Course Specifications

Course Title:	Methods for Spectroscopic and Electrochemical Analysis
Course Code:	542CHEM-2
Program:	Master of science in Chemistry
Department:	Chemistry
College:	Science
Institution:	King Khalid University

Table of Contents

A. Course Identification

1. Credit hours:	2
2. Course type	
a.	University ☐ College ☐ Department ■ Others ☐
b.	Required ■ Elective ☐
3. Level/year at which this course is offered:	Level 2 / Year 1
4. Pre-requisites for this course (if any)**:**	No pre-requisite
5. Co-requisites for this course (if any)**:**	No co-requisite

No	Mode of Instruction	Contact Hours	%Percentage
1	Traditional classroom	1	50
2	Blended	0	0
3	E-learning	1	50
4	Correspondence	0	0
5	Other	0	0

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	15
2	Laboratory/Studio	0
3	Tutorial	15
4	Others (specify)	0
	Total	30
Other Learning Hours*		
1	Study	30
2	Assignments	30
3	Library	15
4	Projects/Research Essays/Theses	5
5	Others (specify)	0
	Total	80

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

In general, Analytical Chemistry divided into types and methods. Types are quantitative analysis and qualitative analysis. Methods are divided into two; classical methods (volumetric and gravimetric) and instrumental methods (Spectroscopy, Electrochemistry, Thermogravimetry and Chromatography). This course focuses on two branches of instrumental methods; Spectroscopy and Electrochemistry. Spectroscopy branch divided into four sub-branches based on light behavior when interacting with matter, which are absorption, emission, scattering and refracting. While, Electrochemistry divided into five branches based

on electric characteristics of the matter, which are Coulometry, Conductometry, Amperometry, Voltammetry and Polarography.

This course aims to introduce to the students the advanced techniques of both Spectrophotometric and Electrochemical techniques and their applications. Molecular absorption spectroscopy (UV-Vis. and IR). Fluorescence Spectroscopy; Molecular fluorescence, phosphorescence and chemi- luminescence, spectroscopy. Atomic spectrometric methods based on absorption, Emission spectroscopy, and X-ray spectroscopy. Principle of Inductively Coupled Mass Spectroscopy (ICPMS) and Inductively Coupled Optical Emission. Spectroscopy (ICP-OES) Electrochemistry branches are Potentiometric Analysis, Polarography, Amperometry; Coulometry; Conductometry.

2. Course Main Objective

The aim of the course is to enable students to understand the separation methods. The separation methods will include liquid chromatography, gas chromatography and electrophoresis. Students should recognize the different between chromatography methods and their applications

By the end of this course, the student should be able to:

1. Identify the advanced techniques of Spectrophotometric Analysis.
2. Describe the different methods of Electrochemical Analysis.
3. Indicate the main components of spectrophotometer, types of electrodes and cells used for potentiometric, conductometric, voltametric, polarographic, and Amperometric analysis
4. Analyze UV and Visible spectra and chromatograms.
5. Solve spectrophotometric and electrochemical problems.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	To gain the knowledge of the fundamental concepts and principles of spectroscopy and Electrochemistry.	K1, K2, K3
1.2	To understand various applications related to the Spectroscopy & Electrochemistry methods	K1, K2, K4
2	**Skills :**	
2.1	To analyze, interpret and explain the Spectroscopy & Electrochemistry methods in the course topics.	S1, S2
2.2	To use gained knowledge to develop and/or apply specific Spectroscopy & Electrochemistry methods.	S1, S2, S3
3	**Competence:**	
3.1	To present an oral explanation for a subject in the aspect of application	C1,C2, C3 and C4
3.2	To interact positively with colleagues in a group work.	C2, C3 and C4
3.3	To contribute with colleagues to prepare and deliver a presentation and report of group work	C2
3.4	To summarize the literature and sources for a specific topic in the course.	C4

C. Course Content

No	List of Topics	Contact Hours
1	Molecular absorption spectroscopy (UV-Vis. and IR).	2
2	Molecular fluorescence, phosphorescence and chemi-luminescence, spectroscopy.	2
3	Atomic spectrometric methods based on absorption	2
4	Emission spectroscopy.	2
5	X-ray spectroscopy.	2
6	Fluorescence Spectroscopy	2
7	Principle of Inductively Coupled Optical Emission Spectroscopy (ICP-OES)	2
8	Principle of Inductively Coupled Mass Spectroscopy (ICPMS)-1	2
9	Principle of Inductively Coupled Mass Spectroscopy (ICPMS)-2	2
10	Potentiometric Analysis	2
11	Polarography	3
12	Amperometry	3
13	Coulometry	2
14	Conductometry	2
Total		30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	To gain the knowledge of the fundamental concepts and principles of Spectroscopy & Electrochemistry methods	Lectures, interactive teaching sessions, Tutorials, problems solving sessions	Written exams, electronic quizzes, Oral discussion and examinations
1.2	To understand principles of separation methods and link them to the applications		
2.0	**Skills**		
2.1	To analyze, interpret, and explain the Spectroscopy & Electrochemistry methods in Analytical Chemistry	Lectures, problems solving sessions	Written exams
2.2	To use the gained knowledge to develop Spectroscopy & Electrochemistry methods.		Oral discussion,
3.0	**Competence**		
3.1	To present an oral explanation for a subject in the field.	Demonstration of basic skills on oral presentation.	Oral presentation.
3.2	To interact positively with colleagues in a group work.	Interactive teaching sessions	Oral presentation on a group report
3.3	To contribute with colleagues to prepare and deliver a presentation and report of group work	Interactive teaching sessions	Discussion within a group
3.4	To summarize the literature and sources for a specific topic in the course.	Guided reading of books and articles	Written Reports and summaries

2. Assessment Tasks for Students

#	*Assessment task	Week Due	Percentage of Total Assessment Score
1	Written Reports and summaries	5th	10
2	Oral discussion	8th	5
3	Presentations and reports	4-7th	5
4	Midterm exam-1	6th	15
5	Midterm exam-2	11th	15
6	Final exam	16th	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

10 office hours are offered for students for individual consultations. Communications are available on-site, phone conversations, and chatting by social media.in addition, each student has scientific guide presents the required academic counseling

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1. by Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch, Fundamentals of Analytical Chemistry, Ninth Edition Publisher: Mary Finch, 2004. 2. Skoog, Holler, Crouch,. Principles of instrumental analysis 6th ed.Thomson Brooks. 2007
Essential References Materials	1. by Gary D. Chastain James E. O'Reilly Surfaces, G. Attard, C. Barnes, Instrumental Analysis Oxford University Press Oxford, 2004. 2. Harris, Quantitative Chemical Analysis 8th edition-1982.
Electronic Materials	1- https://pressbooks.bccampus.ca/chem1114langaracollege/chapter/1-3-laboratory-techniques-for-separation-of-mixtures/
Other Learning Materials	No other learning materials.

2. Facilities Required

Item	Resources
Accommodation Classrooms, laboratories, demonstration) (.rooms/labs, etc	Classroom and computer lab
Technology Resources AV, data show, Smart Board, software,) (.etc	Accessible databases
Other Resources Specify, e.g. if specific laboratory) equipment is required, list requirements or (attach a list	-

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Course delivering	Student	Questionnaire
Course contents (update)	Plan and curriculum committee	Report
Teaching materials	Faculty	Meeting
Learning materials	Student	Discussion
Assignment	Program instructor and Faculty	Report
Exams	Program instructor and Faculty	Report

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Chemistry Department Council**
Reference No.	**Session number 22**
Date	**27/04/2021M / 15/09/1442H**