CHM-411/511: Modern Instrumental Methods
Spring 2014
Course Syllabus

Lecture Instructor: **Dr. Rosalynn Quiñones**
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Times
Lecture Meeting: Science Building 405, 12:30 – 1:45pm Tuesday and Thursday
Laboratory: Science Building 492, 1:00 – 3:45pm Monday
Course Credits: 4
Office Hours: MTW 9:00am –11:00am or by appointment. I welcome drop-in visits, but cannot guarantee that I will be available to help you during non-office hours. Simple questions can be answered via email.

Prerequisites: C or better in CHM 307 or CHM 357

Course Overview:

"Modern Instrumental Methods" is a course that satisfies one of the upper level elective requirements for the Chemistry Major. In this course, the students will be introduced to the principles behind and the techniques associated with chemical measurements that utilize scientific instrumentation such as spectroscopy, chromatography methods, surface analytical methods, thermal, and electrochemistry analysis. The purpose of this course is providing the necessary background to choose the most appropriate instrumental method to solve qualitative and quantitative chemical problems efficiently. Chemical measurements are designed to provide the most accurate and precise information possible and, to acquire information to this level, chemical techniques must be understood in terms of detection limit, sensitivity, and/or spectral resolution. Chemical information obtainable from various techniques will be presented and discussed. Error analysis and data processing techniques that reduce or filter instrument noise and provide signal enhancement will be introduced. Applications presented in this course will focus on chemical systems of modern interest such as polymers, nanostructures, surface and material chemistry. The goal is to understand the advantages and limitations of various instrumental techniques and how chemical information, which is obtained by a specific instrument, can be processed to explain chemistry and solve scientific problems.

One of the main objectives of this course is to promote active learning that will be accomplished by having students report on and design concept maps from literature studies to further develop their previous knowledge and to draw a parallel of the topics discussed in the lecture. This will be built-in by class lectures and active discussion, homework, and exams. Problem solving skills and critical thinking will be improved by analyzing experimental data during class time and having group discussions led by the instructor. To this end, the class will engage in individual and group problem solving activities in lecture, and learn to search and read the chemical literature in order to address problems associated with chemical measurements. These educational skills will be useful in future science classes but also in analyzing issues in other classes and areas of study.

This experience will promote the importance of chemistry; challenging not just the intellect but also will engage the students in instrumental measurements through inquiry-based learning. Our main goal is to turn students in to scientist and not train them to be technician. By doing so, students become more enthusiastic about learning and understanding the subject of instruments used in chemical measurements.

Student Learning Objectives:

1. Apply the scientific method to analytical and instrumentation problems, in order to explain chemical realities.
2. Acquire problem solving skills during different assessments; in groups and individually.

3. Mathematical assess qualitative and quantitative data obtained by various tools
4. Relate how the electromagnetic waves with atomic and molecular species interact.
5. Discuss the uses of spectrometry for structural determination of molecular species.
6. Review the theory and practical applications of the electromagnetic spectrum.
7. Discuss surface and material chemistry for future advanced chemistry courses.
8. Deliberate electroanalytical methods to obtain qualitative and quantitative data based on electrical properties.
9. Apply chromatography method to separate, identify and determine components in a mixture.
10. Analyze how a physical property or reaction product is measured as a function of temperature.
11. Apply research experience into the applicability by analyzing data obtained by various instruments.
12. Apply presentation skills, oral skills, critical thinking, ability to handle questions, and audience engagement by oral presentations.

Materials
Book: Principles of Instrumental Analysis (Book Title) by Douglas A. Skoog, 6th edition;
Lab: Scientific Calculator; Lab Notebook, Lab Notes (notebook)

Attendance
Attendance for lecture is optional, but strongly encouraged. You are responsible for all announcements and material given during class. A tentative lecture schedule of topics is attached. Absences from exams can only be made-up if the absence falls within one of the categories outlined in the undergraduate catalog. To make-up an exam, you will need to follow the process for securing an excused absence. All excused absences must be obtained as soon as possible.
Lab attendance **is mandatory** and will be monitored by Instructor. There are no make-up lab times scheduled for this course.

