

Ability to apply knowledge and understanding
Thanks to the skills acquired and the teaching methods, the agricultural engineer will be able to:
- Analyze the interactions of agriculture with the environment and identify the most correct methods of investigation and assessment of the quality of the relevant environmental compartments and the consequent impacts of agricultural activities.
- Identify and implement optimal solutions for dynamic and adaptive irrigation to climate change and soil/vegetation conditions.
- Identify and implement optimal solutions for the treatment and recovery of water, nutrients and energy from liquid and solid waste generated by agricultural and agro-industrial activities.
Learning area: Industrial Engineering for Agriculture

Knowledge and understanding
The Agricultural Engineer will acquire knowledge related to:

- Main actuation and control devices currently used in the agricultural sector.
- Modeling of the interaction between a mechanical device and its control system.
- Characteristics of the main types of vehicles used in agriculture and livestock and possible consequences deriving from the introduction of electrification of traction and autonomous driving.
- Physical principles underlying the innovative technological solutions to improve working conditions, reduce energy consumption and water resources necessary for crops, contain the environmental impact of wastewater, improve the welfare of farm animals.
- Aeronautical and aerospace technologies for monitoring for agriculture and agro-industry.
- Sustainable technologies for the production (pre-harvest) and management (post-harvest) of agricultural products.
- Technologies to support the production and the safe storage of agricultural products.
- Design and management of energy aspects related to agricultural production.

Ability to apply knowledge and understanding
Thanks to the skills acquired and the teaching methods, the agricultural engineer will be able to:

- acquire cognitive tools to evaluate the application of the most modern technological and engineering solutions for precision agriculture;
- apply an advanced engineering approach, characterizing the industrial area, to system and production chain problems of agricultural production;
- implement agricultural production support solutions aimed at managing product safety and sustainability of production;
- integrate technologies (mechanical, aeronautical, chemical, energy) to optimize production.

Learning area: Management for Agriculture

Knowledge and understanding
The Agricultural Engineer will acquire knowledge related to:

- Supply Chain Management
- Production management
- Business Modelling and Business Planning

Ability to apply knowledge and understanding
Thanks to the skills acquired and the teaching methods, the agricultural engineer will be able to:

- Address problems related to the development of production processes of integrated agricultural supply chains, starting from the management of production factors, passing through production on the farm, up to the distribution of processed products (supply chain management).
• Launch and manage innovative activities and projects at any stage of the agricultural supply chain through economic activity planning tools (business plan), models for the design and implementation of the creation of economic value (business model) and control systems for managing projects.

• Implement innovative technologies and systems (robotics, sensors, artificial intelligence, digital traceability, self-driving vehicles) correctly integrated into the agricultural supply chain, such as precision agriculture and agriculture 4.0 solutions.

8. Organization and responsibility of the QA at the Programme of Study Board

**Programme of Study Board**

The Programme of Study Board (CCS) is the structure that designs and carries out the educational career and brings together the professors that hold taught modules provided in the Programme of Study and a number of elected student representatives.

In particular, the CCS prepares and suggests to the related School the Educational Rules of the Programme of Study, analyses the consistency of the educational offer with the approved Educational Rules and the effectiveness of the courses carried out and undertakes any necessary corrective actions.

Each Programme of Study is ruled by the Coordinator, that chairs the CCS and is elected among the members of the Board.

**Coordinator of the Programme of Study Board**

The Coordinators are the first and most important guidance, able to understand the problems, even before their formalization in the monitoring data, and therefore able to promptly provide the right corrective actions. Furthermore, they are responsible to involve the professors of their programme of study, keeping them up to date about the University's strategies and decisions concerning the Programme of Study.

The Programme of Study Coordinator has the duty to perform all that activities required for the planning, definition, creation, activation, change and provision of the educational offer. Given the many activities for which s/he is responsible, s/he usually appoints the reference persons of the Programme of Study and of the School Commissions that work with him/her.

Every year, the Coordinator, in collaboration with the Dean of the School, finds or confirms at School level:

• the members of Degree Commissions;
• the members of Admission Commission to the MSc (Laurea Magistrale);
• the members of International Mobility Commission;
• the members of Tutoring Commission;
• the members of Exams/Timetable Commission;

and for each Study Programme
• the members of the Review Group;
• the Quality Assurance Reference Person;
• the recognition and transfer Reference Person;
• the Reference Persons of the Study Plan of the Study Programme;
• with procedures and times defined in the School regulations.

Management of the educational offer for the current academic year
The management of the educational offer for the current academic year requires, by the Programme Coordinator, the following activities:

• Admission to Laurea Magistrale (equivalent to Master of Science) programmes: s/he works with the Admission Commission of the School to evaluate the admission requirements to the Laurea Magistrale and suggests the allocation of specific educational obligations to candidates.

