

**Professor:** Dr. Sarah Smith  
**Office:** Jepson 440  
**Email:** ssmith23@umw.edu  
**Phone:** (540)-654-1409

**Lecture:** MWF 11:00 – 11:50 p.m.; Jepson 219  
**Lab:** W 2 – 4:45 pm; Jepson 416

**Office Hours:**

M 1:30 – 3:30 pm

TR 3:30-4:30 pm

F 1:30 – 3:30 pm

Other times by appointment. If my door is open, drop by anytime!

**Required Materials:**

Quantitative Chemical Analysis, 9<sup>th</sup> edition., Harris D.C

Lab Notebook with carbonless duplicate pages

Laboratory goggles and lab coat

Access to Canvas

Access to a printer or money on your eagle one card

Calculator with scientific notation and logarithmic/exponential functions; you must purchase a Casio FX260 solar or TI-30X IIS for **ALL** examinations or an equivalent approved by the instructor. Cellular phones are not permitted on exam days.

**Recommended Materials:**

Solutions Manual for Quantitative Chemical Analysis, 9th ed. I have a copy in my office if you would like to see it during office hours.

**Course Prerequisite:**

This course requires a grade of C or better in CHEM 112

**Web Site:** This course will make use of the Canvas course management system. Please check here frequently as materials posted will include course announcements, assignments, and other course materials as necessary.

**Course Description:**

Chem254 provides a theoretical and hands-on introduction to some of the most common spectroscopic and chromatographic instrumentation used in chemical analyses. Our major goals are to:

- understand the basic theory underlying the construction of several common instruments
- become familiar with the operation of spectroscopic and chromatographic instruments and the influence of instrumental settings
- apply proper data analysis to evaluate the accuracy of your quantitative technique
- gain familiarity with identifying and correcting common errors and interferences

<b>Grading:</b>	<b>Points</b>	<b>Total</b>
Literature Assignments (2)	25	25
Quizzes (best 5 of 6)	20	100
Lab Reports (6)	25	150
Final Project	125	125
Instrument Demo Presentation	100	100
In-Class Exams (3)	100	300
Final Exam	200	<u>200</u>
		1000

Students with a C average or lower will receive a Mid-Semester Deficiency Report.

<b>Points accumulated</b>	<b>Letter Grade</b>	<b>Points accumulated</b>	<b>Letter Grade</b>
≥ 930 points	A	769 – 730 points	C
929 – 900 points	A-	729 – 700 points	C-
899 – 870 points	B+	699 – 650 points	D+
869 – 830 points	B	649 – 600 points	D
829 – 800 points	B-	below 600 points	F
799 – 770 points	C+		

**Honor System:** In accordance with the University's Honor Code, All graded work (hourly exams, online exercises, extra credit assignments, *graded* assignments, final exam) must be your own and pledged as such. (use **these** words)

*I hereby declare upon my word of honor that I have neither given nor received any unauthorized help on this work.* *Signed*

**Academic dishonesty in any shape or form will not be tolerated.**

Suspected violations of the Honor Code will be addressed according to the policy established by the Honor Council. Please familiarize yourself with the University's policies on academic dishonesty: ignorance is not an excuse.

**In-Class Behavior:** Please act respectfully in class of other students and myself. This includes turning your cell phone, etc. off during class time, using electronic devices only for note taking purposes, and arriving to class on time. You are expected to participate in all activities and discussions. I reserve the right to dismiss you from class if I feel you are acting disrespectfully or are disrupting the class.

**Literature Assignments:** Being able to read and understand chemical literature is important for all areas of chemistry. There will be a total of two literature assignments. More information will be given closer to the assignment due dates.

**Quizzes:** A total of six 15-20 minute quizzes will be given throughout the term at the end of class. Quiz questions will be similar to problems in the text or come from the assigned reading or lecture material. The lowest quiz grades will be dropped. **There will be no make-up quizzes without prior arrangements with me.**

**Exams:** There will be three in-class exams during the semester which will emphasize material introduced since the last exam. There will be no make-up exams without **prior** arrangements with me.

The final exam will be a comprehensive and must be taken at the time scheduled by the University: **May 1st, 12:00-2:45 pm**. According to University policy, any student who does not take the final exam will fail the course.

**Exam Policies:** No cell phones or other personal electronic communication devices (including smart watches) will be permitted in the classroom during exams. You may only use approved non-graphing calculators for **ALL** quizzes and examinations.

If you feel a mistake has been made in the grading of your exam, you must write out what you wish to be re-graded and why (your reasoning is critical) on a separate sheet of paper. This must be turned in to me with the exam no later than one week after the graded exam is returned. Please note that the *entire* exam will be re-graded, and the new score (higher or lower) will be recorded.

