

# Communication in nutrition and agrifood business [ 1203002 ]

Offerta didattica a.a. 2024/2025

**Docenti:**

**Periodo:** Secondo Ciclo Semestrale

**Syllabus non pubblicato dal Docente.**

**L'attività didattica è offerta in:**

**Facoltà Dipartimentale di Scienze e Tecnologie per lo Sviluppo Sostenibile e One Health**

<b>Tipo corso</b>	<b>Corso di studio (Ordinamento)</b>	<b>Percorso</b>	<b>Crediti</b>	<b>S.S.D.</b>
Corso di Laurea Magistrale	Corso di Laurea Magistrale in Scienze e Tecnologie alimentari e Gestione di Filiera (2022)	comune	3	MED/49

*Stampa del 07/05/2025*

# "Data Representation, Management and Processing Models" [ 1203203 ]

Offerta didattica a.a. 2024/2025

**Docenti:** LUCA VOLLERO, ANNA SABATINI

**Periodo:** Primo Ciclo Semestrale

## Obiettivi formativi

The course aims to provide advanced data processing tools for managing, storing, and processing structured and unstructured data in applications scenarios related to, but not limited to, industrial food supply chain management and IoT logic-based monitoring.

Sustainable Development Goals, SDGs:

Goal 12. Ensure sustainable consumption and production patterns

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

## Prerequisiti

none

## Contenuti del corso

Syllabus:

Contents covered by the lecturer (32 hours):

- Information representation formats.
- Data representation, resolution, encoding.
- Vector, matrix and tensor data.
- Conversion between formats.
- XML and JSON representation.
- Processing techniques for matrix-structured data.
- Creating summaries and reports from heterogeneous data.
- Data visualization techniques.
- Statistical testing.
- Creation of custom processing blocks.

Content provided by the co-teacher (12 hours)

- Data manipulation exercises
- Development of data analysis forms
- Development of dashboards

## Metodi didattici

The course consists of lectures (80%), in which theoretical topics are covered, and exercises (20%) in which practical problems related to data representation, processing and analysis are solved together with the students.

## Modalità di verifica dell'apprendimento

The learning assessment is conducted by means of the discussion of homework and an oral test.

The analysis of the homework aims to ascertain:

1. knowledge and understanding skills applied to the analysis of data representations and processing,
2. independent judgment in evaluating and choosing solutions to data representation and processing problems.

The oral test aims to ascertain:

3. knowledge and ability to understand the course topics,
4. communication skills in the formal description of data representation and processing topics,
5. ability to apply acquired knowledge and learning skills in formulating original solutions to data representation and processing problems.

Criteria for measuring learning and defining the final grade:

The final grade, given in 30ths, is obtained as the average (50% on points 1 and 2, 50% on points 3 and 4) of the results of the homework and oral test given in 30ths.

The exam is successful if the candidate reaches a minimum of 18/30.

The awarding of honours requires as a necessary condition the achievement of 30/30 on points 1-4, and is based on point 5, namely the learner's ability to apply maturely and originally and to extend what was learned during the course.

### Testi di riferimento

- Michael Alexander, Richard Kusleika, Excel 2019 Bible, Wiley
- Course notes

### Altre informazioni

Knowledge and understanding skills:

- Knowledge and understanding of the main data representation models.
- Knowledge and understanding of methods of conversion between data representation formats.
- Knowledge and understanding of data description methods.
- Knowledge and understanding of data visualization methods.

Applied knowledge and understanding skills:

- Ability to identify data representation modes.
- Ability to convert and automate conversion between representation formats.
- Ability to analyze data summaries and produce them in an interactive or automated way.
- Ability to generate graphical representations of data,
- Ability to produce interactive or automated summaries.

Autonomy of judgment:

- Ability to independently and critically apply the acquired techniques in solving data representation, processing and visualization problems.

