

82293Chemistry 314 Instrumental Analysis  
Spring 2017  
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**Description:**

This is the capstone, writing intensive, service learning class for chemistry majors. This class is intended to integrate all core concepts from previous classes while simultaneously providing hands-on experience on common chemical instrumentation. The class can best be described as a “finishing class”. Students leaving this class will be able to successfully survive a job interview for an industrial position and will be able to describe a research project for a graduate or medical school interview. The first 2/3 of the class are devoted to providing *analytical thinking* and *professional* training so that the student may solve a field environmental question related to lead with full quality control and assignment of uncertainty and validity to those results, as prepared by the student in the final 1/3 of the semester.

**Textbooks:**

Optional, in the years that I require the textbook students tell me that they didn't need it. In the years that I make the textbook optional students tell me that they did need it. You are now within 6 months of being a certified professional. Use your own discretion:

1. Skoog Holler and Crouch: Principles of Instrumental Analysis
2. Web source (exceptionally good): Analytical Digital Sciences Library
3. Very Useful: Robert de Levie: How to Use Excel in Analytical Chemistry or equivalent text.

**Materials for Lecture and Lab**

Lecture material made available as we proceed through the labs.

The “lecture” section is designed to move along as closely as possible with the work in the lab. Time is allotted in each lecture section to discuss concepts and data obtained within the lab, as a result each student is expected to come to class prepared to ask questions and discuss the material from lab. Students will be asked to present data as they have obtained it.

**Materials and Equipment to Be Supplied by the Student and brought to all classes**

- Flash drive, pencils, calculator
- Lab-book with carbon tear out sheets
- Laptop computer with a database, preferably Excel (available through Open Office)

**Responsibility of Students for Preparation and Cleanliness**

- Students are expected to arrive with a working knowledge of the content of the assigned lab and be ready to begin promptly in order to complete the various tasks.

- *T.A.s will check the lab book to determine that each student has written a synopsis of the work to be accomplished.*
- Grades can drop if laboratory cleanliness is not adhered to. Each group is responsible for the cleaning of all lab ware used and to return the equipment to the appropriate space. If this becomes an issue the groups, semester grade may be lowered by a full grade.

### **Groupings**

In order to allow each student hands on access to the equipment each lab is split into 2 to 3 groups, each group having no more than 3 participants. The groups will follow DIFFERENT schedules throughout the semester as indicated on the next page. 2 labs deal with manipulation of data.

Working in groups is not easy. We expect you to make an honest effort to evaluate your own contribution and that of your partners to the group. At week three you will be given an opportunity to restructure. If an individual performs so poorly within a group that they are not “desirable” they will be expected to complete the work on their own with no decrease in the amount of work.

### **Readings**

Readings for the first part of the semester have been posted.

### **Grading**

Type of Item	Pts/Item	Total Items	Total
Exam (Take Home)	100	3	300
Project/Final	100	1	100
Homework	10	5	50
Labs	50	10 – 1=9	450
			900

Grades are assigned on a 60, 70, 80, 90 scale for D, C, B, and A. + - is at the discretion of the instructor.

Semester Week	Mon of Week	Topics	Wednesday Lab Kathryn Renyer Group 1 Group 2 Group 3	Friday Lab Norberto Gonzalez Group 1 Group 2 Group 3	Exams On Monday
1	16-Jan	Communication, Confidence, Statistics, Digestions	Statistics		
2	23-Jan	Information Processing: Noise in Instrum; Enhancement of Data	Information Processing		
3	30-Jan	Intro to Optics	Information Processing		Exam 1 Takehome
4	6-Feb	Intro to Optics	UV-Vis FTIR Raman	UV-Vis FTIR Raman	
5	13-Feb	Molecular Spectroscopy UV-Vis	FTIR Raman UV-Vis	FTIR Raman UV-Vis	
6	20-Feb	Molecular Spectroscopy FTIR	Raman UV-Vis FTIR	Raman UV-Vis FTIR	
7	27-Feb	Molecular Spectroscopy Raman	IC FAA ASV	IC FAA ASV	
8	6-Mar		Spring Break		Exam 2 Takehome
9	13-Mar	Atomic spectroscopy	FAA ASV IC	FAA ASV IC	
10	20-Mar	Anodic Stripping Voltammetry	ASV IC FAA	ASV IC FAA	
11	27-Mar	Intro to Separations	GCMS Projects	GCMS Projects	
12	3-Apr	IC	GCMS Projects	GCMS Projects	Exam 3 In Class
13	10-Apr	Programmed GC	Easter Break		
14	17-Apr	MS, GCMS	Projects GCMS	Projects GCMS	
15	24-Apr	Wrap Up	Projects Projects	Projects Projects	

