**CHEM 5220 -ADVANCED ANALYTICAL CHEMISTRY II**

**Text:** Contemporary Instrumental Analysis, 2000 ed., by Rubinson & Rubinson.

**Pre-requisite:** One year of analytical chemistry

**Course Description:** In this course we discuss the general instrumental analytical process, sampling, sample preparation, electronics and noise, and the principles of contemporary instrumental analysis. Our main concern is to understand the chemical processes occurring in each instrument. The following instrumental analysis methods will be introduced: Electrochemical Analysis, infrared and Raman spectrometry, Atomic spectrometry, Mass spectrometry, and Chromatography. We assume a certain level of preparation in math and physics; basic algebra and knowledge in general chemistry.

I. Introduction

- Analytical methodologies

- Measurements and errors analysis

- Figures of merits

- Analytical literature

II. Elementary Electronics, Microprocessors, and Computers

- Elementary electronics

- Digital electronics

- Noise

- Signal-to-Noise enhancement

- Microprocessors and computers in analytical instrumentation

III. Instrumentation for Optical Measurements

- Radiation sources

- Wavelength selectors: filters, monochromators

- Sample handlers

- Detectors

- Data handling

IV. Molecular Ultraviolet and Visible AbsorptionSpectroscopy

- Principles

- Definitions

- Quantitation

- Instrumentation

- Applications

V.Molecular Emissions, Fluorescence, Phosphorescence, Chemiluminescence

- Principles of the emission process

- Quantitation

- Instrumentation

- Application

VI. Atomic Absorption

- Principles of atomic absorption

- Atomization methods: flame, electrothermal

- Instrumentation

- Applications

VII. Atomic Emission

- Principles of atomic emission

- Atomization methods: flame, plasma, arc, spark

- Instrumentation

- Applications

VIII. Infrared Absorption and Raman Spectroscopy

- Principles of IR and Raman Spectroscopy

- Instrumentation

- Application

IX. Surface Techniques

- X-ray methods

- Electron spectroscopy

- Mass spectrometric methods

X. Electroanalytical Chemistry

- Terms and definitions

- Electrochemical cells

- Electrode potentials, cell potentials

- Calculations involving potentials

- Potentiometric methods

- Coulometric methods

- Voltammetry and polarography

- Conductometric methods

XI. Separation Techniques

- Principles, definitions

- Gas chromatography:

principles, instrumentation, applications

- Liquid chromatography:

principles, instrumentation, applications

- Planar chromatography:

TLC, paper, misc.

XII. Modern Advances in Analytical Chemistry

- Survey of advances in analytical techniques through analytical literature