If you feel there has been a numerical error in calculating your exam score, please bring this to my attention no later than one week after the graded exam is returned.

**Attendance:** Attendance in lab is mandatory. Attendance in lecture is highly recommended. Occasionally, material will be presented in lecture that is beyond the scope of your textbook or with a different emphasis than that of the text, and you will be responsible for learning this material even if you are absent.

Regardless of attendance, all assignments are due on the scheduled date. **No late assignments will be accepted without my prior consent.**

**Absences:** You should notify me of an expected absence as early as possible. Make-up exams will not be given except in the event of EXTREMELY extenuating circumstances. If you must miss a quiz, see me as soon as possible *prior* to the quiz to arrange a time for a make-up quiz.

**Reading:** Reading of the appropriate sections of the textbook should be done *before* coming to class. You will be responsible for this material, *even if it is not covered in lecture.*

**Disability Services:** The Office of Disability Resources has been designated by the University as the primary office to guide, counsel, and assist students with disabilities. You will need to request appropriate accommodations through this office as soon as possible, and then make an appointment with me to discuss your approved accommodation needs. I will hold any information you share with me in the strictest confidence unless you give me permission otherwise.

If you have allergies to any chemicals or other emergency medical information, please notify me as soon as possible.

**Title IX:** University of Mary Washington faculty are committed to supporting students and upholding the University's *Policy on Sexual and Gender Based Harassment and Other Forms of Interpersonal Violence*. Under Title IX and this Policy, discrimination based upon sex or gender is prohibited. If you experience an incident of sex or gender based discrimination, we encourage you to report it. ***While you may talk to me, understand that as a "Responsible Employee" of the***

*University, I MUST report to UMW's Title IX Coordinator what you share.* If you wish to speak to someone confidentially, please contact the below confidential resources. They can connect you with support services and help you explore your options. You may also seek assistance from UMW's Title IX Coordinator. Please visit <http://diversity.umw.edu/title-ix/> to view UMW's *Policy on Sexual and Gender Based Harassment and Other Forms of Interpersonal Violence* and to find further information on support and resources.

**Class Recordings:** Video and/or audio recording of class lectures and review sessions without the advance consent of the instructor is prohibited. On request, the instructor may grant permission for students to record course lectures, on the condition that these recordings are only used as a study aid by the individual making the recording. Unless explicit permission is obtained from the instructor, recordings of lectures and review sessions may not be modified and must not be transferred or transmitted to any other person, whether or not that individual is enrolled in the course. Students with approved accommodations from the Office of Disability Resources permitting the recording class meetings must present the accommodation letter to the instructor in advance of any recording being done. On any days when classes will be recorded, the instructor will notify all students in advance. Distribution or sale of class recordings is prohibited without the written permission of the instructor and other students who are recorded. Distribution without permission is a violation of educational law. This policy is consistent with UMW's Policy on Recording Class and Distribution of Course Materials.

**Weather Policy:** To determine if classes will be held during inclement weather check the school website or call campus safety. If the campus is closed due to weather or other conditions on a day when an exam is scheduled, the exam will take place during the next class period when campus is open. If an assignment is due in class on a day when campus is closed due to weather or other conditions, it will be due at the next scheduled class meeting. Check Canvas for announcements.

### **How to Succeed in Chem 254:**

- **DO PROBLEMS EVERYDAY!!!**
- No, seriously, do problems everyday!
- Spend about one hour per day on chemistry (reading, reviewing notes, **doing problems**)
- Attend all lectures, sit near the front, and take careful notes
- Attend all labs and complete the required lab assignments
- Use your textbook wisely

Start by quickly skimming each chapter. Look at what seems familiar and unfamiliar, and use it to plan your reading

Go over each "Sample Problems" in the chapters carefully and then try the "Follow-Up Problems" that follow immediately after the samples

Note that there is a glossary of terms in the back of the book that you may find useful.

- Review the appropriate sections of the text before class
- Review the appropriate sections of the text after class and organize your notes
- Do the practice problems alone and in groups
- Come to review sessions prepared with questions
- asking questions
- Seek the instructor's help when needed (office hours, before/after class, email)

## Laboratory

### **Expectations of Students:**

- 1) Students may not work on experiments outside of laboratory time (2:00 pm until 4:50 pm on Wednesdays) *without the explicit permission of the instructor* and may not work in the laboratory alone.
- 2) Each student is required to complete a pre-laboratory exercise for each experiment. Details of these assignments follow in this syllabus.
- 3) Besides unknown samples and any solutions already prepared and available, the students will prepare all solutions themselves. You will need to include descriptions of how the solutions will be prepared, amounts needed, etc. in your pre-laboratory plan.
- 4) All experimentation, laboratory planning, data discussion must be completed *individually*. You may consult the literature or Dr. Smith, but you may not seek assistance from any other faculty member (including other disciplines) or student.