Web Site
Information relevant to this course will be posted on MUonline. MUonline is highly utilized in this class. Please check MUonline site regularly. Your homework, useful websites, grades and announcements will be posted there. You must submit your homework and paper in MUonline. Moreover, some exercises assigned in class will be deeply discussed, and answered.

Course Policy

Exams: There are Three (3) exams which 2 exams will be given during lecture period and one exam during final exam period. The exams will consist of multiple choices, essay questions, and problem solving in which all steps leading to the solution must be shown. Exam dates are approximate. You will be given 1 week prior notice before all exams.
Make-up exams will be given only to students whose absence has been approved by the Dean of Student Affairs (for policy, see link on next page of syllabus) and must be arranged in advance (if possible).
Re-grades will be considered within one day of the exam being returned. If you request a re-grade, the entire assignment will be reviewed. This may result in either the loss or gain of points.

Homework is very important and useful to enhance the comprehension of the material. Homework will be assigned with each chapter. Some homework will be discussed by the student during the lecture to promote active learning. It will be very difficult to do well in this class without doing the homework. Doing practice problems is the best way to learn the material. The students can use any resources to build up the case: books, internet, and scientific journals. However, at least two (2) scientific references are expected in your inquiry-based lab report.

- The students will prepare a case study based literature search of the topic. Student prospective is highly encouraged in their discussion. The instructor will provide different themes in which the students will

develop using ideas or concepts discussed in the course. This assignment will be individually. The students will prepare 2 case studies throughout the semester. 25 points to each case study will be part of the course assessment.

- Concept maps will be assigned to each student. There will be 12 topics to select from. The students will prepare one concept map for two different topics during the semester. 25 points for each concept map will be part of the course assessment.

Laboratory

The lab is on Mondays from 1:00 – 4:00pm. The experimental information for each lab will be posted online at least one week prior to performing the experiment. Quantitative reports will be due, collected and graded during the semester. These quantitative lab reports will count for 150-180 points (30 per report) as part of the lab course assessment. Lab work will constitute the 30% lab component grade of the course. A handout on how to write a lab report is posted online. Each lab report will be due one week after the completion of the lab (Tuesday of the following week).

- **All lab reports must be uploaded at MUonline in a Word document and Excel (if applicable). The lab reports will be graded also at MUonline.**
- Lab experiments will be performed individual otherwise noted. Every lab data or observations must be collected in the lab notebook. Lab notebook will count 25 points towards lab assessment. Carbon copies of notebook are to be turned in.
- Lab responsibilities will be counted towards 50 points of lab course assessment. This responsibilities will be as followed but not limited to these:
    - Check-in/out drawers
    - Clean up benches, balances and instrumentation area
    - Preparation standards/ solutions and safe them in proper place
    - Chemicals back in place
    - Signup sheet
    - Clean glassware and safe them in proper place
    - Turn on/off instruments
    - Waste
    - Safety
    - Respond in a timely fashion (typically 1-2 days) to emails, and in-class announcements
    - Check regularly Mu Online
    - Update individual data in Excel spreadsheets
    - Upload lab reports in a timely manner at MUOnline website
- The students will work on a final paper written according to ACS publications guidelines: http://pubs.acs.org/page/jacsat/submission/authors.html. **This project will be written using all data collected by the students through the semester in just one (1) Module project emphasizing statistics, discussion, and conclusion.** This final paper will count 100 points as part of the course assessment. Final paper will be due on **Wednesday April 30, 2014 by 11pm.**
- A Presentation of this paper will be required and will count an additional 50 points of the course assessment. **This oral project will evaluate presentation skills, oral skills, critical thinking, ability to handle questions, and audience engagement.** Final oral presentations will be held during lab section on **Monday April 28, 2014.**
  Late work: Late work will be penalized 5 points per day. No assignments will be accepted more than one week late.

