NJIT New Jersey Institute of Technology

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF CHEMISTRY AND ENVIRONMENTAL SCIENCE

CHEM 480-101: INSTRUMENTATION NALYSIS LABORATORY

Fall 2023 Course Syllabus

CHEM 480. INSTRUMENTAL ANALYSIS. 2 CREDITS, 4 CONTACT HOURS (0; 4; 0).

Prerequisite: CHEM 221, CHEM 222 or equivalent with a grade of C or better. Laboratory exploring the principles of operation of modern instruments for chemical analysis. Ultra-violet and infrared spectroscopy, mass spectrometry, gas chromatography, high performance liquid chromatography, voltametry, and potentiometry are among the instruments utilized. Apply calibration methods, statistical data treatment, and sample preparation techniques are applied.

Number of Credits: 2

Prerequisite: CHEM 221, CHEM 222 or equivalent with a grade of C or better

Instructor: Dr. Chaudhery Mustansar Hussain
Office: Tiernan Hall (TIER) 151D
Email: chaudhery.m.hussain@njit.edu

Laboratory time: Wednesdays; 06:00 PM - 10:05 PM
Tiernan Hall (TIER) 205

Office Hours: With an appointment
Please send an email to schedule an appointment.
If you need assistance and wish to discuss with your instructor, please email to schedule a Webex meeting (https://njit.webex.com/meet/hussainnjit.edu or 927 520445.). Additional concerns and questions, you can call on my cell phone 862-215-5781. I will be more than happy to help.

Required textbook: CHEM 480: Instrumentation Analysis Lab Laboratory Manual, available at the NJIT bookstore.

*Textbook "Principles of Instrumental Analysis", 6th ed, by Doglas A. Skoog, F. James Holler, Stanley R. Crouch

REQUIRED MATERIALS

- Safety goggles (available at the NJIT Bookstore or Homedepot). Provided/sometime not Provided
- Disposable nitrile gloves (available at amazon.com or Homedepot). Provided
- Disposable lab coat or you can buy cloth lab coat (available at amazon.com). Not provided
- Lab notebook: (available at the NJIT Bookstore or Homedepot). Not provided

Students are RESPONSIBLE of bringing their own PPE (Lab Coat, Safety Goggles & Nitrile Gloves) to the lab.

LAB REPORT FORMAT

Reports handed in later than the scheduled due date will lose 25% of available pts, 2 weeks after scheduled due date will lose 50% of available pts. If you are having difficulty writing up a lab, please make arrangements with the instructor.

1. **Title: Title of the experiment, submitted to, Instructor name, submitted by your name, the date the report is submitted.**
2. **Introduction/ Theory: Describe the nature and objective of the experimental investigation and the method(s) used.**
3. **Objective and purpose: What is the objective of the experiment? , What was measured and how was the data obtained?**
4. **Chemicals and Apparatus: List all the chemicals used in the experiment, and record the exact amount. Prepare a schematic diagram of the apparatus and identify components.**
5. **Procedures: Cite the reference that describes the details of the experimental procedure. Describe any procedure you used that differs from the cited reference. Specify the precision of the instruments used in the measurements. Identify and define all variables and constants. Specify the quantities that are measured and those that are calculated.**
6. **Results and discussion: State the phenomena observed during the experiment. State the experimental measurements that were made, and what was calculated. Give the equations used for the calculations. Present the experimental data collected and the calculated results in tables and graphs where appropriate.**
7. **Conclusions: What were the results and how do they compare with the literature? Provide approximately two or three concise sentences for each answer.**
8. **References: List all the literature sources used to prepare the report.**

POLICIES

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. ***Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.*** *If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu*

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

Individual grades	
Safety and cleanliness, Participation	10%
Quizzes	20%
Research Project (poster)	10%
Group grades	
Laboratory reports	50%
Oral presentation	10%

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

A	100-90%	**C**	74-70%
B+	89-85%	**D**	69-65%
B	84-80%	**F**	Below 65%
C+	79-75%		

The experiments will be conducted as a group of 3-4 students, as chosen by the instructor. Laboratory reports will be a group assignment, and each group will do an oral presentation on one of the experiments at the end of the semester. Each student is however required to attend and participate in the laboratory, by recording their own notes in their laboratory notebook and helping in keeping the lab safe and clean. In addition, quizzes will be given to each student.

