Chemistry 105: Analytical & Physical Chemistry Methods

This is primarily an experimental chemistry course. Nine experiments are specifically designed for those who want to acquire basic knowledge and experimental stills in analytical and physical chemistry. Through this course, students will learn how to properly acquire and analyze data, and how to write standard lab reports. Lecture topics include: Data and error analysis, analog electronics, advanced solution equilibria, potentiometric analysis, chromatographic separations, optical (UV-Visible) spectroscopy, and lasers.

Textbook: *Principles of Instrumental Analysis.* Skoog, Holler, and Nieman, 5th, 6th, or 7th edition and the lab manual.

Prerequisite: CHE 110A or CHE 107B

Grading:

You will be graded by your performances in the following areas:

• Lab reports	800 points
• Lab practical	100 point
• TA evaluation of lab manner:	100 points
• Midterm (about chemical principles taught in the lectures):	400 points
• Final (about chemical principles taught in the lectures):	600 points
Total:	**2000 points**

Lecture:

Following is a tentative guideline of the lectures to be given - subject to change:

Week 1: **Introduction** | Laser Training | Electronics
Week 2: Data Analysis | Data Analysis
Week 3: Electroanalytical chemistry | Electroanalytical chemistry
Week 4: Electroanalytical chemistry | Gas chromatography
Week 5: Gas chromatography |
Week 6: Gas chromatography | Light and chemistry
Week 7: Spectroscopy and lasers | Spectroscopy and lasers
Week 8: Semiconductor lasers | Semiconductor Lasers
Week 9: Atomic system and spectroscopy | Emission spectroscopy
Week 10: Emission spectroscopy | Overview

Experiments

1. **Analog Electronics**: Examining the properties and uses of operational amplifiers.
2. **Standardization of HCl**: Preparation of standard HCl.
3. **Potentiometry**: Determination of an unknown Soda Ash: The unknown soda ash which contains sodium carbonate and an inert substance is to be titrated with standard HCl using a potentiometric (pH) end point measured with a pH meter employing a pH glass electrode.
4. **Gas Chromatography**: Separation of analytes with GC.
5. **Principles and Properties of Semiconductor Lasers**: Semiconductor lasers and optical elements, their construction, operation, and applications
6. **Trace Metal Analysis of Coffee:** Using MP-AES to determine amount of trace metals.
7. **Absorption spectroscopy of conjugated dyes**: This experiment investigates the absorption spectra of a series of 3, 3'-diethylcyanine iodide dyes
8. **UV-VIS spectroscopy**: Determination of Protein Concentration in Solution: Determination of the absorbance of proteins using absorption spectroscopy.
9. **Atomic absorption spectroscopy**: Using hollow cathode lamp sources and a monochromator to determine the absorbance and concentration of Fe and Mn neutrals produced in a flame.

Each laboratory report will be due **one week** (by the end of your session) after the experiment.

All laboratory reports must be turned in to pass the course. Late reports will be deducted 20 points for each day. You have until the last day of instructions to turn in all late reports. Late reports with zero value must still be turned in to pass the course.