Course Point Allocation	
3- exams (100 points each)	**50%**
4- Homework (25 points each)	**10%**
Lab	**30%**
Final paper/ Presentation	**10%**
Total	**100 %**

Grade Scale

Grade Chart	
100-90	A
89-80	B
79-70	C
69-60	D
59-0	F

Miscellaneous policies

I have an Open Communication Policy: If you are having trouble with a problem, concept, or anything class related please do not hesitate to email me or come by my office. Please silence cell phone ringers during class or exams. The instructor reserves the right to answer any ringing cell phones during lecture, or to dismiss the offending student. Use of cellphones / PDAs / MP3 players and similar devices during tests and exams will be considered academic dishonesty. Recording of lectures without the instructor's permission is prohibited. Laptops should not be used during class without permission. The content of this course will adhere closely to the information contained in the textbook. You may use other resources (alternate texts, notes from other professors, etc.). If you find information that contradicts something written in the textbook or said in the lecture, please consult Dr. Quiñones. Class announcements may occasionally be made via email to your university email address. Please check it on a regular basis. Lecture notes and handouts will be posted at MU Online as time permits.

University Excused

If a student is absent from class because of a circumstance that is included in the excused absence policy, the student can obtain an official excused absence following the procedure described below. (http://www.marshall.edu/academic-affairs/policies/#ExcusedAbsences).

Academic Honesty

The university policy will be enforced. See page 69 of the 2013-14 undergraduate catalog. Some examples of academic dishonesty include (but are not limited to) copying another student's assignment, lying about being ill on the day of a test, using a cell phone or other communication device during a test, quoting an author's writing (including material found on the internet) without giving due credit.
http://muwww-new.marshall.edu/catalog/files/2013/07/UG_13-14_preliminarypublished_noplans.pdf

Incomplete Coursework

The university policy will be enforced. See page 92 of the 2013-14 undergraduate catalog.
http://muwww-new.marshall.edu/catalog/files/2013/07/UG_13-14_preliminarypublished_noplans.pdf

D/F Repeat Rule

See page 87 of the 2013-14 undergraduate catalog.
http://muwww-new.marshall.edu/catalog/files/2013/07/UG_13-14_preliminarypublished_noplans.pdf

Accommodations for Disabilities

Students with disabilities must contact the Office of Disabled Student Services in Prichard Hall 117, phone 696-2271 to provide documentation of their disability to ensure proper accommodation. Please visit http://www.marshall.edu/disabled for additional information.

Tentative Course Schedule

Weeks	Lecture
Jan. 13- 17	Measurement Basics (Chapter 1, 5, Appendix 1)
Jan. 20- 24	Atomic Spectroscopy (Chapter 6, 9-9A, 9D)
Jan. 20	*Martin Luther King, Jr.- No classes*
Jan. 27- 31	Atomic Spectroscopy (Chapter 6, 9-9A, 9D) Molecular Spectroscopy: UV-Vis (Chapter 13, 14A, 14B)
Feb. 3 - 7	Molecular Spectroscopy: Luminescence (Chapter 15)
Feb. 10 - 14	Molecular Spectroscopy: Luminescence (Chapter 15)
Feb. 17 - 21	Molecular Spectroscopy: IR, Raman (Chapter 16, 17A, 17B, 18) **Exam 1**
Feb. 24 - 28	Molecular Spectroscopy: IR, Raman (Chapter 16, 17A, 17B, 18) Molecular Spectroscopy: MS (Chapter 20, 11A, 11B, 11C)
Mar. 3 - 7	Surface Characterization (Chapter 21)
Mar. 10 - 14	Surface Characterization (Chapter 21)
Mar. 17 - 21	*Spring Break – No Classes*
Mar. 24 - 28	Electroanalytical Chemistry (Chapter 22, 23A, 23B, 24A, 24B, 25A, 25B, 25D) **Exam 2**
Mar. 31 - Apr. 4	Electroanalytical Chemistry (Chapter 22, 23A, 23B, 24A, 24B, 25A, 25B, 25D) Chromatography (Chapter 26)
Apr. 7 - 11	GC Chromatography (Chapter 27)
Apr. 14 - 18	HPLC Chromatography (Chapter 28)
Apr. 21 - 25	Thermal Methods (Chapter 31A-C)
Apr. 28 – May 2	Thermal Methods (Chapter 31A-C)
May 5 - 9	**Exam 3- Final exam week-TBA**