

CHEM 425
(2 credits)
Instrumental Methods of Analysis
M, W 3:10 – 4:00 p.m. (Fulmer Hall 225)
Spring 2014

“There is no such thing as luck; there is only adequate or inadequate preparation to cope with a statistical universe.”
R. A. Heinlein

Instructor:	Brian Clowers, PhD
Office:	Fulmer 432
Office Hours:	Tues 10-11 am & W 2 – 3 pm or by appt.
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Course Goals and Student Learning Outcomes

- Gain a detailed understanding of the range and types of modern chemical instrumentation commonly used to deduce and explain chemical phenomena.
- Develop a fundamental knowledge of modern chemical instrumentation and analytical applications.
- Establish a core statistical framework for interpreting and evaluating experimental data and instrumental results.
- Leverage knowledge of chemical systems and utilize the appropriate instrumentation to exploit chemical characteristics.

Is This Course Hard?: As with most things in life, the answer to this question is that *it depends*.

- If you want to understand the material so that you're an educated consumer of information, then **YES** this is a hard class.
- If you want to learn the material so that you can be an asset to the company or organization you want to work for, then **YES** this is a hard class.
- If you want to know about instrumental methods of analysis and statistics so that you are on track for your graduate program, then **YES** this is a hard class.
- If you want to get a good grade for your transcript, then **YES** this is a hard class.
- If you don't care to make a good grade and in fact you think you might like to take this class at least two times, then **NO**, this is NOT a hard class.

Texts and Materials

Required Textbook: Principles of Instrumental Analysis; Skoog, Holler, and Crouch, 5th or 6th Edition, Harcourt Brace & Company, Philadelphia.

Supporting Materials: Students may find Harris (Quantitative Analysis, 8th Edition) an extremely useful resource though this text is not required.

Course Policies and Expectations

Class Expectations: I expect that you'll attend every class, participate fully in activities and lecture material, and come prepared by reading your textbook(s).

I appreciate your full attention in class. Like you, I have a life outside of school and I often take time away from my family to make sure your educational needs are met. While I am genuinely interested in the topic of this class, I sometimes find it hard to be excited when students arrive late or leave early, text or Facebook during class, chat or pass notes, sleep, etc. Perhaps paradoxically, I find it MORE respectful for you to choose NOT to come to class if you'd rather not be there.

You are responsible for the material in the text and you should read the material before class. Information presented in class may come from the text or additional sources, thus you will be responsible for the material presented in lecture. If you miss a class, you should obtain notes from a fellow student. Important announcements will be made at the beginning of class, so you should be in class on time. You are responsible for obtaining any missed information. Please be respectful of other students and your instructor by not disrupting class, including coming to class late or leaving early.

Lecture Attendance: I do not take attendance in lecture but I **STRONGLY ENCOURAGE** you to attend every class, be engaged, take notes, and ask questions.

Use of Angel: I use Angel for many things, including making announcements, sending emails, and posting accompanying material for both lectures and labs. You should plan to check Angel regularly. Additionally, you may access your grades under the **Report** tab in Angel or in the **Grades** bar on the main page. When checking your grades on the **Grades** bar, be sure to click on the "Refresh" link to see the most current grades. I will occasionally make contact with you through Angel, either in the format of announcements or emails. You are responsible for checking Angel and Angel email regularly!

Lecture Notes: Lecture material will be presented in class. Slides or lecture notes will **not** be provided to you in any other way. To obtain material from which to study, you should plan to attend class and take notes. On occasion, I will post supplementary materials in Angel. It is *your responsibility* to access these materials before class. I will teach as though you have these materials, so be prepared by accessing, downloading, and/or printing them before class.

Exam Review: I will offer brief study guides for each exam. These study guides will include information from both the lectures and text that I feel is important to understand for the exam. NOTE: These are meant as GUIDES for STUDYING and not simply a list of everything on the exam. This means that there may be things on the study guides that are NOT on the exam and things that are on the exam that are NOT on the study guide. To do your very best on exams, you should 1) read the text and/or supplementary material, 2) attend class, 3) pay attention to lecture, 4) take good notes, 5) ask for clarification when needed, 6) study regularly and often (as opposed to cramming right before the exam), 7) complete the homework assignments, as well as 8) complete the study guide. At a minimum you should spend at least 6 hours a week on this class to fully develop an understanding of the material.