LEARNING OUTCOMES

After completing this course, students will be able to:

- Comply with safety rules in the setting of instrumental analysis laboratory.
- Identify and mitigate potential safety hazards.
- Conduct instrumental analysis chemistry experiments in a safe and clean environment, and properly manage the waste generated.
- Use a laboratory notebook to record scientific experiments, from the planning stage to the observations;
- Demonstrate the ability to use instrumental analysis glassware to perform techniques
- Demonstrate the ability to use analytical equipment such as GC, HPLC, AA and UV etc.
- Apply their knowledge of analytical chemistry principles to solve problems in the laboratory.
- Analyze data and prepare high-quality laboratory reports.
- Present the results of their experiments in a professional and engaging way.
- Learn how to establish an instrumental analysis lab in any industry

SAFETY RULES IN THE LABORATORY

(SAFETY GLASSES MUST BE WORN AT ALL TIMES)

- **If the fire alarm sounds, leave the building immediately.**
- **Always conduct yourself in a professional manner. Have fun while working in the laboratory, but refrain from activities that might be dangerous to you or your neighbor.**
- **You must learn where the safety equipment is and how to use each item during the first day in class. In the event of an emergency, you should use whatever you need to address the emergency. Again, you do not need to ask for permission to respond to an emergency. Usually, your response will be to advise your TA and instructor and then follow his/her instructions. As a general rule, and if time permits, students should not attempt to provide first aid but should concentrate on contacting a professional (x3111 for emergency) in that area.**
- **No consumption of food (including gum) or beverages will be allowed.**
- **You are not to perform any unassigned experiments.**
- **Do not use your mouth to fill pipettes.**
- **If something is spilled on you, wash it off immediately with lots and lots and lots of water, and then report to the TA. Clean up the spill later according to instructions from the TA.**
- **Uncontrolled long hair or clothing (loose sleeves, ties, jewelry) that might come in contact with a flame or become entangled in mechanical equipment will not be permitted. You will not be permitted to work in the lab without protection for your feet (no sandals, for example).**

- **Never heat a closed system. It may result in an explosion.**
- **Never heat flammable materials with an open flame or near an ignition source.**
- **Do not heat or mix anything near your face (or anyone's face).**
- **Review the hazards of all reagents for an experiment before you start, so you know how to respond to an emergency. The SAFETY DATA SHEETS (SDS) for each reagent we use are available on the Internet (Consult Fischer Scientific Website www.fischersci.com). You are encouraged to review any MSDS any time you have a question. You should also note that a considerable amount of safety information is on the reagent labels. Read them before you use the reagent.**
- **Do not rub your eyes with your hands. Your hands are frequently contaminated.**
- **Protective clothing (lab coat) is not required, but highly recommended. You will not be permitted to work in the lab in shorts and without protection for your legs and feet.**
- **You cannot tell when glass and other objects are hot by looking at them. Be careful and don't get burned by trying to pick up something that is hot.**
- **Do not store reagents near a sink or leave them near the balance where they will be in the way and get knocked over. Return all reagents to their proper location as soon as possible after you have finished with them. Be sure everything is returned to its original location before you leave and that you have left nothing in the balance room, in a fume hood or at some other location.**
- **Be sure you know where the safety equipment is located so you can find and use each item in an emergency (if the power fails, and the lab is dark, for example).**
- **Be sure that, in an emergency, you know how to turn off all of the utilities (gas, water, electricity) you have been using.**
- **Never attempt to identify an unknown by smelling or tasting it as recommended in some (especially old) textbooks.**
- **Use the appropriate safety equipment (safety shield, gloves, fume hood, shower, eye wash, etc.) and supplies as needed. Be sure any supplies you use are promptly replaced so they are available for the next emergency. It may be you again.**
- **Read all chemical labels prior to use. Be sure you know what you are using.**
- **Do not store chemicals near non-compatible chemicals (acids with bases or oxidizers with fuels, for example) even for short periods of time. 23. Transport and dispose of all chemicals properly. If you are not sure how to do so, ask your TA.**
- **Do not use chipped or broken glassware. Broken glassware will not be accepted at the end of the course and should be replaced during check-in or as soon as it is broken.**
- **Do not operate electrical equipment with wet hands.**
- **Do not wear contact lens to the laboratory.**
- **The EMERGENCY telephone number is 9-1-1 for university security/safety, x3568 for the department office.**

THE NJIT HONOR CODE WILL BE UPHELD, AND THAT ANY VIOLATIONS WILL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE DEAN OF STUDENTS. STUDENTS WILL BE CONSULTED WITH BY THE INSTRUCTOR AND MUST AGREE TO ANY MODIFICATIONS OR DEVIATIONS FROM THE SYLLABUS THROUGHOUT THE COURSE OF THE SEMESTER.

Email Policy: In accordance with College policy, the instructor will use your NJIT email address (@njit.edu) and Canvas to communicate with you about all course-related matters. Please make sure

that you check these accounts regularly.

Make-up Laboratory or Quizzes Policy: There will be **no make-up laboratories or quizzes** during the semester. In the event that a student has a legitimate reason for missing an exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the laboratory and/or quiz, 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 laboratory period will be missed so that appropriate steps can be taken to make up the grade.

