SYLLABUS FOR CHM 6155
SPECTROCHEMICAL METHODS
Spring 2012

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 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

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, their associated components (lenses, mirrors, gratings, interferometers) and associated concepts (wave description, radiation parameters, dispersion, resolution), will be described in details. Radiation sources (including lasers), and different type of detectors will also be discussed.

Section II. Analytical spectroscopy. Signals, noise and measurements (calibration functions). Chapters 5 and 6 (~ 3 weeks)

The second Section will focus on the derivation of an analytical 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 and limit of detection.

Section III. Atomic Spectroscopy and its applications to chemical analysis. Chapters 7-11. (~3 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. Topics include: Spectroscopic structure and energy levels, spectral line profiles, analytical reservoirs (flames, plasmas, graphite furnaces), sample

introduction methods, analytical applications of atomic emission, absorption and fluorescence spectroscopy.

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. Topics include: Molecular spectra, UV-visible absorption, infrared absorption and luminescence spectrometry, and linear and non-linear Raman scattering. Analytical applications for each technique will be discussed.

Section V (if time permits). Specialized techniques (and applications), Chapter 17 and Handouts. (~ 1 week)

The fifth special Section will give a brief overview of recent spectroscopic techniques, mainly involving the use of lasers. Examples are: Laser-induced breakdown spectroscopy (LIBS), Laser ablation and Ionization-Mass Spectrometry.

3. Grading

There will be 2 Progress Tests, and a Final Test.
Tentative dates (except for the final exam, whose date is fixed) are planned as follows:
First Progress test: 17 February; Time:12:45 PM-3:00 PM; Location: CLB 212
Second Progress Test: 30 March; Time:12:45 PM-3:00 PM; Location: CLB 212
Final Test: Thursday, May 3 – 12:30 pm - 2:30 pm; Location: CLB 212

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.

4. 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.

5. Miscellaneous

Students are referred to the instructions given in the University of Florida website regarding the University's honesty Policy 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.

5. Instructor

Dr. Nicoló Omenetto

Office: CLB C201A *(Ring the bell or knock on the door of CLB 201*).

Official office hours: Monday, Tuesday, Thursday: 8^{th} – 9^{th} period (3:00 pm – 5:00 pm)

Available for questions: Monday thru Friday 10 AM - 5 PM

Phone: 392-9853

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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**