Instrumental Analysis

Course Code	Course Num.	Course Name	Credit Hours	Lec	Lab	Tut	Prerequisites
CHM	332	Instrumental Analysis	4	2	3	1	CHM 231

Objectives:

- Improve the students' knowledge of the instrumental analysis by providing them with basic concepts, functionality of different instrumental techniques.
- Develop their hand on skills to use the different instruments and obtain results using appropriate techniques.

Syllabus:

Electromagnetic spectrum, relationships between frequency, wavelength and E, and absorption and emission spectroscopy. Components of an optical spectrometer.

Energy levels, selection rules, instrumentation, hollow cathode lamps. Sample atomization, flame and graphite furnace. Emission of radiation, ground and excited states, flame photometer, instrument anatomy, alkali metal emission spectra. Inductively Coupled Plasma (ICP), comparison with flame photometry, instrument anatomy and components function .

Ultra violet and visible spectroscopy, ultraviolet and visible regions of electromagnetic spectrum, Spacing of electronic levels and electronic. Calibration curve, comparative and standard addition method. Infrared spectroscopy Dipole moment, molecular stretching and bending vibrations, instrumentation, solid, liquid and gaseous sample preparation for IR analysis. Raman spectroscopy polarizability change, comparison of IR and Raman, Raman spectrometer, Stokes and anti-Stokes lines.

Molecular orbitals, absorption and emission, singlet and triplet states, fluorescence, phosphorescence.

Theory and Instrumentation. Behavior of charged particles in electric and magnetic fields. Mass Spectroscopy Spectrum.

Spin and magnetic quantum numbers. Relationship between nuclear spin and magnetic field H0. The absorption process, Larmour frequency. shielding and chemical shift. H-NMR, peak position and proton environment. Spin-spin splitting, effect of exchange. Procedures for simplifying the spectrum. 13C-NMR, chemical shift, methods of improving the weak 13C-NMR, hetero-nuclear spin- spin splitting of 13C peaks.

X-ray fluorescence. Energy levels leading of X-ray emission. Auger electrons, absorption edges. Instrumentation, production of electrons and X-rays, XRF.

The Nernst equation, cyclic voltammetry, the standard hydrogen and the calomel reference electrodes. pH and other ion-selective electrodes, Polarography, significance of id and ?E½. Dropping, mercury electrode.

Textbook:

Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler & Stanley R. Crouch, 6th edition, Thompson Learning Academy

References:

Quantitative Chemical Analysis, Daniel C. Harris, 8th edition, W. H. Freeman & Co., New York