

Syllabus

Chemistry 315L – Laboratory in Advanced Instrumental Analysis

Fall 2007

Instructors:

Dr. Eric J. Williamsen
Pfahler 303C
Phone: (610) 409-3000 Ext. 2413
[Email: ewilliamsen@ursinus.edu](mailto:ewilliamsen@ursinus.edu)
[WWW page: http://webpages.ursinus.edu/ewilliamsen](http://webpages.ursinus.edu/ewilliamsen)

Office Hours:

M 2–3 PM
Th 3–4 PM

You are invited to set up an appointment at other times (preferred) or just to stop by my office.

Course Webpage:

Course page is on the Ursinus College Blackboard site (uonline.ursinus.edu).
➤ Input your username and password.
➤ Under course catalog go to CHEM315L. FA2007

Class Meetings:

Lab <Pre-lab lectures in Pfahler 208; Laboratory in Pfahler 301, 306, and 316>
F 1:30–4:20 PM

Catalog Description:

Laboratory work related to CHEM-315. Students will gain experience with a variety of instrumental and analysis techniques by investigating how specific instrumental settings affect output. Emphasis will be placed on statistical analysis of experimental data. This course must be taken concurrently with CHEM-315. Prerequisites: CHEM-151 or 206. Three hours per week. *One semester hour.*

Primary Sources:

Skoog, Douglas A.; Holler, F. James; Nieman, Timothy A. *Principles of Instrumental Analysis*, 6th ed.; Thompson: Belmont, CA, 2007. <ISBN 978-0-495-01201-6>

Class notes (will be provided)

Other handouts and web-based resources (on Blackboard)

Course Goals:

The six goals for this course are to demonstrate how different instrumental factors affect the acquired signal, to develop the skills used in performing a good analysis (including sample preparation), to use statistical or chemometric analysis techniques in order to obtain more or better information from your measurements, to show how the thought processes and knowledge gained in learning one technique can be used to understand a new technique, to deepen and solidify the knowledge that you acquired in Chem 315, and to improve your writing of notebook entries and laboratory reports.

Outcomes

You will...

- write a complete, electronic laboratory notebook;
- write research papers, which are formatted in the style of a research article in *Analytical Chemistry*, so that you can more effectively write about your results and read the chemical literature;
- learn how to orally defend your results;
- learn how to efficiently determine experimental conditions for an analysis;
- gain experience in simple troubleshooting of analysis difficulties;
- learn the factors that you need to consider in performing a chemical analysis and how to correctly perform an analysis;
- deepen your knowledge of the techniques to which you will be exposed and of basic instrumental theory;
- determine some of the strengths and weaknesses of the various techniques;
- learn how to perform various simple statistical analyses;
- learn how to more completely analyze your raw data; and
- improve your laboratory technique.

Course Style:

Five sets of experiments will be performed using at least seven different techniques: gas chromatography/mass spectrometry (GC/MS), high-performance liquid chromatography (HPLC), infrared spectroscopy (FTIR), UV-visible molecular absorption and fluorescence spectroscopies together, and atomic absorption spectroscopy (AA) and voltammetry together. From these experiments on the individual pieces of instrumentation, you will learn the basic operation of the particular instruments, will investigate how instrumental settings affect the acquired data, will practice statistical and chemometric analysis of data, and will deepen your knowledge of the techniques. During the FTIR rotation students will also participate in a laboratory practical where they will demonstrate their skill in accurately and precisely making solutions. Unfortunately due to the ratio of students/instruments, you will often need to use techniques prior to when we discuss the topic in Chem 315; you are still responsible for obtaining the background knowledge necessary to complete the experiment. In addition to these experiments, a multi-week, individual and class-wide, unknown project will be performed. In this project each student will be the “expert” on a particular instrument. The class will be given a multi-component unknown mixture, and in addition each student will be given a sample of known identity but unknown concentration. Students will pool their data and assign each other tasks in order to determine the identity of the unknown components (class-wide component), and each student will determine the identity of their unknown (individual component).

