

---

**COURSE: ADVANCED ANALYTICAL CHEMISTRY MODULE B**

---

**ACADEMIC YEAR: 2019-2020**

---

**TYPE OF EDUCATIONAL ACTIVITY: Characterizing**

---

**TEACHER: Rosanna Ciriello**

---

e-mail: [rosanna.ciriello@unibas.it](mailto:rosanna.ciriello@unibas.it)website: [scienze.unibas.it/site/home.html](http://scienze.unibas.it/site/home.html)

---

phone: **0971205944**mobile (optional):

---

Language: **Italian**

---

ECTS: **5**  
(**3** of lessons and **2** of  
practice)n. of hours: **48**  
(**24** of lessons and **24** of  
practice)Campus: **Potenza**  
Dept./School: **Dipartimento di  
Scienze**  
Program: **Chemical Science  
(LM54)**Semester: **I**  
(date) **01.10.2019 –  
20.12.2019/20/01/2020**

---

**EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES**

The course covers the fundamental aspects of modern analytical chemistry in order to understand and evaluate the analytical capabilities of different methods for instrumental analysis. All the stages ranging from the sample treatment to the choice of the analytical method and, finally, to the acquisition and processing of signals, will be taken into account. The goal will be to become familiar with advanced analytical techniques for the analysis of complex matrices.

**Main knowledge:**

- Separation techniques based on capillary electrophoresis
- Electrochemical methods in which convection is absent and hydrodynamic methods
- Modified electrodes and sensors

**Main skills acquired:**

- Evaluation of the instrumental analytical technique
  - Acquisition and processing of the analytical signal
  - Quantification of analytes of interest in real samples
  - Production of complete and concise reports on the analysis carried out and the results obtained during laboratory experiments
- 

**PRE-REQUIREMENTS**none

---

**SYLLABUS**

**INTRODUCTORY PART (4 h).** Tools for analysis: data domains, non-electrical and electrical domains, analog domain and digital information. Signal to noise ratio: sources of noise in instrumental analysis. Elements of statistics: confidence level, degrees of freedom, errors propagation. Quantitative methods in instrumental analysis: calibration curve, standard addition, internal standard.

**SEPARATION TECHNIQUES (8 h).** Capillary electrophoresis: principles of separation by electrophoresis, electroosmotic flow, electrophoretic mobility, fundamental equations. Parameters of an electrophoretic separation: efficiency, selectivity, resolution. Instrumental aspects: methods of sample introduction and detection in CE. Techniques of capillary electrophoresis: capillary zone electrophoresis, micellar electrokinetic capillary chromatography.

**ELECTROANALYTICAL METHODS (12 h).** Kinetic of electrode reactions: Butler-Volmer equation, current-overpotential equation, Tafel diagrams. Mass transport to the electrode, Nernst-Planck equation. Summary on the potential step and potential sweep methods. Methods based on forced convection: rotating disk electrode, Levich equation, Koutecký-Levich equation, flow injection analysis. Modified electrodes: physical or chemical adsorption, chemical bonds formation, electrosynthesized polymers, amperometric biosensors. Quartz crystal microbalance.

Laboratory experiments on the instrumental techniques treated will be carried out (**24 h**).

---

**TEACHING METHODS**Theoretical lessons (24 h), Laboratory tutorials (24 h)

---

**EVALUATION METHODS**

---

---

One oral examination comprising the two modules, 1 and 2, of 'Advanced Analytical Chemistry'.

The laboratory activities require the preparation of reports to be discussed during the oral examination which will be delivered to the teacher a week before the examination date.

---

#### TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

D.C. Harris, "Chimica Analitica Quantitativa", 2<sup>a</sup> edizione, Zanichelli, Bologna (2005)

D.A. Skog, I.J. Leary, "Chimica Analitica Strumentale", EdiSES, Napoli (1995)

D. Baker, "Capillary Electrophoresis", Wiley-Interscience, New York, (1995)

A. J. Bard, L. R. Faulkner, "Electrochemical Methods, Fundamental and Applications", John Wiley & Sons, Inc., New York (2001)

Lecture notes provided by the teacher

---

#### INTERACTION WITH STUDENTS

At the beginning of the course the teacher informs the students about the objectives, the program and the verification methods and collects the list of attending students, together with e-mails. The teacher will provide students with an electronic copy of all the lessons projected in the classroom.

The office hours are as follows:

Tuesday: from 10 am to 11 am at the office 2DA302;

Wednesday: from 10 am to 11 am at the office 2DA302.

Thursday: from 10 am to 11 am at the office 2DA302;

The teacher is available to meet at all times students by appointment agreed through its own institutional e-mail address ([rosanna.ciriello@unibas.it](mailto:rosanna.ciriello@unibas.it)).

---

#### EXAMINATION SESSIONS (FORECAST)<sup>1</sup>

Same sessions indicated in Module A of Advanced Analytical Chemistry

---

SEMINARS BY EXTERNAL EXPERTS    YES     NO

---

#### FURTHER INFORMATION

---

---

<sup>1</sup>Subject to possible changes: check the web site of the Teacher or the Department/School for updates.