

General information	
Academic subject	Analytical and instrumental chemistry with laboratory
Degree course	<i>Food Science and Technology (L26)</i>
Academic Year	<i>Second year</i>
European Credit Transfer and Accumulation System (ECTS)	6 ECTS
Language	<i>Italian</i>
Academic calendar (starting and ending date)	<i>27th February - 16th June, 2023</i>
Attendance	<i>No Compulsory</i>

Professor/ Lecturer	
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Department and address	<i>Department of Chemistry</i>
Virtual headquarters	<i>Microsoft Teams</i>
Tutoring (time and day)	Tuesday -Thursday: 9.00-16.00 (by appointment)

Syllabus	
Learning Objectives	<i>The students will acquire knowledge on the main techniques and instruments useful for carrying out chemical-analytical analyses in the food sector. The qualitative and quantitative aspects of analytical determinations will be treated and some food applications will be discussed.</i>
Course prerequisites	<i>Prerequisites: "Elements of chemistry".</i>
Contents	<p>Introduction to the analytical process, chemical measurements, laboratory instrumentation.</p> <p>Qualitative and quantitative analyses <i>The parameters of a chemical analysis: limits of detection and quantification, experimental error, data distribution, mean and standard deviation, comparison test of means and standard deviations, calibration curves (least squares method), calibration methods (standard addition, internal standard).</i></p> <p>Titrations <i>General: final point determination, acid-base titrations, indicators, pH electrode.</i></p> <p>Spectrochemical methods <i>General: properties of electromagnetic radiation, absorption and emission spectroscopic measurements, Lambert and Beer law, instruments for optical spectroscopy (sources, monochromators, detectors), UV/vis and IR photometers and spectrophotometers, applications of molecular spectroscopy, atomic spectroscopy.</i></p> <p>Chromatographic techniques <i>Introduction to analytical separations, generalities of chromatography (mobile phase, stationary phase, number of theoretical plates), gas chromatography (instrumentation, detectors, sample preparation), high efficiency liquid chromatography (HPLC) (instrumentation, detectors, sample preparation), comparison between chromatographic techniques.</i></p> <p>Mass spectrometry <i>General: Types of spectrometers, coupling with chromatographic methods.</i></p>
Books and bibliography	<i>SKOOG, WEST, HOLLER, CROUCH Fundamentals of Analytical Chemistry, Thomson Learning.</i>
Additional materials	<i>Notes, slides and other bibliographic materials will be furnished during the course.</i>

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/Self-study hours
Hours			
150	32	28	90
ECTS			
6	4	2	
Teaching strategy		<p>Lectures will be presented through PC assisted tools (PowerPoint, video). Field and laboratory classes, reading of regulations will be experienced.</p> <p>Lecture notes and educational supplies will be provided by means of online platforms .</p>	
Expected learning outcomes		<p>The expected learning outcomes, in terms of both knowledge and skills, are provided in Annex A of the Academic Regulations of the Degree in Food Science and Technology (expressed through the European Descriptors of the qualification).</p>	
Knowledge and understanding on:		<ul style="list-style-type: none"> ○ Knowledge of and understanding of analytical chemistry techniques. ○ Calibration of the instrumentation necessary for the determination of nutrients or food pollutants. 	
Applying knowledge and understanding on:		<ul style="list-style-type: none"> ○ Applying knowledge about: <ul style="list-style-type: none"> - ability to select and use analytical chemistry techniques for the evaluation of food quality; - method of calibration of the analytical instrumentation necessary for the purpose; - ability to correctly carry out the sequence of phases of a chemical analysis; - ability to implement safety rules in the laboratory. 	
Soft skills		<ul style="list-style-type: none"> ● <i>Making informed judgments and choices</i> <ul style="list-style-type: none"> ○ The students will acquire adequate skills to correctly guide the choice of the most suitable procedures for the analytical determination of the components in food. ● <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> ○ The students will acquire adequate skills and communication ability to describe the methods and instruments used for quantitative and qualitative chemical analyses. ● <i>Capacities to continue learning</i> <ul style="list-style-type: none"> ○ The students will acquire skills to deepen and update their knowledge related to the topics of the course. 	
<p>The expected learning outcomes, in terms of both knowledge and skills, are provided in Annex A of the Academic Regulations of the Degree in Food Science and Technology (expressed through the European Descriptors of the qualification).</p>			

Assessment and feedback	
Methods of assessment	<p>The exam consists of an oral dissertation on the topics developed during the theoretical and theoretical-practical lectures in the classroom and in the laboratory production plants, as reported in the Academic Regulations for the Bachelor Degree in Food Science and Technology (article 9) and in the study plan (Annex A).</p>

	<p>Students attending at the lectures may have a middle-term preliminary exam, consisting of a written test, relative to the first part of the program, which will concur to the final evaluation and will be considered valid for a year.</p> <p>The evaluation of the preparation of the student occurs on the basis of established criteria, as detailed in Annex B of the Academic Regulations for the Bachelor's degree in food science and Technology.</p> <p>The foreign student's profit test can be done in English in the way described above.</p>
Evaluation criteria	<ul style="list-style-type: none"> • <i>Knowledge and understanding</i> <ul style="list-style-type: none"> ○ The student must be able to describe the methods of use of the analytical tools presented in class and the calibration methods necessary to carry out the qualitative and quantitative chemical analyses. • <i>Applying knowledge and understanding</i> <ul style="list-style-type: none"> ○ The student will have to describe the criteria for the choice of the analytical technique selected for the evaluation of the quality of the food investigated. ○ The student will have to describe the correct succession of the phases of an analytical chemical analysis in the food sector and the safety rules to be applied in the laboratory. • <i>Autonomy of judgment</i> <ul style="list-style-type: none"> ○ The student will have to express reasonable hypotheses for the choice of procedures suitable for the estimation of components in typical foods treated in class. • <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> ○ The student will acquire communication skills and tools to analyse and discuss analytical data related to new process and products with interlocutors with similar and different backgrounds. • <i>Communication skills</i> <ul style="list-style-type: none"> ○ The student will be evaluated considering the use of appropriate technical language. • <i>Capacities to continue learning</i> <ul style="list-style-type: none"> ○ The student will also be evaluated considering his ability to deepen and update his knowledge within the topics of the course also through an efficient bibliographic search using databases, such as Scopus, Google Scholar, etc.
Criteria for assessment and attribution of the final mark	<p>The evaluation criteria that contribute to the attribution of the final mark will be: knowledge and understanding, the ability to apply knowledge, autonomy of judgment, i.e. the ability to criticize and formulate judgments, communication skills</p>
Additional information	