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CHMY 421.01: Advanced Instrumental Analysis

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Chemistry 421 Advanced Instrumental Analysis Spring Semester 2013

Instructor: Prof. Mike DeGrandpre, Chemistry Bldg 318, phone: 243-4118, email: michael.degrandpre@umontana.edu, also <http://www.cas.umt.edu/chemistry/facultyDetails.cfm?id=528> for additional information.

Office hours: During lab hours, 9:10-12:00 Mon.-Thurs. or by appointment. Please go through my lab, Room 317, to get to my office (not through 318).

Texts: Required: *Principles of Instrumental Analysis*, 6th ed. Skoog, Holler, and Crouch. Helpful tutorials can be found at www.thomsonedu.com/chemistry/skoog under “Instructor Companion Site”. Also, *Quantitative Chemical Analysis* by Harris, any edition, is an additional helpful resource.

Background: It is assumed that you have taken CHMY 311 or its equivalent as a prerequisite. If you have not taken this course, please talk to me. Familiarity with a spreadsheet program such as Excel and basic data analysis, e.g. simple statistics, linear regressions, etc. is essential.

Course objectives: In this course you will **1)** obtain a comprehensive knowledge of the theory and practice of instrumental methods used in modern chemical laboratories and **2)** improve your laboratory, data interpretation and technical writing skills. I hope that from this course you will develop your lab skills to a point where you can work with confidence in a modern chemical laboratory. To achieve this goal, you will work more independently than you have in previous lab courses. Lab experiments are intended to give you as much hands-on experience as possible while lectures provide the background of each method. Most experiments are structured to first illustrate the basic operating principles of each instrument followed by analysis of a “real” sample. You will complete the semester with a forensic analysis project where you must identify and quantify an unknown contaminant.

Course logistics: Because of the number of students in the class, it is necessary to run the lab outside of the lab hours scheduled for each section and to team up with a classmate(s). All students must work in groups of three¹. The lab will be open from 8 am - 5 pm Mon-Fri. With this open schedule, you must be self-disciplined and well-organized. During the lab introduction, it is critical that you take detailed notes when I explain how to operate an instrument so that you can perform the experiments later without repeating explanations. **However, if you are uncertain about a procedure please ask – personal injury or equipment damage may result if proper procedures are not followed.**

Lab notebooks and reports: A bound lab notebook with numbered pages is required. Your lab notebook must be present and open in lab **AT ALL TIMES** for recording procedures, data, and observations. The notebook and lab report formats are given later in this lab manual. A laboratory report

¹ Each person MUST analyze their own samples. Lab group multi-tasking, e.g. one person preparing standards while another does the analyses is not allowed. All lab mates must participate in every aspect of the lab.

will be turned in for each lab. **All laboratory reports are due in my mailbox at 5 pm on the Tuesday of the week following completion of each lab.** Late reports lose 10% each day thereafter.

Safety: Corrosive, toxic, and flammable chemicals are used in this class. You must use good judgment when handling all chemicals, e.g. use the hoods when working with volatile substances or gloves when using toxic chemicals. Specific hazards regarding the chemical instrumentation are presented in each lab handout. Lab coats are recommended. **Safety goggles or safety glasses are required.** Please note locations of the eyewash and shower stations. Cleanliness is also an important aspect of a safe laboratory. Keep the work areas clean! Unsafe lab practices could result in a deduction in your final course grade.

Other Stuff: You will need some sort of data storage medium (e.g. flash memory) for saving programs and spreadsheet files. Do not rely on the lab computers for storage. Files may be inadvertently deleted. Lastly, I appreciate your help in maintaining the lab. Please keep the printers loaded with paper, throw away (or recycle) used paper, fill distilled water (DW) bottles, etc.

Grading: Grades will be on the +/- scale (A,A-,B+, etc) with the following breakdown:

- Labs (includes in-lab performance as a portion of each lab grade) 45%
- Two semester exams 25%
- Homework assignments 5%
- Independent project 10%
- Final Exam 15%



**Chemistry 421– Advanced Instrumental Analysis
Spring 2013 Schedule**

General topics	Dates	Specific labs	Reading (focus on chapters related to your current lab)
Topic 0: Warm up period	1 week Jan 28 – Feb 1	Course intro; lab check in	Chapters: 1, 2A1-3, 2B, 3A, 3B, 3C-1, 4, 5, 22A-C, 23A-D, 23G-H
Topic 1: General lab instrumentation; potentiometry	2 weeks Feb 4 – Feb 15	Electronics and LabView programming; Computer interfacing and pH measurements	same as above
Topic 2: Spectrochemical methods	4 weeks** Feb 19 - Mar 15	UV/VIS, fluorescence and atomic absorption spectrophotometry	Ch. 6, 7A-H, 8, 9A-D, 13, 14A-D-2, 15
Topic 3: Chemical separations and mass spectrometry	4 weeks ** Mar 18 - Apr 19	GC-MS and liquid chromatography	Ch. 20A-B-1, 26,27,28
Topic 4: Independent project	3 weeks Apr 22 - May 10	N/A	above chapters
Finals Week	3:20-5:20 Thurs May 16	N/A	all course material

**Holidays Feb 18 (President's Day), April 1-5 (Spring Break)