Communication skills:

- Ability to describe the models and systems learnt in the course in a coherent and clear form.
- Ability to consistently and clearly formalize and describe problems and solutions related to data representation, processing and visualization.

Ability to learn:

- Ability to independently extend the body of knowledge acquired in the course.

### L'attività didattica è offerta in:

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<b>Tipo corso</b>	<b>Corso di studio (Ordinamento)</b>	<b>Percorso</b>	<b>Crediti</b>	<b>S.S.D.</b>
Corso di Laurea Magistrale	Corso di Laurea Magistrale in Scienze e Tecnologie alimentari e Gestione di Filiera (2022)	comune	5	ING-INF/05, ING-INF/05

Stampa del 07/05/2025

# Engineering of Food Technology [ 1203202 ]

Offerta didattica a.a. 2024/2025

**Docenti:** MARCO SANTONICO

**Periodo:** Primo Ciclo Semestrale

## Obiettivi formativi

Specific Learning objectives:

The main objective of the integrated course is to provide the technological basis for the formation of the new profession of technologist-nutritionist. Starting from the study of the fundamental theoretical elements, the student will assess how they have applied food production facilities, understanding the functionalities of equipment and the integrated control systems.

Sustainable Development Goals (SDGs)

Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation

Goal 12: Ensure sustainable consumption and production patterns

Goal 13: Take urgent action to combat climate change and its impacts

## Prerequisiti

Propedeuticità:

None

Prerequisites

Basic mathematical, physical and chemistry knowledge acquired during the bachelor studies.

## Contenuti del corso

Principles of Chemical Engineering

Prof. Marcello De Falco

- Theoretical principles
  - o The main chemical-physical properties of materials: mass and density, specific heat, latent heat, conductivity, diffusivity. Unit of measure.
  - o Energy balance: energy conservation principle, Fourier equation, applications.
  - o Material balance: definition of convective and diffusive fluxes, Fick equation, applications.
  - o Principles of heat transfer: the coefficients of heat transfer, natural and forced convection, conduction, radiation, calculation of temperatures.
  - o Fluid dynamic, the Reynolds number and types of flow, definition of viscosity, Bernoulli principle.
  - o Phase equilibrium.
  - o The equation of ideal gases.
  - o Chemical reactions equilibrium.
- Unit operations theory:
  - o Definition of unit operation.
  - o The separation between phases.
  - o The principles of separation by distillation.
  - o The principles of the absorption with solvents.
  - o The principles of adsorption on solid bed.
- Unit plant
  - o Heat exchangers.
  - o Pumps and compressors.
  - o Distillation.
  - o Absorption.
  - o Adsorption.
  - o Solvent extraction.
  - o Drying.
  - o Centrifugation.
- Plant applications in the food industry

- o Definition of block diagrams, process schemes and P&I.
- o The process control
- o Fermentation processes.
- o Industrial production processes.

#### Sensors and Applications Prof. Marco Santonico

- Response curve, sensitivity, noise, resolution, selectivity, specificity, reproducibility.
- Characteristic parameters of the sensors; transduction principles (AT, AQ,  $\Delta c$ , AQ,  $\Delta V$ ,  $\Delta I$ ,  $\Delta n$ ,  $\Delta C$ ).
- Transducers and transduction techniques (QMB, MOS-FET, optical).
- Sensing materials, introduction to nanotechnology.
- Sensors for chemical quantities (concentration of ions in solution: static and dynamic aspects, volatile compounds), sensors for physical variables (temperature, pressure, RH) sensors for biological variables.
- Interfaces between subsystems for chemical, physical and biological sensors.
- Accurate measurements of impedance, static and cyclic voltammetry with different waveforms.