• Approval of Study Plans: s/he collaborates with the Study Plan Reference Person of the Study Programme in the approval of the Individual Study Plans which have discrepancies from the educational regulation and from the educational offer and which cannot be submitted/modified on-line (e.g.: change of educational system). S/he receives the study plan scanned via e-mail from the Registrar's Office, evaluates the request, and validates it using the application "Study Plan Submission".

• Teaching assignment forms: s/he approves the teaching assignment forms, prepared by the professors of the courses, and checks the consistency between the educational offer and what is included in the application "Teaching Sheet_Detailed Programme".

• Educational mix: s/he collaborates with the School Presidency staff to supervise the carrying out of the educational activities. If the difference on the educational mix provided compared to the expected one is greater than ± 10 hours or if the difference between the ECTS provided compared to those expected has negative delta, s/he solves the inconsistencies or pushes the professors for registration.

• Identification and availability of infrastructures: s/he collaborates with the University services in identifying any problems related to the infrastructures used by the students and professors of the Programme of Study, communicating any proposals for solution to the Dean.

• Meeting for first-year students: s/he organizes the first meeting with the first-year students to present the Programme of Study and explain how the evaluation of the education takes place.

• Degree Commission: s/he collaborates with the Dean in defining the members of the Degree Commission to be submitted to the Rector.

• In-course Tutoring: s/he collaborates with the School Tutoring Commission to the organization and management of the guidance and in-course tutoring service.

• International Mobility: s/he decides on the proposals made by the School International Mobility Commission in the choice of agreements for international student mobility and collaborates with the University services to the organization and management of the assistance service in order to carry out the exchange programmes abroad.
• Requests: s/he is responsible for the management of request applications submitted by students and received via email from the Registrar's Office or from other University offices.

• Improvement Actions: s/he enacts the improvement actions proposed in the Review document preceding the current academic year.

Management of the educational offer for the next academic year
The management of the educational offer for the next academic year, if no amendments are envisaged, calls for the following activities:

• Review and improvement actions: s/he receives from the University the data about every Programme and the review form to be used; after having selected and convened the Review Group s/he initiates reflection and the draft of the document, laying down the improvement actions for the following years. Once the first review phase is concluded, he sends whatever produced to the Self-assessment, Periodic Assessment and Accreditation (AVA) Centre (presidioAVA@polimi.it). The Review documents are re-examined and sent by the AVA Centre to the respective Joint Teacher-Student School Boards (defined as mentioned in the University Statute – article 27), one of whose tasks is to assess them, putting forward any improvement proposals at School level. The Programme Coordinators will then receive the reports of the respective Joint Staff-Student Boards to embark on a further review of the document and the proposed improvement actions or confirm their suitability.

• Review and improvement actions: s/he receives from the University the data about every Programme and the review form to be used; after having selected and convened the Review Group s/he initiates reflection and the draft of the document, laying down the improvement actions for the following years. Once the first review phase is concluded, he sends whatever produced to the Self-assessment, Periodic Assessment and Accreditation (AVA) Centre (presidioAVA@polimi.it). The Review documents are re-examined and sent by the AVA Centre to the respective Joint Teacher-Student School Boards (defined as mentioned in the University Statute – article 27), one of whose tasks is to assess them, putting forward any improvement proposals at School level. The Programme Coordinators will then receive the reports of the respective Joint Staff-Student Boards to embark on a further review of the document and the proposed improvement actions or confirm their suitability.

• Students’ opinions on the teaching activities: s/he collaborates with the Dean of the School in analysing the results obtained for his/her own Programme. He defines possible problems, their causes and any solution proposals.

• Definition of the scheduled number of students: s/he collaborates with the Dean in laying down the scheduled number of students of Programmes falling under the Programme of Study Board.

• Degree Programme: s/he suggests to the School of affiliation the Degree Programme falling under the Study Programme Board.

• Educational Rules: he draws up and submits to the School of affiliation the Educational Rules on the Programmes falling under the Programme of Study Board by laying down:
  o The professional profile and the professional and employment opportunities based on the results achieved from consultation with the world of work.
The admission requirements, the procedures for checking fulfilment of the admission requirements, and the rules on recognising prior study and learning periods.

