

# **CHEM 530: ANALYTICAL CHEMISTRY I, Fall 2013**

## **Spectroscopic Methods of Analysis**

**Monday, 6:00-7:20 PM, CAT 76**

**Wednesday, 7:30-8:50 PM, CAT 76**

**Dr. Joe Foley**

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**Office Hours:** 4:30-5:30 pm on Mondays and Wednesdays or by appointment (set up at a mutually agreeable day/time via e-mail).

**Dr. Kevin Owens**

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**215-895-2621; 215-895-1265 (fax)**

**e-mail: kevin.owens@drexel.edu**

**Office Hours:** Monday and Wednesday 4:30-5:30pm or by appointment (set up at a mutually agreeable day/time via e-mail).

### **Course objectives**

To develop a basic understanding of the interaction of electromagnetic radiation with matter, and how these interactions can be utilized for qualitative and quantitative analysis

To develop an understanding of the principal building blocks of optical instrumentation

To understand the types of noise present in spectroscopic measurements, and hardware and software methods to improve the measured signal-to-noise ratio

To understand the use of flame and plasma based absorption and emission methods for atomic/elemental analysis

To gain a basic appreciation of the electronic, vibrational, and/or rotational transitions that a molecule can undergo after absorbing electromagnetic radiation (UV-vis, near-IR).

To understand the comparative advantages and disadvantages of molecular absorbance and luminescence spectrophotometry, as well as common phenomena that can cause nonlinear deviations from ideal behavior in each

To gain an appreciation of the applications of molecular absorbance and luminescence spectrophotometry, particularly for quantitative analysis

**Text(s):** Please purchase or rent the *required text*: James D. Ingle, Jr. and Stanley R. Crouch, *Spectrochemical Analysis*, Prentice-Hall, Inc., 1988 (ISBN-10: 0-13-826876-2). This textbook may be purchased from the Drexel bookstore or on-line from Amazon, etc. Some on-line sources offer the less-expensive option of renting the textbook.

**Other materials:** Supplementary information (TBD) may be posted on the Bb Learn website for this course.

**Grading:** Your course grade will be determined as outlined below.

|  |             |
|--|-------------|
| <b>Selected homework (computer exercises/problem sets)</b> | <b>40 %</b> |
| <b>Mid-Term Exam (take-home and/or in-class)</b>           | <b>30 %</b> |
| <b>Final Exam (December 9, 6-8 PM, CAT 76)</b>             | <b>30 %</b> |

**Grading scale:** The standard Drexel grading scale is employed, i.e.,  $\geq 97 = \text{"A+"}$ ,  $93-96 = \text{"A"}$ ,  $90-92 = \text{"A-"}$ , etc.

**Reading assignments:** For every topic that either of the instructors covers in class that is also discussed in the required textbook, the instructors expect you to read the corresponding chapter or section without having to make a formal assignment. That said, the instructors will try to remind you of reading assignments verbally at the beginning or end of class.

**Computer Exercises/Problem Sets:** Up to 8 problem sets will be assigned, collected, and graded during the quarter. Problem sets should be submitted in the following format or as otherwise specified by the instructor: (i) 1-2 page summary sheet of the answers to the problems *in the order assigned*; (ii) detailed solution to each of the problems *in the order assigned*. Students are strongly encouraged to use some type of spreadsheet (Google, Microsoft Excel, etc.) for statistical or repetitive calculations.

Late problem sets will be penalized up to 5% per day unless there is a legitimate reason (as determined by the instructor).

**Exams:** If you cannot attend a scheduled exam, you must notify the instructors in advance. If no such notification is given before the exam and no *acceptable* excuse is given afterwards, you will receive a zero for the exam.

**Communication by Bb Learn and e-mail:** It is VERY important for the instructors to be able to communicate with each member of the class quickly and efficiently. Reading and homework assignments, usually announced in class, are posted on Bb Learn. Please be sure to *check Bb Learn at least 3 times a week*, e.g., every weekend and each night before our class so that if you have a question about an assignment, you could ask the instructor about it in class the next day.

You are also welcome to submit a question about CHEM530 to the relevant instructor via email. If the number of questions submitted by email is not too large, the instructor will reply by email and distribute the answer to the entire class (without revealing your identity!).

**If you use an email address or alias other than your official Drexel email address** ("firstname.middlename.lastname@drexel.edu"), **it is now university policy that it is your responsibility, not the responsibility of the university or the instructor, to arrange for email to be forwarded appropriately, i.e., it is your responsibility to make sure that you receive all email messages that are sent to your official email address.**

## Academic Policies

Please review the following policies provided below:

**Academic Misconduct, Cheating, Fabrication, Plagiarism, Withdrawal of a Degree**

[http://www.drexel.edu/provost/policies/academic\\_dishonesty.asp](http://www.drexel.edu/provost/policies/academic_dishonesty.asp)

**Course Drop Policy**

[http://www.drexel.edu/provost/policies/course\\_drop.asp](http://www.drexel.edu/provost/policies/course_drop.asp)

**Course Withdrawal Policy**

[http://www.drexel.edu/provost/policies/pdf/course\\_withdrawal.pdf](http://www.drexel.edu/provost/policies/pdf/course_withdrawal.pdf)

**Course Change Policy**

The instructors reserve the right to make changes to the course during the term. If changes are made to the course, students will be notified via Bb Learn and/or email, and will be made aware verbally at the beginning of the next scheduled class.

**Schedule of lecture topics for CHEM 530, Fall 2013**

*Introduction – week 1 (Foley)*

Chapter 1: Spectrochemical Information

Chapter 2: Spectrochemical Measurements

*Optical Instrumentation – weeks 2-5 (Owens)*

Chapter 3: Optical Components of Spectrometers

Chapter 4: Optical Sources, Transducers and Measurement Systems

Chapter 5: Signal-to-Noise Ratio Considerations

Chapter 6: Methodology in Spectrochemical Analysis

*Atomic Analysis – weeks 6-7 (Owens)*

Chapter 7: Introduction to Atomic Spectroscopy

Chapter 8: Flame and Plasma Atomic Emission Spectrometry

Chapter 10: Atomic Absorption Spectrophotometry

*Molecular Analysis – weeks 8-10 (Foley)*

Chapter 12: Introduction to Molecular Spectroscopy

Chapter 13: Ultraviolet and Visible Molecular Absorption Spectrophotometry

Chapter 15: Molecular Luminescence Spectrometry