**Attendance:** Attendance in the laboratory is mandatory. **Unexcused absences from laboratory cannot be made up. MORE THAN ONE UNEXCUSED LABORATORY ABSENCE WILL RESULT IN FAILURE OF THE COURSE.** Excused absences may be made-up, if possible, at the discretion of the instructor. If you have to miss a laboratory due to an **emergency** or if you expect to be absent due to an interview, intercollegiate athletic event, etc., you should inform the instructor as soon as possible to schedule a make-up.

It is also imperative that you be on time for the laboratory. The pre-lab lectures cover important safety and procedural information. If an individual is repeatedly tardy, a **five-point deduction** will occur for each instance or the student will not be permitted to perform the experiment.

**In-lab Behavior:** It is absolutely critical that you respect the dangers inherent in laboratory space. **If I feel your behavior is seriously unsafe to either you or your classmates, you will be asked to leave immediately and will receive a zero for that day's effort.**

Be sure to bring the Laboratory Experiment Reading (posted on Canvas), scientific duplication notebook, a blue or black pen, and calculator to each experiment. You are required to have goggles and laboratory coats for each experiment. Failure to bring the appropriate materials to the laboratory may result in a penalty to your grade.

You will be working in pairs to complete the experiments. Your group assignments will rotate for each experiment and will be announced at the start of the laboratory period. This work is solely to carry out the procedures and collect the data. Students must write the pre-laboratory assignment, analyze the data individually, and write an independent lab notebook.

**Lab Safety:** Safe lab practices are expected of you. There are potential risks, such as exposure to hazardous chemicals and minor injuries (e.g., cuts and burns). During the first week of the semester, the safety rules will be presented and reviewed. To participate in this course, each student must sign a statement (last page of the syllabus) in which they acknowledge

the risks associated with the course and agree to follow all safety rules and to assume responsibility for their actions in the laboratory.

**Honor System:** Although you will be working as groups to complete the experiments, all assignments must be completed individually. You may not collaborate on the data analysis, pre-laboratory assignments, or notebook write-ups. Any assignment for which you will receive a grade must be completed individually and pledged as your own work. This includes notebook pages, literature assignments, etc. The honor pledge must be written in full: *I hereby declare upon my word of honor that I have neither given nor received unauthorized help on this work. (Signature)*

Alteration of data or copying data from another individual is an honor offense. You may discuss how to do the calculations with other students or get help from the instructor, but your final report must be your own work.

**Lab Experiments:** There is no lab manual for this course. Experimental procedures and readings will be posted on Canvas. You must download these before lab to properly prepare for the exercise. Furthermore, the labs will frequently cover material not yet introduced in lecture. It is therefore essential that you do the assigned readings prior to performing labs.

**Lab Reports:** Unless specified, all reports must be completed *individually*. They must be double-spaced with 1.25 in. margins, have numbered pages, be between 3 to 5 pages (not including notebook pages), and follow the format below.

**Attribution:** including your name, your partners' names, dates of work, and title

**Abstract:** one brief paragraph describing your major results.

**Results:** a brief discussion accompanying your results, data presented in tabular or graphic format as appropriate. This section must begin with prose, not data/figures.

**Discussion Questions:** answers to assigned questions (provided with lab)

**Notebook pages:** all pages used in lab, including organized procedure and relevant calculations

Each report requires slightly different content, which will be discussed in class or made explicit in the lab assignment. Many labs require a spreadsheet data analysis, which is graded as analysis & calculations.

**Notebook and Calculations:** Your lab notebook serves as a record of your experimental methods and data. Anyone reading it should be able to understand your purpose, your methods, and your data analysis. *Each experiment must start on a new page and have (1) a descriptive title, (2) a brief statement of purpose, (3) a safety statement and how to mitigate the risk (4) a procedural outline including any changes made to the procedures DURING the lab period, (5) a clear presentation of the raw data, and (6) a well-organized collection of all calculations performed in lab and post-lab.* In cases where there are repetitive calculations done via spreadsheet, the notebook should show an example calculation.

**Notebooks will be checked before lab** and must already contain the title, purpose, safety, and procedural outline. *If your notebook is not ready, you will not be allowed in lab and will receive a failing grade for that lab.*

**Projects:** At the end of the semester, you will complete a self-directed project in teams. This will count as 12.5 % of your OVERALL grade. Graded portions of the projects include a “white paper” proposal, a team oral presentation of the proposed experimental design, a Team Poster presentation at Research and Creativity Day, and a self-assessment. Experimental work will occur during three weeks at the of the semester. Serious planning must occur well before the work begins. This means paying careful attention to detail in the areas of sampling, sample preparation, instrumental method validation, and obtaining high quality data.