1. This is the schedule for both lab and “lecture”. You will note that we cannot always be in sync for each working group for lab. Therefore there will be times when you must read ahead.

2. As in real life, we work with instrumentation and that instrumentation does not always obey commands to “sit, work, and stay”. There may be adjustments to this schedule.

3. We will be doing a in community service project that will take up the final weeks of the semester. You have been allotted 4 weeks to complete the project. You will, however, provide reports prior to that work about the planning that has taken place to

- Sample the soils
- What type of sample prep you decide on
- Quality Control constraints added
- Anticipated Limit of Detection required to meet regulatory limits
- Choice of instrumentation based on Figures of Merit

Your choices will affect the amount of time you need to spend in lab. The lab time is flexible and will NOT be constrained to the lab period only.

## Reading Assignments

Week	Labs Found in 10 Labs Stand Alone		"11. Excel" and/or "12. Instrument"			"book"		
	Title	pg #	Excel #	Title	pg #	Chap	Title	pg #
1	Statistics Analyzed on Spreadsheets	457	1	Loading Tool Pack	356-377	4	Statistics Behind the Measurements	95-119
			2	Tip Sheet				
			3	Creating Graphs with multiple sets of Data				
			4	Statistics				
2	Digital Filtering of Data	461	6	Digital Filtering of Data	381-384	5	Communication Systems	150-167
3	Deconvolution and Baseline Subtractions	463	7	Calibration Curve with Confidence	385-388	4	Statistics Behind the Measurements	121-123
	Calibration Curve	465	8	Concentration from Calibration with Conf	389-394		"	125-128
			9	Baseline Subtraction	395*	5	Communication Systems	167-170
			10	Deconvolution	397-406			
4 thru 6	Chelation UV-Vis Dithizone	475		VWR UV-6300PC	417			
	FTIR –How does Pb bind to EDTA?	491		Thermo Nexus FTIR 470	419			
	Lab Raman Test of dyed cotton	495	11	Excel: FT for IR	407 excel			
				Ventana 785 Raman	425			
6 thru 10	Flame Atomic Absorption Spectrometry	503		Shimadzu 7000 Instructions for Flame Continuous	441			
	Dropsensor stripping	527		Metrohm Dropsensor	445			
	Understanding your IC lab	529						
	Pre-lab IC	533						
	IC	535		Instrument Instructions: Metrohm 883 Basic IC	439			

Week	Topics	"Chapter"	Title	Pages
1	Communication	1	Your Mission	1-6
	and	2	How Do We Communicate	9-34
	Statistics	3	How Do We Know: Sources of Variation	35-56
2	Statistics	3	How Do We Know: Sources of Variation	57-91
	and Filters	4	Statistics Behind the Measurements	94-141
3	Data Manipulation and Intro to Instrumentation	5	Communication Systems	143-170

**Fitch Schedule (and office hours)**

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:30					
10:25					
11:15					
11:30				Chem 380	
12:35	Chem 314		Chem 314		Chem 314
1					
1:40		Office Hours	Chem 314 Lab	Office Hours	Chem 314 Lab
2:30					
3:45					
5:30					
	Grp Mtg				