

Fall 2020

CHEM 222-001: Analytical Chemistry

Carlos Pacheco

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Chemistry: *Fall 2020 Course Syllabus*

NJIT Academic Integrity Code: The shift to remote and converged teaching due to the COVID-19 pandemic has required that both instructors and students make changes to their normal working protocols for courses. Students are asked to practice extra care and attention concerning academic honesty, with the understanding that all cases of plagiarism, cheating, multiple submission, and unauthorized collaboration are subject to penalty. Students must properly cite and attribute all sources used for papers and assignments. Students may not collaborate on exams or assignments, directly or through virtual consultation, unless the Instructor gives specific permission to do so. Posting an exam, assignment, or answers to them on an online forum (before, during, or after the due date), in addition to consulting posted materials, constitutes a violation of the university's Honesty policy. Likewise, unauthorized use of live assistance websites, including seeking "expert" help for specific questions during an exam, can be construed as a violation of the honesty policy. All students should be familiar with the NJIT Academic Integrity Code.

All Students should be aware that the Department of Chemistry & Environmental Science (CES) takes the NJIT Academic Integrity Code 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

Course Description: This course is designed to introduce students to the fundamentals of Analytical Chemistry. Analytical Chemistry is a sub-discipline of Chemistry, which deals with the identification, and assay of materials and their components. Quantitative Analysis deals with the latter of these processes; i.e. how much of a certain substance is in the material to be analyzed. CHEM 222 is an introduction to the theory and applications of quantitative chemical analysis developed from a rich variety of phenomena such as the law of mass action, the Nernst equation, conservation of mass and charge to mention just a few. Topics to be covered include data analysis, chemical equilibria, acid-base chemistry, titrimetric methods, electrochemistry, spectroscopy, and mass spectrometry and separation techniques. Classical techniques will be complemented with discussions on the use of database and statistical methods.

Number of Credits: 3

Prerequisites: CHEM 125, CHEM 126, and CHEM 124

Course-Section and Instructors

Course-Section	Instructor
CHEM 222-100	Dr. Carlos Pacheco
	E:mail: carlos.n.pacheco@njit.edu
	Office: B006; Lab: B008 -- NMR laboratory

Class time: Tue & Thur 9-10:20am

Office hours: 1) IN-PERSON, by appointment, one-by-one, 15-min slots: Wednesdays, 1pm-2pm.

2) VIRTUAL, WebEx, **GROUP meeting**: Wednesdays, 2pm-3pm.

E-Mail: All E-mails should include **CHEM 222** in the subject so that it can be filtered appropriately.

Textbook: *Quantitative Chemical Analysis*, 10th Ed., DC Harris, CA Lucy, NY, 2020, ISBN-10: 1-319-16430-7

University-wide Withdrawal Date: The last day to withdraw with a **W** is Monday, November 9, 2020. It will be strictly enforced.

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	10%
Quizzes	10%
Midterm Exam I	20%
Midterm Exam II	20%
Comprehensive Final Exam	30%
Literature Research/Group Learning	10%

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 handed in for grading and will be used in the determination of the final letter grade as described above.

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	October 13, 2020
Midterm Exam II	November 19, 2020
Final Exam Period	December 15- 22, 2020

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 – Friday 10:00 am - 6:00 pm. 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 Chantonette Lyles, Associate Director at the Office of Accessibility Resources and Services at 973-596-5417 or via email at lyles@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/studentssuccess/disability-support-services/>

Important Dates (See: [Fall 2020 Academic Calendar, Registrar](#))

Date	Day	Event
September 1	T	First Day of Classes
September 8	T	Last Day to Add/Drop Classes
November 9	M	Last Day to Withdraw
November 25	W	Friday Classes Meet
November 26 - November 29	R - Su	Thanksgiving Break - University Closed
December 10	R	Last Day of Classes
December 11	F	Reading Day 1
December 14	M	Reading Day 2
December 15-21	T - M	Final Exam Period

Class Participation - Class participation includes, but is not limited to, class engagement; attendance and response to questions during class. This is a discussion driven and student-centered class, students are expected to be actively involved in discussions and other class activities that would generate the robust energy needed for a successful discussion. Active participation includes completing assignments on time, being present for impromptu class discussions and quizzes. Students who record four or more unexcused absences will receive no points for class participation. You are strongly advised to use all means available to contact me if you need to be excused from class in an emergency. When you miss a class, it will be your responsibility to find out what was discussed.

Literature Research/Group Learning - Group learning is a prospective approach to be pursued as part of this course. The objective is to instill creative-problem solving skills, and to relate the concepts of chemistry principles to real-life situations. Students will be grouped into sub-teams and each team is required to diagnose these problems in a team setting during class and provide answers. A typical problem solving class exercise will require analytical, evaluative, or creative thinking. Students would need to explain familiar phenomena in terms of course concepts.

Course Outline

Course Objectives and Learning Outcomes*

1. develop a sound physical understanding of the principles of analytical chemistry
2. show how these principles are applied through laboratory exercises and problem-solving skills, and
3. develop an understanding of the limitations and uncertainties of results using statistics and spreadsheets exercises.

Lecture	Section	Topic	Assignment
1	September 1	Welcome and Introduction to Analytical Chemistry	
2	September 3	Methods & Operations of Analytical Chemistry	
3	September 10	Statistical Manipulation of Analytical Data	
4	September 15	Errors in Chemical Analyses and Spreadsheets	
5	September 17	Gravimetry	
6	September 22	Volumetric Titration	
7	September 24	Chemical Equilibrium & Activity	
8	September 29	Class Interactive Discussion I (Quiz)	
9	October 1	Acid-base Equilibria	
10	October 6	Systematic Treatment of Equilibrium	
11	October 8	Volumetric Calculations, Review for Exam 1	

12	October 13	Midterm Exam I
13	October 15	Acid-Base Titrations
14	October 20	Buffers, Polyprotic Acids
15	October 22	Alphas, Problem Solving
16	October 27	Metal-complex Equilibria
17	October 29	Class Interactive Discussion II (Quiz)
18	November 3	Fundamentals of Electrochemistry
19	November 5	Redox Equilibria and Redox Titrations
20	November 10	Potentiometry, Voltammetry & Electroanalytical Methods
21	November 12	Introduction to Spectrometric Methods
22	November 14	Atomic Spectroscopy
23	November 17	Problem Solving & Review for Exam II
24	November 19	Midterm Exam II
25	November 24	Introduction to Analytical Separations
26	December 1	GC and HPLC
27	December 3	Chromatographic Methods and Capillary Electrophoresis
28	December 8	Mass Spectrometry
29	December 10	Problem Solving & Review for Final Exam

** A learning outcome for CHEM 222 is that, given a citation, students will be able to look up information in a journal article using both Online and traditional print databases. *Integration of Biochemistry across the curriculum, include biochemical examples in the syllabus, lectures and exams. examples in the syllabus, lectures and exams.*

*Updated by Genti Price – August 2020
Department of Chemistry & Environmental
Sciences (CES) Course Syllabus, Fall 2020*