#### Exercitations:

- Application of sensors for food analysis: selected case study.
- Design of experiment.
- Measurements of food characteristic volatile organic compounds using gas sensor arrays.
- Characterization of liquid samples using voltammetric sensors

#### Principles of Automatic Control Prof. Marco Santonico

- Control Theory: The basic elements of control: measurement, model and implementation
- Open loop and closed loop control schema
- PID controllers
- The automated production line:
- Industrial monitoring and control systems
- Human machine interfaces and synoptic panels

### **Metodi didattici**

#### Principles of Chemical Engineering

The course includes theoretical lectures and frequent exercises on real cases with the aim of applying mathematical tools to solve practical problems.

#### Sensors and Applications

The course includes theoretical lectures. The course consists of lectures and laboratory activities. In the laboratory, students will be able to apply some sensors to a specific case study.

#### Principles of Automatic Control

The course includes theoretical lectures and frequent exercises. The lectures, which represent about the 70% of the total amount of hours, are addressed to illustrate the topics of the course. During the interactive exercises, the students will apply different methods and tools applied to specific case studies.

### **Modalità di verifica dell'apprendimento**

Knowledge assessment methods and criteria:

The examination will be based on a written test relative to Unit Operations of Food Technology and Machinery and Equipment Food Industry, consisting of 3 exercises to be solved within three hours, and of an oral exam composed of one question about each of the following subjects: Unit Operations of Food Technology and Machinery and equipment Industry Food, three questions about the "Sensors and Applications" topics, of which one question will be relative to lab activity and two questions about the module of "Principles of Industrial Automation". The student will pass the exam only if the grade acquired for each module is sufficient (18/30). The final evaluation of the student will also consider (as well as the acquired competence) the correct use of language and the ability to link different course topics. Honors will be awarded to the students who have obtained a final grade higher than 30.

Criteria for measuring learning and defining the final grade:

The final grade will be calculated as the mean of the grades obtained in the different tests foreseen by each module.

### **Testi di riferimento**

MODULO DI PRINCIPI DI INGEGNERIA CHIMICA

Material provided by the teacher

**MODULO DI SENSORI E APPLICAZIONI**

Material provided by the teacher

**MODULO DI CONTROLLO AUTOMATICO**

Material provided by the teacher

**Altre informazioni**

Knowledge and understanding of unit operations and the theoretical and practical models useful to their understanding, mathematical models for solving numerical problems of the project and control of plant process diagrams, optimization criteria and the main production processes in different food chains and of the structure and organization of the automatic production lines and monitoring techniques using sensors or multisensory systems. The student will be an expert in particular real contexts related to the food fields and in overall production processes, their monitoring and control.

Applying knowledge and understanding of theoretical elements will be continuously applied in industrial applications. The exercises will train the student to use mathematical tools. The course will give the students the basic knowledge to analyze and understand design strategies and how they are implemented in the production plants and the technologies for monitoring and control. The student will be able to manage the optimal and updated technologies to use in the monitoring and control of production processes.

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Corso di Laurea Magistrale	Corso di Laurea Magistrale in Scienze e Tecnologie alimentari e Gestione di Filiera (2022)	comune	15	ING-IND/25, ING-INF/01, ING-INF/04, ING-INF/01

*Stampa del 07/05/2025*

# Metodi avanzati di analisi degli alimenti [ 1203206 ]

Offerta didattica a.a. 2024/2025

**Docenti:** CHIARA FANALI

**Periodo:** Primo Ciclo Semestrale

## Obiettivi formativi

The course aims to give in-depth knowledge of advanced analytical techniques and methods, as well as their applications within food and nutritional analysis. The focus will be particularly on green, environmentally friendly analytical methods. Furthermore, the course aims to enable students to develop their ability to use and optimise analytical methods, as well as critically discuss and evaluate their environmental sustainability and its relevance for society.

Several aspects of green analytical chemistry related to the analysis of foods and dietary products will be considered, with emphasis on techniques for the extraction and characterization of molecules in foods. Advanced methods of screening and confirmation of constituents will be explained. Recent research work related to advanced analytical methods applied to food constituents will be discussed.

