CHEM 310
Instrumental Analysis
Spring 2021

INSTRUCTOR

Dr. John Sivey

Email (best way to contact me): jsivey@towson.edu

I make every effort to reply to emails promptly (typically within one business day). Emails received after 5:00 PM on Friday can anticipate a reply by the following Monday.

FORMAT

This course is entirely online. Content will be delivered using a mix of live class sessions (accessible via the Course Room in Blackboard Collaborate Ultra) and pre-recorded lecture videos. The Course Calendar at the end of this syllabus lists the dates of all live and pre-recorded class sessions.

All course content will be delivered via the course Blackboard site. You are encouraged to check the course Blackboard site daily for important updates. Additional information will be communicated to you via your university email account.

ONLINE OFFICE HOURS

Immediately following each live lecture and lab session, I will remain in the Course Room on Blackboard Collaborate Ultra to discuss any questions you may have. I am also happy to meet with you by appointment (also via the Course Room on Blackboard Collaborate Ultra). To request an appointment, email me several time slots that can work for you. I enjoy talking about analytical chemistry, so please reach out if you have any questions or concerns.

COURSE DESCRIPTION

This is an advanced course in analytical chemistry emphasizing the theory and practice of instrumental analyses. You will learn how professional chemists determine the composition of solutions and materials in both “clean” and complex samples using a variety of analytical instruments. Topics to be examined include: potentiometry, spectrophotometry, liquid chromatography, gas chromatography, mass spectrometry, and atomic spectroscopy. We will also cover important quality assurance considerations, including sample preparation techniques, advanced calibration strategies, and signal-to-noise ratios.

COURSE PREREQUISITE

Grade of “C” or better in CHEM 210 and (CHEM 330 or CHEM 331).

COURSE OBJECTIVES

After completing this course, you should be able to:

1. Explain the operational theory of selected instrumental methods of analysis
2. Discuss the advantages and limitations of the analytical methods discussed in class
3. Describe safe, precise, and accurate analytical laboratory procedures
4. Apply appropriate computational and statistical tools to assess analytical data
5. Propose troubleshooting strategies for systematic errors associated with instrumental operations
6. Critically assess reports related to analytical chemistry from the peer-reviewed literature
7. Demonstrate mastery of course material through effective written and spoken communication skills

REQUIRED MATERIALS

- Textbook: *Quantitative Chemical Analysis*, 9th edition, by Daniel C. Harris
    - A new (10th) edition of this textbook was recently released, which is substantially different than the 9th edition. We will use the 9th edition, which is the same edition used in CHEM 210.
- Access to a computer with functioning microphone, webcam, and Internet connection.

ATTENDANCE POLICY

Attendance at all live (synchronous) class sessions is **required**. In-class assignments will be included as components of your final grade. **No make-ups** will be given for missed in-class assignments. Some material covered in class is not covered in the textbook. **All** material covered in class is "fair game" for graded assessments. If you miss a class, be sure to contact a colleague to obtain copies of any missed material not otherwise available on Blackboard.

Out of respect for your busy schedules, I make it a priority to start class on time and to finish class on time. Please demonstrate mutual respect for all members of the class by joining each live class session on time and remaining for the duration of each class. If an unavoidable circumstance requires you to arrive late or leave early, please inform me (in advance, if possible) via email.

TIPS FOR PARTICIPATING IN LIVE CLASS SESSIONS

- Join sessions at least 5 minutes early to ensure you are fully connected prior to the beginning of class.
- Once each session begins, please mute your microphone to reduce background noise. Please remember to unmute your microphone when asking or responding to questions.
- I strongly encourage you to ask questions and to share your perspectives with the class. Make frequent use of the "Raise Hand" feature in Blackboard Collaborate.
- Take notes. I will post all slides (without audio or annotations) following each class session, so you do not need to copy what is shown on the slides. You will, however, want to take notes on the explanations and discussions that supplement the slides because class sessions will generally not be recorded.
- To assist you in taking notes, I typically post lecture slides in advance of each live class session in case you wish to print the slides prior to class. Lecture slides will be posted in the Lecture content area on Blackboard (typically the evening before each live class session).
- If I lose connectivity during (or at the beginning of) a class session, please stay connected for 15 minutes to give me a chance to reconnect. If I am unable to reconnect after 15 minutes (and if you don't hear otherwise from me via email), you may leave the class session and assume that we will resume at the beginning of the next scheduled class period.

