



King Saud University
Department of Chemistry

CHEM 350

Instrumental Methods of Analysis

First Semester 1446 (2024/2025)



Credit Hours: 4 hours (2+2)

Time: Lecture: Sun & Tue 08:00–08:50, Lab: Tue 02:00–05:50

Lecture Theater: Building No. 5 (A 057 1 05 0140)

Instructor: Dr. Ahmad Aqel

Web Site: faculty.ksu.edu.sa/en/aifseisi/home

Office No.: 2A/149, AA/53, & 2A127

Office Hours: Sun & Tue: 11:00–12:00, Mon & Wed: 10:00–12:00 and by appointment

E-mail: aifseisi@ksu.edu.sa

Teaching Assistant: Dr. Turki Alkhulaiwi

Prerequisites: CHEM 101 or 103

Course Objectives ...

The main purpose of this course is to help the students to learn and understand several concepts in spectroscopic and electro-analytical methods. By the end of this course, students expected to:

- Define the basic principles of electromagnetic radiation.
- Be familiar with some of the spectroscopic techniques such as fluorometry, phosphorometry, and chemiluminescence.
- Describe the basics of molecular and atomic spectrometry.
- Know the proper analysis tool for specific metals or compounds.
- Define the basic principles of electro analytical techniques.
- Recognize the theory of the three main categories electro analytical methods; potentiometry, coulometry, and voltammetry.
- Interpret the spectroscopic and electrochemical experimental data.

This course also designed to give students the opportunity to perform and evaluate different spectroscopic and electro-analytical experiments, to identify various standard compounds, and to deal with some traditional and modern analytical instruments.

Course Description ...

This course is designed to provide principles and practical experience in spectroscopic and electro-analytical methods for BSc students. The course consists of two hours lecture and two hours lab per week. Lectures and experiments provide the fundamentals needed to understand the techniques and instrumentations involved in these powerful analytical tools.

Textbook & References ...

- 1- Douglas A. Skoog, F. James Holler, Stanley R. Crouch, Principles of Instrumental Analysis, 7th ed., 2018, Cengage Learning, USA.
- 2- Ibrahim Al-Zamil, "Analytical Chemistry, Instrumental Analysis" 5th Ed., Al-Khrigi Publisher, 2015 (in Arabic).
- 3- G.D. Christian, P.K. Dasgupta, K.A. Schug, "Analytical Chemistry", 7th Ed., John Wiley & Sons, 2013.

Course Contents (Lecture) ...

The course includes series of lectures and experiments covers the following subjects:

- Interaction of electromagnetic radiation with matter.
- Basic principles of molecular and atomic spectrometry.
- Spectrometric instrumentation.
- Atomic absorption, emission and fluorescence spectrometry.
- Basic principles of electro analytical techniques.
- Potentiometry and potentiometric titrations.
- Coulometry and conductimetry.
- Voltammetry and related techniques.

Course Contents (Laboratory) ...

During this practical course, students will be exposed to some traditional and modern techniques for analysis of several chemicals. Various spectroscopic and electro chemical techniques such as AAS, AES, ICP, and other instruments for measuring cell potential and voltage will be included. Each experiment consists of general principles, components of the system and applications.

Experiments of Instrumental Analysis

Spectroscopic methods and applications

Experiment Number 1
Spectrophotometric determination of manganese

Experiment Number 2
Spectrophotometric determination of permanganate and dichromate mixture

Experiment Number 3
Spectrophotometric determination of total iron (Fe^{2+} , Fe^{3+}) using 1,10-phenanthroline and determine the molar absorptivity (ϵ)

Experiment Number 4
Spectrophotometric study of complexometric compounds

Experiment Number 5
Determination of preservatives (benzoic acid) in soft drinks by molecular absorption of UV spectroscopy

Experiment Number 6
Determination Na and K in drinking water using flame atomic emission

Experiment Number 7
Optimize determination of Ca using flame atomic absorption

Electroanalytical methods and applications

Experiment Number 8
Determination of phosphoric acid using pH titration

Experiment Number 9
Potentiometric titrations of oxidation-reduction reactions between (Fe^{2+} and Ce^{4+})

Experiment Number 10
Polarographic study of metals

Experiment Number 11
Amperometric titration of lead with dichromate using dropping mercury electrode

Experiment Number 12
Conductimetric titration

Evaluation & Assessment ...

Midterm exam	20%
Assignment, discussion, homework's & attendance	10%
Laboratory (reports & quizzes)	30%
Final exam (comprehensive)	40%

Good Luck!