B.A. Junior Year – Spring Semester

CEM 333 Instrumental Methods and Applications

Description: Principles and applications of instrumental analysis.

Credit: 3 Credits (2 hours lecture and 3 hours laboratory per week)

Prerequisite: CEM 262 or (CEM 162 and BLD 213L and BLD 313) and (CEM 143 or CEM 251 or CEM 351) and completion of Tier I writing requirement.

Lecture topics:

Theory, background, and instrumentation for the techniques used in the laboratory experiments.

Experiments:

No formal laboratory reports. Student report results on report sheet (provided) and answer questions.

1. **UV-Vis Spectrometry**
   (Investigation of spectrometer components, spectral response curve, and Beer's law)
2. **Molecular Fluorescence Spectrometry**
   (Determination of fluorescence sensitivity and Zn^{2+} concentration, standard additions)
3. **Infrared Spectrometry**
   (Components of an FTIR instrument; solid sample preparation: KBr pellet and nujol mull; analysis of solid, liquid and gas samples; identification of unknowns from FTIR spectra)
4. **Atomic Absorption Spectrometry**
   (Comparison of flame and graphite furnace AA for quantitation of aqueous metal ion solutions; examination of matrix effects)
5. **Atomic Emission Spectrometry**
   (Use of ICP-OES to determine the concentration of metals in a multivitamin)
6. **Stripping Voltammetry**
   (Determination of trace amounts of Cd, Cu, and Pb ions in water samples; electrochemical bench)
7. **Potentiometry**
   (Redox titration; buffering capacity analysis using pH electrode; determination of $[Na^+]$ and effect of interfering ions using ion selective electrode)
8. **Gas Chromatography**
   (Quantitative and qualitative analysis of alcohol mixture; comparison of polar and non-polar columns; use of TCD, FID, and ECD; separation optimization using temperature programming)
9. **Liquid Chromatography**
   (Flow rate optimization; quantitative analysis of a mixture of PAH's using an internal standard; use of an HPLC simulation program to investigate the effects of various paraments on chromatographic separation)
10. **Mass Spectrometry**
    (GC/MS separation and identification of aromatic molecules; tour of mass spectrometry facility)

Practicum:

Students work in pairs on a quantitative analysis problem which is assigned mid-semester. They are responsible for searching the literature for an appropriate method for solving the problem; writing a proposal, collecting and analyzing the data during the final two weeks of lab; and preparing a report of their findings.