Instructor Availability: I am available to meet with students face-to-face during my office hours or by appointment and by email and/or phone. With the exception of the times that I teach, unreasonable days/times (such as the weekends or the middle of the night), and some regularly scheduled work-related or personal activities, I'm available to accommodate your schedule. If you need to contact me by email, use exercise reason and do not expect a response regarding a Monday class when your e-mail was sent at 11:33 pm on Sunday. Given the volume of my inbox it could take up to three academic days to respond to your email. If you don't hear from me in this timeframe, send me a respectful reminder. Sometimes you can drop by my office to chat. If my door is closed, even if I'm in my office, it usually means I'm busy and not to disturb me. If my door is open, on the other hand, feel free to stop in.

University Policies

Accommodations for Students with Documented Disabilities: Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center. For more information contact a Disability Specialist at 509-335-3417, <http://accesscenter.wsu.edu>, or Access.Center@wsu.edu

Campus Safety Plan & Emergency Management: Washington State University is committed to enhancing the safety of the students, faculty, staff, and visitors to the Pullman campus. It is highly recommended that you review the Campus Safety Plan (<http://safetyplan.wsu.edu/>) and visit the Office of Emergency Management web site (<http://oem.wsu.edu/>) for a comprehensive listing of university policies, procedures, statistics, and information related to campus safety, emergency management, and the health and welfare of the campus community.

WSU Academic Integrity Statement: *"As an institution of higher education, Washington State University is committed to principles of truth and academic honesty. All members of the University community share the responsibility for maintaining and supporting these principles. When a student enrolls in Washington State University, the student assumes an obligation to pursue academic endeavors in a manner consistent with the standards of academic integrity adopted by the University. To maintain the academic integrity of the community, the University cannot tolerate acts of academic dishonesty including any forms of cheating, plagiarism, or fabrication. Washington State University reserves the right and the power to discipline or to exclude students who engage in academic dishonesty."*

Academic integrity will be strongly enforced in this course. All forms of academic dishonesty, including cheating, plagiarism, fabrication, or knowingly facilitating academic dishonesty, are strictly prohibited. If you are caught engaging in academic dishonesty, you will fail the course and your case will be reported to the Office of Student Standards and Accountability. Cheating is defined in the Standards for Student Conduct WAC 504-26-010 (3). It is strongly suggested that you read and understand its definition: <http://conduct.wsu.edu/default.asp?PageID=338>. For more information about WSU's Academic Integrity Program, please go to <http://academicintegrity.wsu.edu/default.asp?PageID=4614>. For more information about plagiarism and steps that can be taken to avoid committing it, please go to <http://www.wsulibs.wsu.edu/plagiarism/main.html>.

Withdrawing from Chem 425: The WSU Catalog specifies the details of the WSU withdrawal policy, as indicated below. See the course schedule for withdrawal dates.

68. WITHDRAWAL FROM A COURSE

An undergraduate or professional student may withdraw from a course after the 30th day of the regular term up through the end of the 13th week with these provisions:

- (a) At the end of each term, the number of withdrawals will be counted for undergraduate and professional students. Once four withdrawals have been used, no further withdrawals will be allowed in subsequent terms. Withdrawals that result from the cancellation of enrollment will not be counted. (For those entering WSU in fall 1998 through summer 2004, once six withdrawals have been used, no further withdrawals will be allowed in subsequent terms.)
- (b) After the withdrawal limit is reached, an undergraduate or professional student may, in exceptional circumstances, submit a petition through the Registrar's Office for an exception to the withdrawal limit. See Rule 57.
- (c) If a grade has been entered for a course, the grade may not be changed to a withdrawal without the instructor's consent.
- (d) Withdrawals do not reduce tuition charges or the total official hours of enrollment.
- (e) For academic calendars that vary from the regular 15-week term, a prorated schedule will be used to determine the withdrawal deadline.
- (f) The grade shall be marked W, and payment of the service fee shall be mandatory.

Mid-Term Grades: During the 2011-2012 school year, the Associated Students of Washington State University (ASWSU – your student government) successfully appealed to the WSU Faculty Senate to institute a policy in which instructors are required to submit mid-term grades for all students, not just Freshmen and transfer students. Here’s the policy:

88. MIDTERM GRADE SUBMITTAL. Midterm grades will be submitted for students enrolled in undergraduate courses by 5:00 p.m. on the Wednesday of the eighth week of the fall and spring semesters. For courses that are letter graded, midterm grades may reflect the full range of letter grades (A-F) or may use the C or F grade only. The instructor’s syllabus will specify which type of midterm grade will be given to assess progress. For midterm grades, C and F are defined as follows: A C midterm grade is given to any student who is making satisfactory progress. An F midterm grade is given to any student whose progress is not acceptable and who needs to discuss his/her progress with the instructor. The assessment should not be interpreted as a formal grade, but rather as an indication of the student’s progress to date. Midterm grades are advisory and do not appear on the student’s permanent record, the WSU transcript.