Recent research works related to advanced methods of analysis applied to food components will be discussed. Sustainable Development Goals: Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

## Prerequisiti

Prerequisites:

Basic knowledge of General and Inorganic Chemistry and Physics.

## Contenuti del corso

Development of an analytical method.

Introduction to the concept of Green Chemistry & Green Analytical Chemistry: history, evolution and the 12 principles.

Sample pretreatment techniques.

Advanced methods of sample preparation and extraction of analytes.

Analyte extraction techniques using green solvents and reagents.

Miniaturized analyte extraction techniques.

Analytical methods.

Direct spectroscopic and spectrophotometric methods.

Remainder of the theory of separative/chromatographic analytical methods.

Green Liquid chromatography.

Methods for evaluating a green analytical protocol and its examples.

Applications of green analytical chemistry to the analysis of food and nutritional samples.

## Metodi didattici

Theoretical lectures with slide support.

Hours of lessons: 32

## Modalità di verifica dell'apprendimento

The course exam consists of an oral test. The ability to describe and apply an analytical method that includes the pre-analytical and analytical phases for food and nutritional determinations will be assessed.

## Testi di riferimento

Teaching materials used during classes will be shared with students through the university's sharing platform e-learning.

• Skoog DA, West DW, Holler FJ, Crouch SR. Fondamenti di Chimica Analitica, terza edizione, EDISES (Napoli), 2015.

## Altre informazioni

Conoscenze e capacità di comprensione

Knowledge and understanding of the advanced instrumental analytical methods used for the chemical analysis of foods, food matrices and dietary products, with particular attention to the techniques of extraction and analysis of

molecules of food interest for the determination of food quality and nutritional value.

Capacità di applicare conoscenza e comprensione

The student will be able to present the concepts of advanced applied and instrumental analytical chemistry, integrating them with the methods of sample preparation, with the final treatment of the data and with the critical analysis of the results obtained to carry out quality checks on food, for their nutritional enhancement and for the identification of food fraud and counterfeiting.

**L'attività didattica è offerta in:**

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Corso di Laurea Magistrale	Corso di Laurea Magistrale in Scienze e Tecnologie alimentari e Gestione di Filiera (2022)	comune	4	CHIM/01

*Stampa del 07/05/2025*

# Food microbiology and Agricultural genetics [ 1203201 ]

**Offerta didattica a.a. 2024/2025**

**Docenti:** ANNAMARIA BEVIVINO, EUGENIO BENVENUTO

**Periodo:** Primo Ciclo Semestrale

## Obiettivi formativi

The course, subdivided in two modules, aims at understanding the innovative and advanced skills on the innovative aspects of food microbiology and agricultural genetics.

Sustainable Development Goals, SDGs:

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Goal 12. Ensure sustainable consumption and production patterns

Goal 13. Take urgent action to combat climate change and its impacts

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

## Prerequisiti

Concepts of General Microbiology and Food Microbiology, Food Technology, Molecular Biology, Plant Physiology, Food security and safety, Plant Biology.

## Contenuti del corso

The course takes place in the first semester. The course consists of two integrated modules, Food Microbiology (7 CFU) and Agricultural Genetics (5 CFU) and deals with the topics indicated in the individual modules. The Food Microbiology module includes practical exercises in the laboratory (12 hours) in which students, divided into groups, will try their hand at the applications of the main current methodologies used for the study of microorganisms.

### FOOD MICROBIOLOGY

#### PART I (18 hours)

Food-associated microorganisms: the role of pathogenic, spoilage and useful microorganisms

Food microbial ecology: factors affecting the growth and survival of microorganisms in foods

Microbial biofilm in the food environment: characteristics, dynamics and control strategies

Quorum sensing and food spoilage

Emergence and diffusion of antibiotic resistance in the agro-food chain: new control and monitoring strategies

Mycotoxins and food safety

#### PART II (20 hours)

Microbiological analysis of food: conventional and molecular methods

Application of biomarkers for traceability and food safety

Innovative methodologies for the study of microorganisms and their application in the agri-food sector

Microbial characterization of food raw materials, products and processes

#### PART III (10 hours)

Role of microbial starter cultures in the food production system

The potential of microbiome application for new and sustainable food systems: from farm to fork

Beneficial microbes for human health: the gut microbiome

Journal Club: Discussion of scientific articles focused on the above themes.