- The criteria for assigning specific additional curricular integrations and the procedures for checking their fulfilment.
- The specific mission and goals of the programme.
- The expected learning outcomes.
- The procedures for monitoring the learning tests and the final test in collaboration with the School.
- The Programme of Study and the characteristics of the teaching and the other educational activities;

- Admission to Laurea Magistrali: s/he collaborates with the Admission Commission – Admission to Laurea Magistrali to assessment of the equivalence of foreign qualifications for admission to the MSc (Laurea Magistrale) programme.
- Assessment of the prior career: s/he collaborates with the transfer and acknowledgments liaison officers in assessing the prior career of students who apply for transfer to one of the Programmes falling under the Programme of Study Board through the University online application. Admissions to the MSc (Laurea Magistrale) programme follow the normal procedure.
- World of work: s/he collaborates with the Career Service to identify the representative organisations of the world of work and define the methods, timeframes and outcomes of their consultation.
- Single Annual Programme Card (SUA): s/he fills out the Single Annual Programme Card for all the programmes except for newly established ones.
- Open Day: s/he supervises the presentation of Programmes falling under the Programme of Study Board during Open Days.

The management of the educational offer for the next academic year, when amendments to the system are envisaged, calls for the same activities as those listed above, but subject to earlier deadlines. The proposed amendments need to be submitted in the “educational system in force” (RaD) section of the Single Annual Programme Card by February.

The Coordinator submits to the School of affiliation the proposed amendments to the system of the Programmes falling under the Programme of Study Board. With a frequency not exceeding five years and in any event at the specific request of the ANVUR (National Agency for the Evaluation of the University and Research System), the MIUR (Ministry of Education University and Research) or the University, or in the presence of deeply critical issues or substantial amendments to the system, the Programme Coordinator is responsible for:

- Laying down the learning objectives to achieve.
- Laying down the activities suited to attainment of the learning objectives (teaching, monitoring procedures, etc.).
- Systematic monitoring of attainment of the learning objectives (cyclical Review).

9. Academic calendar
Academic Calendar
https://www.polimi.it/studenti-iscritti/calendario-e-scadenze/

It is advisable to periodically consult the notice board of the website of the School of Industrial and Information Engineering and of the Cremona Campus for any changes in dates.

Cremona Campus
https://www.polo-cremona.polimi.it/

10. Faculty

Faculty and course syllabi are available on the degree programme since the month of September. The master programme is published every year on the Politecnico di Milano website.

11. Infrastructures and laboratories

Laboratories
The teaching activity provided in the Agricultural Engineering course also includes access to the didactic laboratories of the Politecnico di Milano to carry out specific laboratory experiences.

Student services
Student services deal with orientation activities, career management of students enrolled in bachelor's and master's degree courses, right to study, international mobility, and all those services to support and support university life.

Student offices
Toll-free number 800.420.470 (Monday to Friday, 9.30-12.30)
Student services

12. International context

Degree courses in Agricultural Engineering are spread all over the world and it is therefore easy to find courses corresponding to those provided at the Politecnico di Milano.

Politecnico also carries out comparative analyses with the main international universities. From the benchmark analysis carried out by keyword research on dedicated portals, using Agricultural Engineering as keywords, similar educational initiatives emerged in the following universities:

- University of Southern Queensland, Australia
- Ghent University, Belgium
- Tokyo Agricultural University, Japan
• Wageningen University & Research, Netherlands
• Universidad de Almería, Spain
• Universidad de León, Spain
• Royal Agricultural University, UK
• University of Lincoln, UK
• Iowa State University, USA
• Pennsylvania State University, USA
• University of Georgia, USA
• National Taiwan University, Taiwan

The list is not exhaustive, but is intended to represent the diffusion on all continents of similar study programs.

Information on exchange programs, double degree projects and international internships, European research projects and international relations can be found at Exchange programs https://www.polimi.it/servizi-e-opportunita/studiare-allestero/mobilita-per-studio/

13. Internationalization

The students of the Master of Science in Food Engineering at Politecnico di Milano can accumulate up to 30 ECTS (CFU) at one of the partner university in exchange programmes approved by Politecnico di Milano. A CCS International Mobility Committee approves the courses via a formal process before the exchange.

Students from other universities who want to accumulate credits at Politecnico di Milano are admitted after an evaluation of their CV by the CCS International Mobility Committee.

Information on exchange programmes, double degree projects and international internships, European research projects and international relation projects are available in the degree prospectus. The degree prospectus is published annually on the Politecnico di Milano website.

More information available at https://www.polimi.it/en/exchange-students-incoming/

14. Quantitative data

The Didactic Observation Unit (“Osservatorio della didattica di Ateneo”) and the Evaluation Nucleus (“Nucleo di Valutazione di Ateneo”) perform periodic analysis on the overall results, by analysing the teaching activities and the follow-up of job placement of graduates.

Reports and studies are available on the website of the Politecnico di Milano.

15. Further information
16. Errata corriges