KAT 241/3 Analytical Chemistry II

Course Objective: To gain some familiarity with the fundamental principles and applications of spectrochemical, separation and electrochemical methods.

Topic	Content	Number of lecture hours	Expected outcome – upon completion of the course, the student should be able to:
1. Spectrochemical Methods	• An introduction to spectrochemical methods	1	• Understand the electromagnetic spectrum, its properties and common spectroscopic methods based on electromagnetic radiation. • Differentiate between atomic and molecular absorption. • Understand Beer's law and its limitations. • Understand emission spectra including emission by fluorescence and phosphorescence.
	• Instruments for optical spectrometry	3	• Understand the components of the instrument including optical materials, spectroscopic sources, wavelength selectors, radiation detectors and transducers. • Differentiate between single and double beam instruments.
	• Molecular absorption spectroscopy	3	• Understand the absorbing species for ultraviolet (UV) and visible molecular absorption spectroscopy. • Discuss the absorption characteristics of some common organic chromophores. • Know typical instruments for absorption measurements including photometers, spectrophotometers, single-beam, double-beam and multichannel instruments. • Explain the qualitative and quantitative applications of UV/Vis spectroscopy. • Understand the infrared absorption spectroscopy including infrared (IR) absorption spectra, IR instruments, qualitative applications of IR spectrophotometers, and quantitative IR photometry and spectrophotometry.
	• Molecular fluorescence spectroscopy	2	• Understand the theory of molecular fluorescence including relaxation processes and fluorescent species. • Understand the effect of concentration on fluorescence intensity. Know fluorescence instruments, applications of fluorescence methods including methods for inorganic species and methods for organic and biochemical species.

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	• Atomic spectroscopy	3	• Explain the sources of atomic spectra including emission spectra and absorption spectra. • Understand spectroscopy based upon flame atomization including flame atomizers, properties of flame and flame AAS. • Know the instrument for AAS, interferences in AAS and quantitative analysis by AAS. • Know flame emission spectroscopy. • Understand the atomic spectroscopy with electro thermal atomizers, hydride generation techniques and cold vapour Hg. • Discuss the atomic emission methods based on plasma sources.
2. Separation Methods	• An introduction to solvent extraction and chromatographic methods	3	• Understand solvent extraction as a separation method. • Understand the theoretical aspects of chromatographic methods. • Understand the relationship between band broadening and column efficiency. • Use chromatography for qualitative and quantitative analyses.
	• Gas chromatography (GC)	5	• Know the components of the instrument for gas chromatograph including the sample-injection system, the column and the detectors. • Distinguish several types of columns and detectors and select the right column and detector for specific samples. • Appreciate the applications of gas chromatography for qualitative and quantitative analyses.
	• High-performance liquid chromatography (HPLC)	4	• Know the components of the instrument for HPLC including the sample-injection system, the column and the detectors. • Understand several types of HPLC columns and detectors. • Compare between partition, adsorption, ion exchange, size-exclusion chromatography. • Compare between HPLC and GC.
3. Electrochemical Methods	• Potentiometry	6	• Understand the Nernst equation and the working principles of ion selective electrodes (ISE). • Glass electrodes, pH. • Examples of ISE.
	• Voltammetry	6	• Understand the Ilkovic equation and polarographic methods. • ASV, DPP
TOTAL		**36**	