CHEMISTRY - CHM 6155
SPECTROCHEMICAL METHODS
Spring 2019

Class times: M,W,F 1:55 PM - 2:45 PM (7th Period); FLI 0109
Instructor: Prof. Nicoló Omenetto **Office**: CLB C201A *(Ring the bell of CLB 201*).
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Office hours: Tuesday, Thursday: 8th – 9th period (3:00 pm – 5:00 pm) or by appointment.

1. Course objectives.

This course will lay the foundations of the interaction between electromagnetic radiation and matter, the instrumental aspects of the spectroscopic methods and the optimization of the analytical signal and signal to noise ratio. The basis of the processes of absorption, emission, fluorescence, and Raman scattering in the different regions of the electromagnetic spectrum will be treated in detail, mostly from the classical point of view. The final goal of the course is to provide the student with the basic knowledge of spectroscopic instrumentation and methodologies, and with the capability of associating the most appropriate technique to the analytical problem on hand.

2. Textbook.

The course will be organized around the textbook: "*Spectrochemical Analysis*" J.D. Ingle and S.R. Crouch, Prentice Hall, Upper Saddle River, New Jersey (1988). Handouts will also be given on special topics, if necessary.

3. Material covered and planned weekly schedule

Basically, the course will develop according to four major sections and one specialized section, identified as follows:

Section I. Spectrochemical Information and Measurements. Instrumental Tools. Chapters 1-4 (~ 4 weeks).

The first Section will cover the basic definitions and concepts related to atomic and molecular spectroscopy. The various interaction processes will be illustrated together with the instrumentation needed for their practical exploitation. Optical systems, associated components (lenses, mirrors, gratings, interferometers) and concepts (wave description, radiation parameters, dispersion, resolution), will be described in detail. Radiation sources (including lasers), and different type of detectors (optical transducers) will also be discussed.

Section II. Analytical spectroscopy. Signals, Noise and Measurements. Chapters 5 and 6 (~ 3 weeks)

The second Section will focus on the basic theoretical derivation of emission, absorption, and fluorescence signals and their dependence upon the concentration of the atomic and molecular species sought. The calibration function, its shape, the noise affecting the various measurements, the resulting signal-to-noise ratio and its optimization will be treated, together with the definition and use of analytical figures of merit like sensitivity (calibration and analytical) and limit of detection.

Section III. Atomic Spectroscopy. Chapters 7-11. (~4 weeks).

The third Section will deal with the theory and the various instrumental set-ups and the practical applications of the atomic methods described before. Specific topics will include spectroscopic structure and energy levels, spectral line profiles, and analytical reservoirs, with particular emphasis on plasma sources. Among the techniques, laser ablation and laser-induced emission spectroscopy will be covered.

Section IV. Molecular Spectroscopy. Chapters 12-16 (3 weeks)

The fourth Section will deal with the theory, instrumentation and practical applications of molecular absorption, fluorescence and scattering (Raman) methods, with emphasis on fluorescence and associated concepts (e.g., lifetime, quantum yield, polarization, anisotropy). Topics include: Molecular spectra, UV-visible absorption, infrared absorption and luminescence spectrometry, linear and non-linear Raman scattering, and laser-based analytical methods.

4. Tests and Grading

There will be *2 Progress Tests*, and a *Final Test*. Progress Test 1 will include the material covered in Section I, and Progress Test 2 that covered in Sections II and III. The Final Test will cover Section IV. *Tentative* dates for the exams are planned as follows:
First Progress test: 10 February; Time and Location: TBA
Second Progress Test: 24 March; Time and Location: TBA
Final Test: Date, time and location: TBA to be announced.

Grading will be based on a 300 points total and on a point distribution as follows: 1/3, 1/3, 1/3. *See Table on page 3* for the correspondence between points and letter grades. Note that, if necessary, the written test could be followed by an individual oral discussion with the instructor.

5. Policy related to class attendance, class demeanor and make-up exams

Students are expected to attend 85% of the course. Punctuality is recommended. Cell phones should be silent during class time.
Late exams are possible (if justified) with no additional penalty if taken within the next two days of the actual dates of the exam. This may not be applicable to the Final test.

Students are expected to provide feedback on the quality of the instruction in this course by completing on-line evaluations at https://evaluations.ufl.edu. Evaluations are open two or three weeks before the end of the semester.

6. Miscellaneous

Students are referred to the instructions given in the University of Florida website regarding the University's honesty Policy (http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/), as well as phone numbers and contact sites for university counseling and mental health services.
Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

CORRESPONDENCE POINTS - LETTER GRADES

≥ 255	**A**
245-254	**A-**
235-244	**B+**
225-234	**B**
215-224	**B-**
200-214	**C+**
180-199	**C**
150-179	**C-**
130-149	**D+**
120-129	**D**
110-119	**D-**
≤ 110	**E**