Scientific-Disciplinary Sector (SSD): CHIM01 – Analytical Chemistry

Academic year: 2017-2018
Faculty: Department of Chemistry – School of Sciences and Technologies
Study courses: Analytical Chemistry Laboratory II
Study plans/Curricula: 1st Level Degree in Chemistry
Type: Characterizing didactic activity (type b exam)
Total Credits: 6 (3 of class lectures, 1 of numeric exercises, 2 of laboratory activity)
Didactic Methods: Lectures, numeric exercises, laboratory activity
Didactic Period: 3rd year, 1st semester (October-January)
Exam type: Oral, with preliminary discussion of reports on laboratory activity written by students
Professor in charge: **Ilario Losito**

Training objectives: Acquisition of knowledge on principles and applications of analytical molecular spectroscopies (absorption, fluorescence) and ion chromatography. Acquisition of knowledge on statistics for Analytical Chemistry and of expertise on the use of the main analytical instrumental techniques and their application to different matrices

Prerequisites: Knowledge of the main topics in General Chemistry, Volumetric Analytical Chemistry, Physics and of the basic procedures in an Analytical Chemistry laboratory (use of analytical balances, micropipettes, burettes, portable pH-meters)

Didactic Methods: Lectures with PowerPoint presentation, numerical exercises in the classroom, laboratory sessions

Course programme
PROGRAMME:
Lectures: (24 h - 12 lessons lasting 2 h)

1. General concepts on electromagnetical radiation and its interaction with matter
2. Molecular absorption spectroscopy: principles and instrumentation.
3. Molecular absorption spectroscopy: spectrophotometric titrations and spectrophotometric analysis of mixtures
4. Molecular fluorescence spectroscopy: principles, instrumentation and analytical applications
5. Ion chromatography: principles, instrumentation and analytical applications
6. Errors in measurements: general concepts and significant figures
7. Error propagation, frequency histograms, probability density and distribution functions

8. Expectation, central limit theorem; Gaussian, Chi-square, Student-t and Fisher probability density functions; confidence interval for a mean and for a difference between means
9. Comparisons between one mean and a fixed value, two means, a variance and a fixed value, two variances. Paired t, Q of Dixon, Chi-square and Kolmogorov tests
10. Conventional and weighted linear regression
11. Distinction between signal and noise: Neyman-Pearson and Kaiser criterions.
12. Types of noise encountered in analytical instrumentation; noise reduction in analytical signals through hardware or software approaches.

Numerical exercises: (15 h)

1. Significant figures
2. Use of statistical tables
3. Comparison between means
4. Application of Paired t test
5. Application of Kolmogorov test

Laboratory sessions: (30 h)

1a. Photometric determination of antimony
1b. Spectrophotometric titration of copper (II)
2. Spectrophotometric determination of the acid dissociation constant of umbelliferone
3. Spectrofluorimetric analysis of riboflavin in milk
4. Determination of Na^+ and K^+ concentration in human urine
5. Analysis of a mixture of aromatic compounds by liquid chromatography
6. Separation of a mixture of hydrocarbons by gas chromatography
7. Analysis of anions in tap or commercial water.

Reference Texts

Skoog, Holler, Crouch, *Chimica Analitica Strumentale*, EdiSES, Napoli, 2009
Kellner, Mermet, Otto, Widmer, *Chimica Analitica*, EdiSES, Napoli, 2003
Harris, *Chimica Analitica Quantitativa*, Zanichelli, Bologna, 2017