CLASSROOM DIVERSITY AND INCLUSION

The students, faculty, and staff at Towson University represent a diverse and vibrant community of learners and scholars. As a community, we value the unique contributions of each individual and promote active participation in all aspects of the learning process by each community member. I support Towson University's goal of fostering a diverse and inclusive educational setting. I strive to create a classroom environment built upon the principles of mutual respect and support. Toward this end, all participants in this course are expected to demonstrate respect for all other members of the class. If you feel these expectations have not been met, please speak with me or with the designated diversity liaison, Dr. Cindy Zeller (czeller@towson.edu). For further information regarding diversity and inclusion policies, please see the Chemistry Department's Diversity Action Plan.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

If you may need an accommodation due to a disability, please contact me privately as soon as possible to discuss your specific needs. A memo from Accessibility & Disability Services is required. It is your responsibility to present this paperwork in a timely fashion and to follow-up regarding accommodations that require my participation (e.g., testing accommodations). If you think accommodations might be appropriate,

you are encouraged to contact Accessibility & Disability Services (Phone: 410-704-2638 or https://www.towson.edu/accessibility-disability-services/).

ACADEMIC INTEGRITY STATEMENT

The reputation of Towson University and the intrinsic value of your academic degree hinge on the personal integrity of each member of the TU community. I assume a proactive role in preventing and reporting academic integrity violations; you are expected to do the same. Examples of academic integrity violations include (but are not limited to) all forms of: cheating, plagiarism, unauthorized collaborations, alteration of graded assignments, forgery, falsification, lying, and facilitating academic dishonesty. In particular, the scope and severity of plagiarism is often underestimated. Plagiarism is defined as using someone else's words, work, or ideas without proper acknowledgement. Plagiarism is an "academic felony" that I take very seriously.

Unless explicitly authorized by me, you may not reference, review, or otherwise rely on assignments and other materials from previous semesters of CHEM 310.

The penalty for academic integrity violations may include receiving a failing grade for the assignment or receiving an "F" as the final grade for the course. If you have questions regarding how best to avoid academic integrity violations, please consult with me.

For some activities in this course, collaboration with your colleagues is encouraged. Examples are provided below to clarify what levels of collaboration are deemed acceptable.

Acceptable Collaboration Activities:

- Working in groups to determine the key concepts or general strategies that may be relevant to a problem set or a lab assignment. Then, each member of the group works alone when writing their responses to ensure that your *individual* understanding of the assignment is expressed in your *individual* responses
- Answering a colleague's question in a manner similar to how I would answer the question (i.e., helping your colleague to understand the concepts *without* giving away the answers)
- Asking a colleague questions similar to, "What resources did you find most helpful when approaching this problem set question?"

Unacceptable Collaboration Activities:

- Collaborating in *any* fashion on quizzes, exams, or interviews
- Sharing answers to a problem set or lab assignment
- Sharing Excel spreadsheets
- Asking a colleague questions similar to, "Is this the answer you arrived at?"

I encourage you to review the entire Student Academic Integrity Policy available here.

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EVALUATION AND GRADING

Grades for this course are based on 1300 total points, as outlined below:

Lecture Evaluation Item	*Contribution to Final Grade*	*Lab Evaluation Item*	*Contribution to Final Grade*
Lecture Assignments (including problem sets, in-class assignments, and quizzes)	450 pts	**Lab 1 Assignment**	50 pts
Interview #1 Monday, Feb 22 (during lab)	100 pts	**Lab 2 Assignment**	70 pts
Interview #2 Monday, Mar 22 (during lab)	100 pts	**Lab 3 Assignment**	100 pts
Exit Interview (cumulative) Monday, May 10 (during lab)	140 pts	**Lab 4 Assignment**	100 pts
Final Exam (take-home) Due by 6:00 PM on Friday, May 14	150 pts	**Lab 5 Assignment**	50 pts
Total Lecture Points	940 pts	**Total Lab Points**	360 pts

Interviews: Dates for interviews (i.e., oral exams) are shown in the table above. Interview times will be announced approximately one week in advance. **No make-up interviews will be given**. If you miss a midterm interview due to an unavoidable and verifiable reason, your percentage score on the exit interview will also be your percentage score for the missed midterm interview.

Lecture Assignments: Lecture assignments will include problem sets, in-class assignments, online quizzes, and literature discussions. Assignments will often require you to synthesize your knowledge of analytical chemistry and apply it to understanding real-world applications and cutting-edge technologies.

Lab Assignments: More details on lab assignments will be provided as the semester progresses.

Submitting Assignments: Unless indicated otherwise, all assignments must be submitted as **pdf files** using links provided on Blackboard. Other file types (e.g., Word documents) will *not* be accepted. It is your responsibility to ensure that all files are uploaded properly onto Blackboard before the deadline. I recommend viewing any uploaded assignments in Blackboard to confirm that the file appears as you intended.

Re-Grade Policy: If you believe a grading error has been made on an assignment, you must notify me via email within three days of the grade being posted. In your email, you must clearly explain your rationale for requesting that the assignment be re-graded. If a re-grade request is accepted, I reserve the right to carefully re-grade the entire assignment.