In this class, I will be using the C/F grading at mid-term. If you receive a C, you’re performing satisfactorily in the course (i.e., you’re receiving a C- or better). If you receive an F, you’re performing unsatisfactorily in the course (i.e., you’re receiving a D+ or worse).

Grading Elements

Homework: These problems sets will focus both on the material in class and the topics covered in the text. It is designed to provide you with a framework to understand the lecture material. Homework problems will be available in Angel as printable worksheets and will be ***due at the BEGINNING of the class period on the Monday following assignment*** as indicated on the course schedule below by an asterisk. All homework must be completed and turned in ON the printable worksheets. ***NO LATE ASSIGNMENTS WILL BE ACCEPTED (SUBMISSIONS AFTER THE BEGINNING OF THE CLASS PERIOD ARE CONSIDERED LATE!)***. After the completion of each homework assignment, I’ll randomly select a subset of questions that will be graded. This means that not all of the questions will be graded and you won’t know which questions will be graded when the homework is assigned. Once the due date and time have passed, I’ll post the correct answers (though ***not*** the solutions) in Angel for you to compare with your homework answers. I suggest that if you arrived at an incorrect answer, you review your solution and correct the error. If you are unable to determine why you arrived at an incorrect answer, even after attempting to rework the problem, please feel free to discuss it with me or your lab instructor outside of class or lab time. I expect to see all your work (and rework) for the question you’re consulting me about. Each homework assignment will be worth 10 points for a total of 90 points toward the overall grade in the class.

The “St Happens” Policy:** Because I realize that stuff happens (i.e., unforeseeable events that interfere with your ability to complete a homework assignment on time), I allow you to submit one homework assignment up to one week late without penalty and with no questions asked. If your homework assignment is submitted late, it must be handed in directly to me (***NOT*** given to the administrative assistants in the Chemistry office, put in my mailbox, slid under my office door, or emailed to me). Submissions directly to me will be accepted both inside and outside of the class period but will conform to the following rules:

The “Schtuff Happens” Policy applies to:
Only ONE homework assignment this semester,
Up to ONE week late,
NO penalty,
NO questions asked,
Handed in DIRECTLY to Dr. Clowers

Quizzes: Quizzes will be administered during the last 10 minutes of class and will cover the material in the previous two lecture periods. They will comprise of T/F, multiple choice or short. Make-up quizzes will **not** be given, since I will drop your two lowest quizzes. ***Do NOT ask me for one; I will not grant it.*** Attendance is not required but is expected since quizzes are in-class exercises.

Exams: There will be 4 exams throughout the course of the semester. These exams may consist of a range of multiple-choice and T/F questions along with a series of short answer question. Each exam will be worth 50 points but only a total of 150 points will be used for calculation of final grades. In essence, your lowest exam grade will be dropped for the calculation of grades. The first exam will be take home in nature in order to provide for a suitable number of points to be awarded prior to issuing mid-term grades. Though the fourth exam will be during the final exam period, it is **NOT** cumulative. Each exam will cover the material since the previous exam.

Make-Up Exams: Make-up exams will **only** be allowed if your absence is excused by the regulations in the WSU Catalog (e.g., university sponsored events, military service, illness, family emergency, etc.). Students needing to take a make-up exam should notify me **AS SOON AS POSSIBLE BEFORE THE DAY OF THE EXAM** so that we can make arrangements. You will be required to submit a written explanation of your absence and must complete the exam within seven days of your return to class. The make-up exam will consist of different questions than the regularly scheduled exam and may include short answer questions in addition to multiple-choice questions.

Extra Credit Opportunities: Occasionally in-class extra credit opportunities will be provided. These **in-class** opportunities will vary in numbers of points per activity and will be offered at random intervals. To receive these extra credit points, you must be present when they're offered.