You will work in pairs or individually in the laboratory, but all lab reports are individually written. The first five experiments will be performed in two-week rotations. At the beginning of each rotation, you will be provided with simple instructions on how to operate the instrument, a reference list, and a list of tasks. To help you prepare for the experiment, you must complete a short, prelab quiz that will be available on Blackboard. During the two-week period you must follow instructions or design experiment(s) for each task that will demonstrate various instrumental and analysis concepts. Work will primarily be performed during the laboratory period, but if necessary and with approval, you may use instrumentation outside of the laboratory period. During the last three weeks the qualitative and quantitative unknown will be performed.

In addition to laboratory manipulations, writing skills will be emphasized. Guidelines will be provided for the writing of the reports and the laboratory notebook. All written reports must follow the format of a research article submitted to *Analytical Chemistry*.

Approximate Lab Outline and Length of Time

Topics	Assignments Due
Introduction Aug. 31	
Rotation 1 Sept. 7, 14	<i>Quiz must be completed by noon Sept. 6.</i> Written Results & Discussion due: Sept. 24
Rotation 2 Sept. 21, 28	<i>Quiz must be completed by noon Sept. 20</i> Oral Results & Discussion: Half hour between Oct. 4–11
Rotation 3 Oct. 5, 12	<i>Quiz must be completed by Oct. 4</i> Written Abstract and Written Results & Discussion due: Oct. 22
Rotation 4 Oct. 19, 26	<i>Quiz must be completed by noon Oct. 18</i> Written Experimental due: Nov. 5 Oral Results & Discussion: Half hour between Nov. 1–8
Rotation 5 Nov. 2, 9	<i>Quiz must be completed by noon of Nov. 1</i> Written Introduction and Written Results & Discussion due: Nov. 19
Unknown Analysis Nov. 16, 30; Dec. 7	Written Final Report and Notebook due: Dec. 12

Approximate Grading Scale

	Points
(Results & Discussion) <Oral or Written>	80 first written and oral rotations each 100 other rotations
Abstract	15
Introduction	50
Experimental	25
Final Project Report	150
Rotation Quizzes	5 x 10
Lab Practical	50
Notebook	60

Laboratory Reports: Technique Rotations

Each technique rotation report will have a Results & Discussion section. With one rotation report you will also submit an Abstract, with another an Introduction, and with another an Experimental Section. You will be graded upon your results (when applicable), the depth and correctness of your discussion, and your writing (formatting, spelling, sentence structure). During the third and fifth rotations your Results & Discussion will not be written but will be reported to me in a one-on-one oral examination.

Final Report

This will be a complete report with an Abstract, Introduction, Experimental Section, and Results & Discussion. The Introduction and Experimental Section will contain information on the technique that you use during the analysis. The Results & Discussion will contain a report and analysis of the qualitative data that you obtained, the qualitative data from other groups, and the quantitative analysis that you performed. You will be graded upon the quality of your report, your results, and the quality of your analysis.

Rotation Quizzes

Before each rotation, you will need to answer some questions in an on-line quiz to help you prepare for the laboratory.

Lab Practical

You will be graded on how well you can perform some, seemingly simple procedures used in sample preparation (such as pipeting, using volumetric glassware, etc.). You will be graded on how well you meet

certain standards.

Notebook

The notebook will be collected at random several times during the semester. You will be graded on how well you fulfill the required format and the completeness of your entries.

****LATE POLICY**:** Unless prior arrangement is made, all assignments are due by the assigned time. Any assignment turned in after the beginning of class but before the next day will have 5% of the total points deducted, before the end of one day after the due date will have 10% deducted, and before the end of two days after the due date will have 50% deducted. No assignments will be accepted more than 2 days after the due date.

Course Policies

Attendance. You will be held to the attendance policy that is outlined in the *Ursinus College Student Handbook*.

Academic Honesty. You are responsible to follow the academic honesty policy as outlined in the *Ursinus College Student Handbook*.

Other Policies. When appropriate, policies on other matters, such as grading will be posted on the class Blackboard site and announced in class.

EJW Last Revision: 16 August 2007