Late Policy: Assignments designed to be completed in class will not be accepted if late; no make-ups for such assignments will be permitted. Late submissions will not be accepted for quizzes and for online discussions. Problem sets and lab assignments received up to one (1) business day late will be assessed a 10% late fee (deducted from the total points available on the assignment). Problem sets and lab assignments submitted more than one (1) business day late will receive a grade of zero. Early submissions are encouraged. Individual technological/connectivity issues are not valid reasons for missing submission deadlines. **Do not wait until the last minute to submit assignments**.

Final Course Grade: Final grades will be based on your total points earned for the course. The grading scale is shown below. There is no "curve" for this course; as such, you are not in competition with your colleagues.

≥ 93.0 %	A	≥ 77.0 %	C+
≥ 90.0 %	A-	≥ 70.0 %	C
≥ 87.0 %	B+	≥ 67.0 %	D+
≥ 83.0 %	B	≥ 60.0 %	D
≥ 80.0 %	B-	< 60.0 %	F

COURSE TOPICS

Topics	***Reading Assignment***	***Approximate Interview Coverage***		
		#1	***#2***	***Exit***
Activity coefficients	8.2 – 8.3; 13.2 (p. 291 only)			
Electrodes, potentiometry, and pH measurements	15.1 – 15.5			
Spectrophotometry	19.1; 20.1 – 20.5			
Noise and signal-to-noise ratios	20.6; additional articles			
Advanced calibration methods	5.3 – 5.4			
Fundamentals of chromatography (review)	23.2 – 23.5			
High-performance liquid chromatography	25.1 – 25.4			
Sample preparation	28 intro. (p. 771 - 772); 28.2 – 28.3			
Theory of liquid-liquid extraction (review)	23.1			
Gas chromatography	24.1 – 24.5			
Mass spectrometry and tandem mass spectrometry (including LC-MS/MS)	22.1 – 22.7			
Atomic spectroscopy and ICP-MS	21.1 – 21.5; 21.7			
Ion chromatography	26.1 – 26.2			

SYLLABUS SUBJECT TO CHANGE

Although I strive to adhere to the syllabus in its current form, all information, schedules, due dates, and policies outlined herein are subject to change. Any changes (including those potentially resulting from a University-wide emergency) will be announced via email and/or via Blackboard.

COURSE CALENDAR

Attendance is required for interviews (shown below in orange), live lecture and live lab sessions (denoted below in green). Live lecture sessions begin at 8:30 AM. Live lab sessions begin at 1:00 PM. Asynchronous (e.g., pre-recorded) sessions are denoted below in purple and often include an associated quiz. Due dates for quizzes and literature discussions will be posted on Blackboard. It is your responsibility to keep track of all due dates and the dates of all live class sessions. Unless indicated otherwise, all assignments are due by 9:00 PM on the dates shown below in red.

January/February

Mo	Tu	We	Th	Fr
Jan 25 LIVE lecture & LIVE lab	26	27 LIVE lecture	28	29 **Prob. Set #1 Due**
Feb 1 LIVE lecture & LIVE lab	2	3 LIVE lecture	4	5
8 LIVE lecture & LIVE lab	9 **Lab #1 Due**	10 LIVE lecture	11	12 **Prob. Set #2 Due**
15 LIVE lecture & LIVE lab	16	17 LIVE lecture	18	19
22 LIVE lecture **Interview #1 (during lab)**	23	24 LIVE lecture	25	26 **Lab #2 Due**

March

Mo	Tu	We	Th	Fr
1 LIVE lecture & LIVE lab	2	3 LIVE lecture	4	5 **Prob. Set #3 Due**
8 LIVE lecture & LIVE lab	9	10 No lecture (Literature Disc. #1)	11	12 **Lab #3 Draft Due**
15	16	17	18	19
← **Spring Break** →				
22 Recorded lecture **Interview #2 (during lab)**	23 **Lab #3 Peer Rev. Due**	24 Recorded lecture	25	26
29 Recorded lecture; no lab	30	31 Recorded lecture	Apr 1	2 **Revised Lab #3 Due**

April

Mo	Tu	We	Th	Fr
5 Recorded lecture LIVE lab	6	7 Recorded lecture	8	9 **Prob. Set #4 Due**
12 Recorded lecture & lab	13	14 Recorded lecture	15	16
19 No lecture (Literature Disc. #2) LIVE lab	20 **Lab #4 Due**	21 No lecture (Literature Disc. #2 cont.)	22	23
26 Recorded lecture LIVE lab	27	28 Recorded lecture	29	30

May

Mo	Tu	We	Th	Fr
3 Recorded lecture LIVE lab	4	5 LIVE lecture	6	7 **Lab #5 Due**
10 No lecture **Exit Interview (during lab)**	11	12	13	14 **Final Exam Due**