Grading

Homework Assignments: 9 assignments @ 10 points each = 90 points (~26%)

Quizzes: 10 (of 12) quizzes @ 10 points each = 100 points (~29%)

Exams: 3 of 4 exams @ 50 points each = 150 points (~44%)

TOTAL POINTS: 340 points (100%)

Final grades will be determined by the following point breakdown (There is no curve in this class):

Grade	Points	Grade	Points	Grade	Points	Grade	Points
A	316-340	B+	296 - 305	C+	262 - 271	D+	228 - 237
A-	306-315	B	282 - 295	C	248 - 261	D	204 - 227
		B-	272 - 281	C-	238 - 247	F	< 204

Your grade is based on the amount of learning you have achieved as measured by the points you have earned. Note that grades are not based directly on the amount of time and effort you expend in studying or how many classes you attend, but rather, on how well you perform. Some students feel they deserve high grade because they work hard or attended every class. However, high grades are not an entitlement due to hard work or attendance alone, but are awarded based on high achievement in the course which includes hard work and attendance. In accordance with the university's guidelines for grading as stated in the WSU Catalog, I use the following meanings of the main letter grades:

- A. Student work demonstrates consistently excellent scholastic performance; thorough comprehension; ability to correlate the material with other ideas, to communicate and to deal effectively with course concepts and new material; reliability in attendance and attention to assignments.
- B. Student work demonstrates superior scholastic performance overall, reliability in attendance, and attention to assignments; may demonstrate excellence but be less consistent than the work of an A student.
- C. Student work demonstrates satisfactory performance overall, as well as reliability in attendance, and attention to assignments.
- D. Student work demonstrates minimal, barely passing performance overall; limited knowledge of subject matter.
- F. Student work demonstrates unsatisfactory performance and comprehension or unfulfilled requirements. The grade is failing.

Academic Difficulty: If you have difficulty understanding the material or if your exam performance is not up to your expectations, make an appointment with me. I will try to help you, and I may be able to offer suggestions to improve your retention of the material. Some suggestions will be offered in class, but I may be able to offer some advice unique to your situation. Please do not wait until the term is halfway over before you seek assistance.

Grading Errors: If, on the very rare occasion I've made a grading error, it is *your responsibility* to identify it and contact me in a *timely* manner. Please do not wait until the end of the semester to draw my attention to a possible grading error. To challenge a possible grading error, you must provide me with evidence that it is a grading error. I cannot accept unsubstantiated claims as evidence of a grading error.

Chem 425 Spring 2014 Course Schedule

(I reserve the right to modify this schedule)

Month	Mon	Tue	Wed	Thu	Fri
Jan 2014	13 Class Introduction Chapter 1 Analytical Domains; Figures of Merit	14	15 Chapter 1 & 5 Figures of Merit	16	17
	20 No Class – MLK Day	21	22 Chapter 5 Quiz; Calibration Curves	23	24
	27 Chapter 6 Introduction to Spectroscopy *Take Home Exam 1 Due	28	29 Chapter 6 Quiz; Introduction to Spectroscopy	30	31
Feb 2014	3 Chapter 6 & 7 Components of Optical Instruments *	4	5 Chapter 7 Quiz; Components of Optical Instruments	6	7
	10 Exam 2	11	12 Chapter 8 Atomic Spectroscopy	13	14
	17 No Class – President's Day	18	19 Chapter 9 Quiz; Atomic Absorption	20	21
	24 Chapter 11 Atomic Mass Spectrometry *	25	26 Chapter 13 Quiz; Introduction to Molecular Spectroscopy	27	28
Mar 2014	3 Chapters 13 & 14 Molecular Spectroscopy *	4	5 Chapters 13 & 14 Quiz; Molecular Spectroscopy	6	7
	10 Spectroscopy Review *	11	12 Exam 3	13	14
	17 Spring Break	18 Spring Break	19 Spring Break	20 Spring Break	21 Spring Break
	24 NMR	25	26 Quiz; NMR	27	28
	31 Chromatography *	1	2 Quiz; Chromatography	3	4
Apr 2014	7 Gas Chromatography *	8	9 Quiz; Gas Chromatography	10	11

Month	Mon	Tue	Wed	Thu	Fri
	14 Liquid Chromatography *	15	16 Quiz; Capillary Electrophoresis	17	18
	21 Mass Spectrometry *	22	23 Quiz; Mass Spectrometry	24	25
	28 Mass Spectrometry *	29	30 Quiz; Separations Review	1	2
May 2014	5 Final Exam Week	6 Final Exam Week	7 Final Exam Week	8 Final Exam Week	9 Final Exam Week