### AGRICULTURAL GENETICS

The fundamental steps that lead to the progress that genetics has made and that place it at the forefront of a technological revolution that involves many sectors of today's society will be illustrated. Particular attention will be paid to the aspects that have determined the current primary production system and those that will be fundamental in the future, operating with new concept genetic interventions, in order to increase the production efficiency necessary to meet the nutritional needs of a world population. constantly growing (8.5 billion by 2030). After a basic knowledge test for each of the three main topics, we will get to the heart of the matter with the description of the fundamental phases. Main topics:

1. Concepts of classical genetics (10 hrs)

Mendelism and basic principles of inheritance. Genetics in agriculture. The domestication of plants. Biological

variability. Plant reproductive systems. Heterosis. Polyploidy. Mutagenesis. The genetic improvement of the main agricultural crops. The green revolution "ante litteram" by Strampelli and Borlaug.

## 2. Concepts of molecular genetics (15 hrs)

Genetic modification and "molecular" genetic improvement. From the basic elements of molecular biology to genetic engineering techniques in plants. The debate on genetically modified organisms. Plants modified to resist the most common pathologies. Molecular agriculture: a biotechnology approach for the production of molecules useful for health and nutrition.

## 3. Concepts of Genomics (15 hrs)

Deciphering the genomes of cultivated plants. Methods and analysis. The "genome editing" technique and the implications for genetic improvement interventions. The food of the future and the future of food.

### **Metodi didattici**

**MODULE FOOD MICROBIOLOGY:** The course is delivered through lectures (80 %) and laboratory activity (20%). Theoretical lectures will be given with the help of ppt presentations, as well as seminars on innovative scientific topics of particular interest for the deepening of some topics. Laboratory activity will be focused on the application of classical and molecular microbiology techniques for the study and characterization of food microbial communities.

**MODULE AGRICULTURAL GENETICS:** The course includes lectures with the aid of power point presentations and seminars on scientific topics.

### **Modalità di verifica dell'apprendimento**

The exam of the integrated course consists of an oral exam which consists, for Food Microbiology module, in the presentation of a scientific publication on one of the topics addressed during the course, and at least two questions on different topics of the program; for the Agricultural Genetics module of an ongoing test and an oral exam consisting of two questions relating to topics of the program.

The elements of evaluation that contribute to the attribution of the final grade are the mastery of the topics of the course acquired by the student (40%), the language skills (20%) and the ability to link the topics covered during the exam with the more general topics covered by the course of study (40%).

In particular, the grade assigned in the intervals below will be based on the learning parameters taken into consideration:

18-23 sufficient of the themes, modest language properties, modest / poor ability to connect between the topics.

24-27 sufficient / good knowledge of the topics, modest / good language skills, modest / good ability to connect between the topics.

28-30 very good / excellent knowledge of the topics, very good / excellent language skills, very good/ excellent ability to connect between topics.

30L excellent knowledge of topics, excellent language skills, excellent ability to connect between topics.

Criteria for measuring learning and defining the final grade: The final grade of the exam will take into consideration the weight in terms of CFU of the relative contents (7 CFU for Food Microbiology and 5 CFU for Agricultural Genetics).

### **Testi di riferimento**

Concepts of General Microbiology and Food Microbiology, Food Technology, Molecular Biology, Plant Physiology, Food security and safety, Plant Biology.

Teaching material:

The teaching material (scientific articles and power-point presentations of the lessons) will be provided by the teachers.

