Minnesota State University Moorhead

CHEM 480: Analytical Chemistry II

A. COURSE DESCRIPTION

Credits: 4

Lecture Hours/Week: 3

Lab Hours/Week: 3

OJT Hours/Week: *.*

Prerequisites: None

Corequisites: None

MnTC Goals: None

Instrumental analysis involving chromatography, spectroscopy and electrochemical techniques. QA/QC addressed. (3 lecture credits, 1 lab credit)

B. COURSE EFFECTIVE DATES: 05/18/1999 - 02/01/2020

C. OUTLINE OF MAJOR CONTENT AREAS

1. Introduction to Analytical Separations
2. Gas Chromatography
3. High-Performance Liquid chromatography
4. Capillary Electrophoresis
5. Fundamentals of Electrochemistry
6. Electrodes and Potentiometry
7. Electroanalytical Techniques
8. Mass Spectroscopy
9. Nuclear Magnetic Resonance

D. LEARNING OUTCOMES (General)

1. Understand the mechanisms involved in the separation techniques; gas chromatography, liquid chromatography and capillary electrophoresis. Define the parameters characterizing the separation processes such as resolution, efficiency, selectivity, retention factor. Interpret peak shapes in chromatography and apply methods for improving asymmetrical shapes. Understand the derivation and utility of Van Deemter equation.
2. Apply dynamic processes in electro-analytical chemistry for qualitative and quantitative analysis. Understand the principles and practice of specific techniques; electro-gravimetry, coulometry, amperometry, voltammetry, polarography, pulsed voltammetric techniques (NPP, DPV, SWV), anodic stripping voltammetry and cyclic voltammetry.
3. Demonstrate a detailed understanding of the heterogeneous equilibrium at electrode surfaces, including redox half reactions, electrode potential calculations, measurements and physical interpretation. Understand the fundamentals of potentiometry, ion selective electrodes, potentiometric selectivity of ISEs, Nicholsky equation, asymmetry potentials, junction potentials.
4. Perform laboratory techniques using GC, LC, potentiometry, pulsed voltammetry, for quantification of analytes in with real life samples with the appropriate use of ; external standard, internal standard and standard addition calibration methods.
5. Understand HPLC systems and Capillary Electrophoretic systems; the experimental parameters, instrumentation and molecular mechanisms involved in their analytical separations process. Understand the principles behind the optimization of analytical protocols.
6. Understand the origin of NMR spectra. Demonstrate knowledge of the instrumentation and the process of the raw acquisition of pulsed-NMR signals to generation of FT-NMR spectra. Understand the use of different ionization techniques on mass spectroscopy. Perform quantitative NMR.
7. Understand the origin of mass spectral peaks. Understand the effect of different ionization techniques on mass spectroscopy. Understand the different types of mass analyzers employed in MS. Understand the analytical utility of total ion current and single ion monitoring in gas chromatography-mass spectroscopy.
8. Understand the physical principles involved in the design of the major instrumental components of chromatography equipment. Understand the column chemistries utilized in the separation techniques. Optimize separations by isothermal, isocratic, temperature programmed and solvent programmed procedures. Use Kovat¿s Retention index of analytes and McReynolds constants for columns.
9. Use spectroscopic instruments in quantification of analytes via calibration methods; external standard, internal standard and standard addition procedures.

E. Minnesota Transfer Curriculum Goal Area(s) and Competencies

None

F. LEARNER OUTCOMES ASSESSMENT

As noted on course syllabus

G. SPECIAL INFORMATION

None noted