In addition, any medical excuse that can be taken into consideration (after receiving confirmation from NJIT Dean of Students office) and the purpose of medical excuse is to grant student an extension on any missing class assignments or quizzes without penalty.

Syllabus modification: Any modification of this syllabus will be distributed in class and via e-mail.

Cellular Phones: All cellular phones and other electronic devices must be switched off during all lab 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: **O**ffice of **A**ccessibility **R**esources and **S**ervices (***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/studentsuccess/disability-support-services/

Important Dates See: Fall 2023 Academic Calendar, Registrar
https://www.njit.edu/registrar/fall-2023-academic-calendar

Sept	4	Labor Day. University Closed
Sept	5	First Day of Classes
Sept	11	Last Day to Add/Drop a Class
Sept	11	Last Day for 100% Refund, Full or Partial Withdrawal
Sept	12	W Grades Posted for Course Withdrawals
Sept	18	Last Day for 90% Refund, Full or Partial Withdrawal - No Refund for Partial Withdrawal after this date
Oct	2	Last Day for 50% Refund, Full Withdrawal

Oct	23	Last Day for 25% Refund, Full Withdrawal
Nov	13	Last Day to Withdraw from Classes
Nov	21	Thursday Classes Meet
Nov	22	Friday Classes Meet
Nov	23	Thanksgiving Recess Begins. No Classes
Nov	26	Thanksgiving Recess Ends
Dec	13	Last Day of Classes
Dec	14	Reading Day 1
Dec	15	Reading Day 2
Dec	16	Saturday Classes Meet
Dec	17	Final Exams Begin
Dec	23	Final Exams End
Dec	25	Final Grades Due

COURSE OUTLINE

	LABORATORY EXPERIMENTS	**INSTRUMENTATION REQUIRED**	**REPORTS**
Week One	CHECK-IN & Safety Lecture		
Exp. 1	Spectrophotometric analysis of a soft drink	Shimadzu -1800 UV-VIS Spectrophotometer	
Exp. 2	Simultaneous determination of dichromate and permanganate	Shimadzu 1800 UV-VIS Spectrophotometer	Report (Exp 1)
Exp. 3	Determination of zinc in cooked beans	Shimadzu AA-7000	Report (Exp 2)
Exp. 4	Analysis of commercial analgesic tablets by HPLC	Shimadzu HPLC-20AT	Report (Exp 3)
Exp. 5	Gas chromatographic separations	Shimadzu GC 3900 FID	Report (Exp 4)
Exp. 6	Determination of water content in paint	Shimadzu GC -TCD– 8A	Report (Exp 5)
Exp. 7	**GCMS Demonstration** (Confirming the Molecular Mass and Structure of a Reaction Product)	Shimadzu GCMS-QP2010	Report (Exp 6)
	Trip to NJIT York center/CES all labs instruments		
	Presentation		

Each laboratory period will begin with a 30-minute discussion of the theory and procedure of the experiment, as well as safety reminders. Then there will discussion questions
Experiments will be performed in groups and simultaneously two instruments

Laboratory notebook guidelines:

This is a research journal. In it you will record exactly what you did. Below is the format you will use:

- Fill in all sections on the top of the page on every page you use.
- Before you come to class:
    - List all chemicals you will be using in the lab in your notebook. Include the chemical name, the chemical formula, and the CAS number.
    - Copy the reaction scheme
    - Make a table showing the physical properties of the reagents
    - Outline the experimental procedure, objectives and safety in your laboratory notebook.

The instructor will verify and initial this entry and your Lab Manual at the beginning of each class. Failure to complete the list and provide your lab manual will result in a maximum of 10-point penalty.

The laboratory notebook is a journal that records your activities in the lab in detail. It is written in "stream of consciousness"; that is...as it is happening. You should record:

- Everything you do in enough detail that a stranger could reproduce your work using only your lab notebook as a guide.
- All observations as you see them.
- All values including masses, lengths, pressures, volumes...etc using correct significant figures and units.
- All calculations. Any calculations should be done in your notebook. If they are done outside of class, you should submit the carbon copies of the work in the next lab session.
- Before leaving class you must:
    - Sign and date the bottom of every completed page
    - Have the instructor sign your last notebook page completed in the lab session.
    - Submit the carbon copies of your notebook pages for that lab session.

Corrections to the notebook

Mistakes will occur when recording data as you collect it. The proper way of correcting mistakes in a laboratory note is to cross out the mistake with a single or double line as seen below and initial the correct entry. Do not scribble out mistake. The mistake must be clearly readable under the line. (This is a legal requirement because laboratory notebooks are legal documents admissible as evidence in court) Cross out mistake and initial it.

Unused space on notebook page

When you are done with a page, you must draw a diagonal line through any blank unused places on the page before you sign, date and submit the carbon copy. This is also a legal requirement. It prevents anyone from adding additional information to the page after the fact.

Remote and converged Teaching

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 in regard to 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**.