**MODULE FOOD MICROBIOLOGY:**

Cocolin L., Gobbetti M., Neviani M. Microbiologia alimentare applicata. Casa Editrice Ambrosiana. Distribuzione esclusiva Zanichelli 2022

Ann Elizabeth Vaughan, Pietro Buzzini, Francesca Clementi, Laboratorio didattico di microbiologia, Casa Editrice Ambrosiana (CEA) 2012

**MODULE AGRICULTURAL GENETICS:** Peter J. Russel Genetica un approccio molecolare, Pearson 2019

### **Altre informazioni**

Knowledge and understanding

- Knowledge and understanding of microbiological problems related to food and nutrition, innovative methodologies for monitoring and prevention of microbial contaminants and for the management of microbial diversity along the food production chain
- Knowledge and understanding of food microorganisms, the use of microorganisms for the improvement of the production process and human health
- Knowledge and understanding of cultivable, phenotypic, biochemical and molecular methods, and experimental procedures for the characterization and identification of food microorganisms
- Acquisition of an in-depth knowledge on the importance of plant diversity that led to the genetic improvement of

plant species of agronomic interest and the possibilities provided by the different plant biotechnologies in the food and nutraceutical fields. This, with the ultimate aim of increasing the efficiency and quality of primary production necessary to meet human nutritional needs of a world population in constant growth.

#### Applying knowledge and understanding

The student will be able to apply and integrate the acquired knowledge in the different productive contexts from the farm to fork, for implementing food quality control of the different supply chains, for improving food safety, for innovation of food industry, for improving food quality and agricultural production, and in the various contexts of primary production, to apply knowledge of the genetic origin of the different plant varieties and their improvement processes, including biotechnological innovation in the food, nutraceutical and pharmaceutical fields. Such discussion skills will be achieved through the study of scientific articles on topics related to the program, and through case studies discussed in the classroom.

#### Judgement skills

The student will have to deal with the problems related to real application contexts, diversified and inherent in the field of food microbiology and agricultural genetics for everything related to the quality, safety and improvement of food systems, also in terms of environmental sustainability and circular economy.

#### Communication skills

The student will be stimulated to developing communication skills using classroom seminars, by means of work in team, and the organization, design, and delivery of the final oral exam which offers the student an opportunity to deepen and verify the analysis, processing and communication skills of the work done.

#### Learning skills

The learning ability will be stimulated by supplementary teaching aids (scientific articles, review articles and monographs) through the independent study of the recent results published in the scientific literature, the consultation of bibliographic material, the synthesis of the results in specific power points and discussion in classroom, also aimed at verifying the effective understanding of the topics covered. This will be achievable and verifiable in the final exam for which the student is stimulated in using literature data.

#### **L'attività didattica è offerta in:**

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Corso di Laurea Magistrale	Corso di Laurea Magistrale in Scienze e Tecnologie alimentari e Gestione di Filiera (2022)	comune	12	AGR/07, AGR/16, AGR/16

*Stampa del 07/05/2025*

## Thesis [ 12032LF ]

Offerta didattica a.a. 2024/2025

**Docenti:**

**Periodo:** Secondo Ciclo Semestrale

**Syllabus non pubblicato dal Docente.**

**L'attività didattica è offerta in:**

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Corso di Laurea Magistrale	Corso di Laurea Magistrale in Scienze e Tecnologie alimentari e Gestione di Filiera (2022)	comune	18	PROFIN_S

*Stampa del 07/05/2025*

## **Apprenticeship [ 12032T1 ]**

**Offerta didattica a.a. 2024/2025**

**Docenti:**

**Periodo:** Ciclo Annuale Unico

**Syllabus non pubblicato dal Docente.**

**L'attività didattica è offerta in:**

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Corso di Laurea Magistrale	Corso di Laurea Magistrale in Scienze e Tecnologie alimentari e Gestione di Filiera (2022)	comune	4	NN

*Stampa del 07/05/2025*