

Spring 2023

## Chem 222-002: Analytical Chemistry

Hao Chen

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## Chemistry: *Spring 2023 Course Syllabus*

**NJIT Academic Integrity Code:** All Students should be aware that the Department of Chemistry & Environmental Science (CES) takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

### COURSE INFORMATION

**CHEM 222 Course Description:** Analytical chemistry deals with chemical separation, identification and quantification. Chemistry 222 is an introduction to the principles and applications of classical and modern analytical techniques. Many topics will be covered in this course, including data analysis, chemical equilibria, acid-base chemistry, titration methods, electrochemistry, spectroscopy, mass spectrometry and chromatography. It is important for students to understand the advantages and disadvantages of each analytical method, besides the underlying principles. Students are encouraged to join discussion how to solve the shortcomings of these methods for improved performance. Students are also expected to develop capability for carrying out necessary calculations for various analytical questions.

**Number of Credits:** 3

**Prerequisites:** CHEM 125, CHEM 126, and CHEM 124

#### Course-Section and Instructors

Course-Section	Instructor
CHEM 222-002	Dr. Hao Chen <b>Email:</b> <a href="mailto:hao.chen.2@njit.edu">hao.chen.2@njit.edu</a> <b>Telephone:</b> 973-596-8571

**Class time:** Mon & Thur 10:00 - 11:20am at KUPF 108

**Office hours:** Monday 11:30-1:30 pm or by appointment.

**E-Mail:** All E-mail to me should start with CHEM 222 in the subject so that it can be filtered appropriately. Any e-mail pertaining to your academic standing (i.e., grades) must be sent from your NJIT account. Anonymous e-mail will not be read.

**Required Textbook:** *Quantitative Chemical Analysis*, 10<sup>th</sup> Ed., D.C. Harris 2020, ISBN:9781319164300

**Secondary reference:** *Fundamentals of Analytical Chemistry*, 10<sup>th</sup> edition, by Douglas A. Skoog, 2022, ISBN: 9780357450444.

## POLICIES

All CES students must familiarize themselves with, and adhere to, all official university-wide student policies. CES takes these policies very seriously and enforces them strictly.

**Grading Policy:** The final grade in this course will be determined as follows:

Homework	15%
Midterm Exam I	20%
Midterm Exam II	20%
Final Exam	30%
Project paper	5 %
Oral presentation for project paper	5 %
Attendance	5%

Your final letter grade in this course will be based on the following tentative curve:

A	90-100	C	70-75
B+	86-89	D	60-69
B	80-85	F	<60
C+	76-79		

**Attendance Policy:** Attendance at classes will be recorded and is **mandatory**. Each class is a learning experience that cannot be replicated through simply “getting the notes.”

**Homework Policy:** Homework is an expectation of the course. The homework problems set by the instructor are to be submitted via Canvas and will be used in the determination of the final letter grade as described above. There will be no points for late homework.

**Exams:** There will be two midterm exams held in class during the semester and one comprehensive final exam. The following exam periods are tentative and therefore possibly subject to change:

Midterm Exam I	Feb. 27
Midterm Exam II	Mar. 27
Final Exam Period	May 5-11

The final exam will test your knowledge of all the course material taught in the entire course.

**Makeup Exam Policy:** There will normally be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event that a student has a legitimate reason for missing a quiz or exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor’s note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the CES Department Office/Instructor that the exam will be missed so that appropriate steps can be taken to make up the grade.

**Cellular Phones:** All cellular phones and other electronic devices must be switched off during all class times. Such devices must be stowed in bags during exams or quizzes.

## ADDITIONAL RESOURCES

**Chemistry Tutoring Center:** Located in the Central King Building, Lower Level, Rm. G12. Hours of operation are Monday, Tuesday, Thursday - 12:00pm - 6:00pm; Wednesday, 12:00pm-5:00pm; Friday, 10:00am-6:00pm. For further information please click [here](#).

**Accommodation of Disabilities:** Office of Accessibility Resources and Services (*formerly known as Disability Support Services*) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact **Scott Janz, M.S.**, Associate Director at the Office of Accessibility Resources and Services at **973-596-5417** or via email at [spj6@njit.edu](mailto:spj6@njit.edu). The office is located in Fenster Hall Room 260. A Letter of Accommodation Eligibility from the Office of Accessibility Resources Services office authorizing your accommodations will be required.

For further information regarding self-identification, the submission of medical documentation and additional support services provided please visit the Accessibility Resources and Services (OARS) website at:

- <http://www5.njit.edu/studentsuccess/disability-support-services/>

### Project paper and Oral Presentation:

Two students form a group and each group is required to find one application of a novel analytical method. You can search literature journals such as *Analytical Chemistry* to find something that really interests you. A written project paper is required at the end of semester. Also, each group needs to make a short presentation (10 minute) about the chosen application.

The paper should be structured as followed:

1. Abstract-- a one paragraph summary of your critique.
2. Introduction-- provide information regarding why the research is important and interesting. Should contain merit and broader implications.
3. Novelty-- present competing methods and explain the novelty of the presented method
4. Validation-- critically assess the paper (are the goals accomplished and are the conclusions adequately and unambiguously supported by the results?)
5. Conclusion -- summarize the three previous sections, the conclusion and the three previous sections should end in a summary.
6. Literature --cite a minimum of 10 peer-reviewed journal articles following ACS format should be turned in with the outline

## Course Outline

Lecture	Section	Topic	Assignment
1	Jan. 19	Lecture 1. Welcome and introduction	
2	Jan. 23	Lecture 2. Chemical Measurements	
3	Jan. 26	Lecture 3. Tools of the Trade	
4	Jan. 30	Lecture 4. Experimental Error	
5	Feb. 2	Lecture 4. Experimental Error (Continued)	
6	Feb. 6	Field trip—Labor tour of LC/MS	
7	Feb. 9	Lecture 5. Statistics	
8	Feb. 13	Lecture 5. Statistics (Continued)	
9	Feb. 16	Lecture 6. Quality Assurance and Calibration Methods	
10	Feb. 20	Lecture 7. Chemical Equilibrium	
11	Feb. 23	Lecture 8. Activity and the Systematic Treatment of Equilibrium	
12	Feb. 27	<b>Exam I</b>	
13	Mar. 2	Lecture 9. Acids and Bases	
14	Mar. 6	Lecture 9. Acids and Bases (Continued)	
15	Mar. 9	Lecture 10. Acid-Base Titrations	
16	Mar. 13	Spring break	
17	Mar. 16	Spring break	
18	Mar. 20	Lecture 11. Fundamentals of Electrochemistry	
19	Mar. 23	Lecture 12. Potentiometry	
20	Mar. 27	<b>Exam II</b>	
21	Mar. 30	Lecture 13. Voltammetry	
22	Apr. 3	Lecture 14. Fundamentals of Spectrophotometry	
23	Apr. 6	Lecture 15. Applications of Spectrophotometry	
24	Apr. 10	Lecture 16. Spectrophotometers	
25	Apr. 13	Lecture 17. Atomic Spectroscopy	
26	Apr. 17	Lecture 18. Mass Spectrometry	
27	Apr. 20	Lecture 19. Introduction to Analytical Separation	
28	Apr. 24	Lecture 20. GC & LC	
29	Apr. 27	Oral Presentations	
30	May 1	Oral Presentations	
	May 5-11	<b>Final exam</b>	TBA

