General information		
Academic subject	**CHEMICAL, PHARMACEUTICAL AND TOXICOLOGICAL ANALYSIS 2**	
Degree course	**CHEMISTRY AND PHARMACEUTICAL TECHNOLOGY**	
Year of study	**THIRD**	
European Credit Transfer and Accumulation System (ECTS)	**9**	
Language	**ITALIAN**	
Academic Year	**2021-22**	
Academic calendar (starting and ending date)	**FIRST SEMESTER (2021.9.20 – 2022.1.21)**	
Attendance	**YES**	

Professor/ Lecturer	
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Department and address	**Department of Pharmacy – Drug Sciences, via Orabona 4, Bari**
Virtual headquarters	**Microsoft Teams Hub**
Tutoring (time and day)	**From monday to friday, (10.00 – 12.00)**

Syllabus	
Learning Objectives	The course aims to train students with theoretical and experimental chemical and analytical knowledge and skills useful for operating in all public and private sectors directly or indirectly connected to the design, development, production, control and marketing of medicines and health products.
Course prerequisites	Basic knowledge of chemistry, analytical chemistry with elements of Mathematics
Contents	Main safety rules and risk assessment sheet in a chemical laboratory. Individual and collective protection devices. Electronic analytical balance. Uncertainties in instrumental measurements and error analysis. Statistical analysis of results and data representation. Concentration expressions: Molarity, Normality, Percentage concentrations, parts per million. Volumetric neutralization. Theory of the indicator. Titration curves: strong acid/strong base, weak acid/strong base and inverse species. Titration of mixtures of acids and bases. Titration in non-aqueous solvent. Error associated with the indicator in the titrations. Volumetric precipitation. Indicators in precipitation titrations. Methods of Mohr, Volhard, Fajans. Titration curves, relative calculations. Volumetric complexation. Indicators in complexometric titrations. Titration curves, relative calculations. Importance of pH in complexometric titrations. Conditional constant. Direct, indirect and displacement titrations. Volumetric oxidation/reduction. Indicators. Titration curves, relative calculations. Use of oxidizing and reducing titrants. Potentiometry. Reference electrodes. Indicator electrodes: metallic, liquid membrane, crystalline membrane, glass. Direct and indirect potentiometric measurements. Amperometry and amperometric titrations. Conductometry. Direct conductometric measurements. Conductometric titrations. Spectrophotometry. Transmittance and Absorbance. Lambert-Beer law. Direct spectrophotometric measurements. Analysis of mixtures. Derivative spectrophotometry technique. Spectrophotometric titrations. Single and double beam spectrophotometers. Fluorimetry. Principles. Instrumentation. Quantitative study of drug-receptor interaction. Receptor affinity. Binding assays with radioligands and fluorescent tracers. Evaluation of the activity of agonists and antagonists. Cell cultures.
Books and bibliography	- Fondamenti di chimica analitica

	D.A. Skoog, D.M. West, F.J. Holler, S. Crouch, EdiSes - Analisi chimica strumentale R. Cozzi, P. Protti, T. Ruaro, Ed. Zanichelli - Chimica analitica quantitativa D.C. Harris, Ed. Zanichelli
Additional materials	A booklet for laboratory practice exercises is available

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
225	70	30	125
ECTS			
9	7	2	
Teaching strategy	Lectures consisting of classroom teaching activities with exercises and laboratory practice exercises. The teaching course is delivered as blended learning.		
Expected learning outcomes			
Knowledge and understanding on:	o Choise of an analytical method o Theory and practical experience of some instrumental techniques (potentiometry, conductimetry, amperometry, spectroscopy UV-Vis, fluorometry) o Data processing by statistical methods		
Applying knowledge and understanding on:	o Application of the suitable method for carrying out a quantitative analysis of substances for pharmaceutical use o Ability to analyze and solve problems related to the quantification of mixtures and / or pharmaceutical forms		
Soft skills	• *Making informed judgments and choices* o Awareness of one's professional and ethical responsibilities • *Communicating knowledge and understanding* o Clear and unambiguous communication of knowledge regarding the acquired skills • *Capacities to continue learning* o capability to pursue with a high degree of autonomy more advanced studies, further developing skills with regards to research and development, and quality control		

Assessment and feedback	
Methods of assessment	Written test consisting of numerical calculations followed from an oral test
Evaluation criteria	• *Knowledge and understanding* o assessment of knowledge and understanding of the topics covered in the course (see teaching contents) and in particular of the fundamentals of quantitative chemical analysis such as the choice and application of the method in its theoretical and practical aspects

	• *Applying knowledge and understanding* ○ Evaluation of the understanding of the mechanisms, problems and evaluations underlying the choice of an analysis method for dosing a drug • *Autonomy of judgment* ○ Evaluation of the ability to critically discriminate between different analytical methods • *Communication skills* ○ Assessment of the ability to convey one's knowledge in a clear and understandable way to one's peers, superiors and all users • *Capacities to continue learning* ○ Evaluation of autonomy in developing, starting from the topics covered in the course, personal and complex considerations in the field of research, development and quality control
Criteria for assessment and attribution of the final mark	The written test consists of three exercises with numerical calculations to be solved in 90 minutes. To pass this test and be admitted to the oral one, a grade of at least 15/30 is required. The final grade is awarded out of thirty and does not necessarily represent the arithmetic mean of the two tests. The exam is passed when the grade is greater than or equal to 18. To achieve a high evaluation, the student must have developed autonomy of judgment and adequate capacity for argumentation and presentation.
Additional information	