DIPARTIMENTO DI SCIENZE

COURSE: **ANALITICAL CHEMISTRY**			
ACADEMIC YEAR: **2019-2020**			
TYPE OF EDUCATIONAL ACTIVITY:**Basic**			
TEACHER: **Prof. Giuliana Bianco**			
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phone: **0971205451**		mobile (optional):	
Language: **ITALIAN**			
ECTS: **8** (**7** lessons and **1** tutorials/practice)	n. of hours: **68** (**56** lessons and **12** tutorials/practice)	Campus: **Potenza** Dept./School: **Department of Sciences** Program: **Pharmacy (LM-13)**	Semester**: I** (from 01 October 2019 to 20 December-2019 - 20 January 2020)

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES:

Knowledge and understanding

The objectives of this course are based on the acquisition of basic knowledge about the thermodynamic conditions of the chemical equilibrium of the reactions. In detail the equilibria regards the acid-base and redox equilibria. The study focuses mainly on the understanding of the most important implications regarding the numerical and conceptual problems in different contexts of the Analytical Chemistry.
The approach on the common analytical techniques such as: potentiometric, spectrophotometric in absorption and/or emission has the aim to provide a basic but exhaustive vision to the chemical analysis and relevant laboratory approaches.
The study of the general characteristics and properties of gas- and liquid-chromatography has finally the purpose of providing the necessary information of these techniques for the purification and/or separation of various classes of molecules. The general combination of chromatographic techniques and some common selected detectors represents the general trends for the definition of analytical procedures for molecules of pharmaceutical interest.

Ability to apply knowledge and understanding

The cycle of lectures, with laboratory approaches, will have the goal to provide the following capabilities:
- Ability to calculate acid-base and redox species under equilibrium conditions;
- Knowledge and critical capacity to the understanding the procedures in order to define the common methods of analysis;
- Comprehension of the main principles and properties of the modern analytical procedures.

PRE-REQUIREMENTS:

The optimal approach of the Course in Analytical Chemistry implies the minimal knowledge of: Mathematics and Physics.
In addition are required the basic knowledge of the General and inorganic Chemistry.

SYLLABUS:

1) STATISTICS: The Gaussian distribution, the Student's t test, Confidence intervals, comparison of means, Q test, Linear least squares regression method, quantitative methods. 4 hours

2) CHEMICAL EQUILIBRIA: Review of the principles of thermodynamics, definition of chemical equilibrium and equilibrium constants. 6 hours
3) ACID-BASE EQUILIBRIUM: Strong and weak protolytes equilibria, pH calculation.
concept of buffer Solution and calculation of the buffering capacity.
Titration concept by volumetric analysis, primary standards, titration curves, pH indicators.
Acid / base titrations of strong and weak protolytes. Titration error 8 hours

4) COMPLEX FORMATION BALANCES: Lewis acids and bases, metal-ligand complexes, algebraic treatment of solutions containing a metal and a ligand, titrations with complexing agents; 4 hours

5) PRECIPITATION EQUILIBRIA: solutions of poorly soluble molecular compounds, calculation of equilibrium concentrations, solutions of poorly soluble salts; 4 hours

6) OXIDORIDUTION EQUILIBRIUM: Galvanic and electrolysis cells. Concept of maximum work and definition of the Nernst equation.
Definition of standard potentials and their experimental evaluation. Calculation of equilibrium constants.
Redox titrations. Redox indicators, titration curves and calculation of potential
6 hours

7) POTENTIOMETRY: Galvanic cells as instruments for measuring the activity of species at equilibrium. Reference electrodes and indicators. Schematic of potentiometric measurement cells. Glass electrode and pH measurement. Other ion-selective electrodes with a crystalline and liquid solid membrane. 6 hours

8) UV-VIS SPECTROPHOTOMETRY: General definitions. Radiant energy-matter interaction; Lambert Beer's law and its limitations.
Energy diagram. Absorption conditions of molecules and chromophoric groups
Single / double beam spectrophotometer scheme.
Direct spectrophotometric analysis. 6 hours

9) EMISSION SPECTROPHOTOMETRY: FLUORESCENCE: General properties and definitions of radiant emission by matter.
Quantum yields, Relationship between molecular structure and emission intensity. Fluorescence and phosphorescence. Fluorescence Report vs. concentration.
Instrumentation and general characteristics. Application examples of fluorescence analysis. 4 hours

10) SEPARATION TECHNIQUES:
Definitions and general properties. Capacity factors, Resolution, Efficiency.
Van Deemter equation. Chromatographic techniques: Gas-chromatography: Packed and capillary columns. Stationary and mobile phases; gas-chromatography in isocratic and thermal gradient conditions. Liquid chromatography: stationary and mobile phases. Liquid chromatography in isocratic and gradient conditions. Types of chromatography: partition, ionic, dimensional exclusion, etc. 8 hours

11) LABORATORY EXPERIENCES: Calibration of the glass electrode for pH measurement, pH measurement of solutions; acquisition of a UV-vis absorption spectrum; 12 hours

TEACHING METHODS:

The teaching method is based on the traditional approach: lecture with extensive use of numerical presentation and exercises; in addition with laboratory experiences. The course consists of 8 (7+1), 7 credits of frontal lessons and 1 laboratory. An important part involves the use of the traditional approach and the use of software for electronic presentation based on the Power Point, Excell, etc.

EVALUATION METHODS:

The evaluation procedures provide a direct interaction phase with students during the cycle of lessons through numerical exercises and questions of topics of interest regarding the modern aspects of the Analytical Chemistry.
The final and definitive evaluation concerning the verification of the learning state, is based on the written test and a subsequent oral examination considering the quantitative numerical approach to the subject of study.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL:

- **FONDAMENTI DI CHIMICA ANALITICA**, Skoog, West, Holler. EdiSES, Napoli.
- **ANALYTICAL CHEMISTRY**, G.D. Christian, 5th Ed. Wiley
- **Fondamenti di chimica analitica quantitativa D.Harris,** Revisione di M. Taddia. Traduzione di S. Cerini, A. Malmusi, F. Mazzanti, 2017. Zanichelli
- **Chimica Analitica Quantitativa**, **D.Harris,** Zanichelli
- **Elementi di Chimica Analitica, D.Harris,** Zanichelli
- **Chimica Analitica,** trattazione algebrica e grafica degli equilibri chimici in soluzione, Di Marco, Pastore, Bombi, Edises.
- **Slides from the course**

INTERACTION WITH STUDENTS

At the beginning of the course, the program, the schedule of exam dates, and the weekly office hours are presented. The teacher will also be available by appointment for individual assistance.
During the course, students will be made aware of the benefits of continuous and constant attendance of lectures and study of the topics covered. The level of achievement of the proposed objectives will be verified through numerical exercises in the classroom and in the laboratory, useful also to solicit the interest of the student.

EXAMINATION SESSIONS (FORECAST)[1]
18th February 2020, 17 th march 2020, 23 th june 2020, 14 th july 2020, 22 th September 2020, 20 th October 2020, 15 th december 2020.

SEMINARS BY EXTERNAL EXPERTS YES □ NO x

FURTHER INFORMATION

[1]Subject to possible changes: check the web site of the Teacher or the Department/School for updates.