

COURSE OF STUDY: *Bachelor degree: Food Science and Technology (L26)*

ACADEMIC YEAR : *2023-2024*

ACADEMIC SUBJECT: *Analytical and instrumental chemistry with laboratory*

General information	
Year of the course	II
Academic calendar (starting and ending date)	Second semester (February 26th – June 21 st , 2024)
Credits (CFU/ETCS):	6
SSD	Analytical Chemistry (CHIM/01)
Language	Italian
Mode of attendance	No Compulsory

Professor/ Lecturer	
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Department and address	Department of Biology, via E. Orabona 4, 70125
Virtual room	codice teams: 8g7dhi2
Office Hours (and modalities: e.g., by appointment, on line, etc.)	Every day (by appointment)

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
150	32	28	90
CFU/ETCS			
6	4	2	

Learning Objectives	The student will acquire knowledge and skills on the main techniques and instruments used to carry out chemical-analytical analyzes in the food field. The qualitative and quantitative aspects of analytical determinations will be treated and some food applications will be discussed.
Course prerequisites	Knowledge of general, inorganic and organic chemistry. "Elements of chemistry. The prerequisites cannot differ for attending and non-attending students.

Teaching strategie	The topics will be treated with the help of Power Point presentations, classroom and/or laboratory exercises and/or video projections and in the discussion of case studies. All the material used for the lessons will be made available to students on specific web platforms.
Expected learning outcomes in terms of	The expected learning outcomes must satisfy the set of knowledge, skills and competences foreseen by the training path. Furthermore, they must stimulate the development of the soft skills defined by the Dublin descriptors, defined below.
Knowledge and understanding on:	-Acquisition of basic theoretical and practical knowledge on: <ul style="list-style-type: none"> ○ laboratory techniques and analytical chemistry instruments, for understanding and carrying out qualitative and/or quantitative analyses

	<ul style="list-style-type: none"> ○ general acquisition of safety standards and “good practice” in the laboratory
Applying knowledge and understanding on:	<ul style="list-style-type: none"> - Ability to apply the skills acquired at the end of the course to: <ul style="list-style-type: none"> ○ the appropriate selection of the technique or techniques, among those studied, for agro-food evaluations ○ the calibration of the analytical instrumentation necessary for the purpose ○ carry out the sequence of phases of a chemical analysis correctly ○ implement safety rules in the laboratory
Soft skills	<ul style="list-style-type: none"> - The development of soft skills is foreseen through numerical exercises in the classroom, carried out on the blackboard by the students themselves under the supervision of the teacher, carrying out practical laboratory tests or watching videos. - The ability to communicate information, ideas, problems and solutions to specialists and non-specialists will be developed through the evaluation of case studies, the drafting of written reports. <p>At the end of the course the student should be able to:</p> <ul style="list-style-type: none"> • Making informed judgments and choices <ul style="list-style-type: none"> ○ orient the choices between the different analytical procedures for agrofood determinations in an appropriate way. • Communicating knowledge and understanding <ul style="list-style-type: none"> ○ evaluate and interpret experimental data for the purposes of qualitative and quantitative determinations • Capacities to continue learning <ul style="list-style-type: none"> ○ deepen and update one's knowledge on the topics of the course also through an efficient bibliographic search using the Scopus database and/or Google Scholar.
Syllabus	
Content knowledge	<p>Introduction to the analytical process, chemical measurements, laboratory instrumentation. Expression of results.</p> <p>Qualitative and quantitative analyses 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).</p> <p>Titration General: final point determination, acid-base titrations, indicators, pH electrode.</p> <p>Spectrochemical methods 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.</p> <p>Chromatographic techniques 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.</p> <p>Mass spectrometry General: Types of spectrometers, coupling with chromatographic methods.</p>
Texts and readings	SKOOG, WEST, HOLLER, CROUCH Fundamentals of Analytical Chemistry, Thomson Learning.

Notes, additional materials	Notes, slides, and other bibliographic materials will be furnished during the course
Repository	
Assessment	
Assessment methods	<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 or 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. There are no different verification methods for attending and non-attending students.</p> <p>The foreign student's profit test can be done in English in the way described above.</p>
Assessment criteria	<ul style="list-style-type: none"> • Knowledge and understanding <ul style="list-style-type: none"> ○ Describe the techniques and analytical instruments studied and illustrate their main applications. ○ Know the calibration methods necessary to carry out qualitative and quantitative chemical analyses. • Applying knowledge and understanding <ul style="list-style-type: none"> ○ Describe the criteria underlying the choice of a specific analytical technique for assessments in the agri-food sector. ○ Describe the correct sequence of the phases of an analytical chemical analysis and the safety rules to be applied in the laboratory. • Autonomy of judgment <ul style="list-style-type: none"> ○ Express reasonable hypotheses for choosing suitable procedures, among those covered in class, for the estimation of components in foods. • Communicating knowledge and understanding <ul style="list-style-type: none"> ○ Use technical-scientific vocabulary appropriately and justify the statements on the topics. • Communication skills <ul style="list-style-type: none"> ○ The student will be evaluated considering the use of appropriate technical language. • Capacities to continue learning <ul style="list-style-type: none"> ○ Knowing how to autonomously identify bibliographic sources to broaden one's knowledge and find more advantageous and innovative solutions for the analytical determination of specific constituents in foods. ○ be able autonomously of interdisciplinary insights
Final exam and grading criteria	<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. The general evaluation criteria that contribute to the assignment of the final grade are: knowledge and understanding, ability to apply knowledge, independent judgement, i.e. ability to criticize and formulate judgements, communication.</p> <p>The final vote is expressed in thirtieths. The exam is considered passed when the vote is greater than or equal to 18/30. The outcome of the preliminary exam, positive starting from 18/30, is valid for one academic year and contributes to the determination of the profit exam, which is given from the average of the marks obtained in the two tests, i.e. the preliminary exam and the oral exam. In the event of a positive outcome of the preliminary exam, the oral will focus on</p>

	<p>an interview on the remaining part of the teaching contents. In case of failure to carry out the preliminary exam, or in case of insufficient evaluation, the verification of the will take place during the oral. The exam for foreign students can be taken in English as described above.</p> <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>
Further information	
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