***Project Topics:*** Topics may be drawn from several sources including: a) recent chemistry literature (i.e., any ACS journal); b) chemical education literature (i.e., the Journal of Chemical Education); or c) an independently planned experiment. You may want to develop a teaching lab, verify or adapt a published analytical technique, or perhaps assemble and demonstrate a novel instrumental device. We will discuss projects in detail on February 28<sup>th</sup>. Key dates to note are:

- 2/19: Team White Paper due- two possible projects must be selected and submitted in 1 page
- 2/28: discussion of possible topics with Dr. Smith, proposal development
- 3/23-26: each group must meet with Dr. Smith separately to discuss their proposal outside of class time
- 3/27: Presentation of Proposed Experiment to class, Detailed Planned Procedure Due
- 4/3: Abstract Draft Due
- 4/22: Poster Due
- 4/24: Presentation of Poster at Research and Creativity Day

Failure to meet these deadlines will result in a 5% penalty to your grade for each missed deadline.

**Instrument Demo Presentation:** A major goal of this course is to leave it knowing how to use each of the five instruments we cover in lab. Therefore, on the week of April 8<sup>th</sup>, each student will need to meet with the instructor for 20 minutes and demonstrate the use of 2 different instruments (10 minutes each) selected randomly. The presentations will be given individually to the instructor and will cover the basic use of the instruments such as Instrument setup, sample data acquisition, shut-down, and data processing. The presentation of each instrument should be 8 minutes long with 2 minutes for questions from the instructor.

**Course Schedule:** The tentative schedule that follows is how I see the course arranged. It is not concrete. If there is material that you, as a class, find confusing, we will spend more time on that topic. The exam dates will remain set according to the schedule. If all of the “scheduled” material has not been presented prior to the exam, the exam will include only what has been covered.

1/13 Introduction Chapter 4/5	1/15 Chapter 5	1/17 Chapter 5
1/20 Martin Luther King Jr. Day – no class	1/22 Chapter 5	1/24 Chapter 18 Literature assignment #1
1/27 Chapter 18 Quiz #1	1/29 Chapter 18	1/31 Chapter 18
2/3 Chapter 20	2/5 Chapter 20 Literature assignment #2	2/7 Chapter 20 Quiz #2
2/10 Chapter 20	2/12 Chapter 21	2/14 Exam 1 (chapters 5, 18, and 20)
2/17 Chapter 21	2/19 Chapter 21 Group White Paper	2/21 Chapter 22 Quiz #3
2/24 Chapter 22	2/26 Chapter 22	2/28 Chapter 22 Project Discussions with Teams
3/2 Spring	3 /4 Break	3/6 Vacation
3/9 Chapter 23	3/11 Chapter 23	3/13 Chapter 23 Quiz #4
3/16 Chapter 23	3/18 Chapter 24	3/20 Exam 2 (chapter 21, 22, 23)
3/23 Chapter 24	3/25 Chapter 24	3/27 Proposal Presentations  Detailed Planned Project Procedure Due
3/30 Chapter 25	4/1 Chapter 25	4/3 Chapter 25 Quiz #5 Abstract Due



4/6 Chapter 25	4/8 Chapter 25	4/10 Chapter 26 Quiz #6
4/13 Chapter 26	4/15 Chapter 26	4/17 Exam 3 (chapter 23, 24, 25, and 26)
4/20 Selected topics	4/22 Selected topics Poster presentation prep	4/24 <b>Research and Creativity Day Poster Presentation</b>

**Final Exam: May 1st, 12:00-2:45 pm.**

Last day to drop a course: January 31st

Last day to withdraw from a course or change to pass/fail grading: March 20th

## Chem 254 Lab Schedule

	Lab	Assignments Due
1/15	Safety, Lab Check-in Use of Volumetric Glassware	Pre-lab Volumetric glassware
1/22	Double Beam UV-VIS	Volumetric glassware lab report Pre-lab UV-VIS
1/29	Fluorescence	UV-VIS lab report Pre-lab Fluorescence
2/5	Fluorescence	
2/12	ICP	Fluorescence lab report Pre-lab ICP
2/19	ICP	
2/26	GC-MS	ICP lab report Pre-lab GC-MS
3/4	Spring Break	
3/11	GC-MS	
3/18	HPLC	GC-MS lab report Pre-lab HPLC
3/25	HPLC	
4/1	Project	HPLC Project Report Due Research Plan pre-lab
4/8	Project	Research Plan pre-lab
4/15	Project	Research Plan pre-lab

4/22	Instrument Demo Presentation	Group Project Poster
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