هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	Spectrophotometric and Electrochemical techniques
Course Code:	4023555-3
Program:	Chemistry
Department:	Chemistry
College:	Faculty of Applied Science
Institution:	Umm Al-Qura University

Table of Contents

A. Course Identification

1. Credit hours:
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: 5th level/3rd year
4. Pre-requisites for this course (if any)**: Volumetric and Gravimetric Analysis Chemistry**
5. Co-requisites for this course (if any)**:**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	2hrs	74%
2	**Blended**		
3	**E-learning**	8hrs	26%
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	22
2	**Laboratory/Studio**	30
3	**Tutorial**	
4	**Others** (specify)	15
	Total	67

B. Course Objectives and Learning Outcomes

1. Course Description

The students will be mentioned to prepare an essay or a report from literature using the library, data base services, and/or websites to follow up and update the new topics of the subject of the course.

2. Course Main Objective

By the end of this course student have all information about the instrumental analysis and have ability to determine the trace amounts of different compounds and metals.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Describe the principles and applications of spectrophotometric and colormetric analysis and electrochemical techniques.	K1 & K2

CLOs		Aligned PLOs
1.2	Recognize the spectrophotometric measurements theory, the potentiometric methods and potentiometric titrations	K2
1.3	Outline voltammetry, polarography techniques and conductmetric methods and their titrations	K1
2	**Skills :**	
2.1	Apply broad theories, principles, and concepts in various contexts, in spectrophotometric and electrochemical techniques	S1
2.2	Solve complex problems in various contexts related to spectrophotometric and electrochemical techniques and overlapped disciplines quantitatively and qualitatively.	S2
2.3	Use and adapt spectrophotometric and electrochemical processes, techniques, tools, instruments, and/or materials that are advanced to deal with various complex practical activities	S5
3	**Values:**	
3.1	Write and present a chemical report and solve problems related to spectrophotometric and electrochemical analysis	V2
3.2	Work collaboratively and constructively in teams with responsibility to perform a specific experiment or preparing a report on the spectrophotometric and electrochemical processes,	V3

C. Course Content

No	List of Topics	Contact Hours
1	General properties of electromagnetic radiation and its interaction with matter, the electromagnetic spectrum as well as the absorption and emission of electromagnetic radiation, practice	3+1E
2	Atomic spectra, molecular spectra, scattered radiation, refracted radiation, dispersed and diffracted radiation, monochromatic vs. polychromatic radiation.	2
3	Instrumentation, radiation sources, monochromators, sample cell (cuvette), detectors, single-beam and double-beam spectrophotometers and photometers.	2
4	Ultraviolet and visible molecular absorption spectroscopy, Beer's law, true and apparent deviations from Beer's law, application of Beer's law to mixtures, calibration curve and the standard addition method.	2
5	Absorbing species, absorption by organic compounds, charge-transfer absorption and ligand-field absorption bands.	2
6	Qualitative and quantitative analysis by UV-Vis. Applications of spectrophotometric methods in chemical equilibrium studies, spectrophotometric titrations	2
7	Turbidimetry and nephelometry	2
8	Mid-term Exam	
9	Molecular fluorescence spectroscopy, theory of molecular fluorescence, relaxation process, resonance lines and stokes shifts, relationship between excitation spectra and fluorescence spectra, effect of structure, temperature and solvents on fluorescence, effect of concentration on fluorescence intensity, instrumentation and applications in organic and inorganic analysis.	2
10	Flame emission and atomic absorption spectroscopy, nebulisation, burners and nebulizers, flames and flame temperature, interferences, types of intereferences and how to solve problem for each type, flame spectrometric techniques, flame emission spectrometry, flame photometer, flame atomic absorption spectrometry and applications	2+2E

10	Introduction to electroanalytical methods, pH and ion selective potentiometry, glass-membrane electrodes, solid-state sensors, liquid-membrane electrodes, gas-sensing and enzyme electrodes, potentiometric titrations	1+3E
11	Voltammetry, polarography and amperometric titrations, current-voltage relationships, characteristics of dropping mercury electrode, half-wave potential, modern voltammetric techniques (ASV and CSV), instrumentation, applications, two indicator electrodes amperometric titrations	2
12	Electrogravimetry and calorimetry, basic principles, equipment for electrolytic separation, electrogravimetry, coulometry and coulometric titrations, conductance methods, electrolytic conductivity, measurement of electrolytic conductance, direct concentration determination, conductometric titrations	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 and Understanding**		
1.1	Describe the principles and applications of spectrophotometric and colormetric analysis and electrochemical techniques.	Lectures and Scientific discussion	Quiz
1.2	Recognize the spectrophotometric measurements theory, the potentiometric methods, types of electrodes with examples and potentiometric titrations	Lectures and Scientific discussion E-learning	Cross question on blackboard
1.3	Outline voltammetry, polarography techniques and conductmetric methods and their titrations	Lectures and Scientific discussion	Quiz and Exam
2.0	**Skills**		
2.1	Apply broad theories, principles, and concepts in various contexts, in spectrophotometric and electrochemical techniques	Lectures	Laboratory demonstration
2.2	Solve complex problems in various contexts related to spectrophotometric and electrochemical techniques and overlapped disciplines quantitatively and qualitatively.	E-learning	Assignment on blackboard
2.3	Use and adapt spectrophotometric and electrochemical processes, techniques, tools, instruments, and/or materials that are advanced to deal with various complex practical activities	Scientific discussion	Laboratory demonstration
3.0	**Values**		
3.1	Write and present a chemical report and solve problems related to spectrophotometric and electrochemical analysis	Class discussion and research activity	Overall student performance in Lab.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.2	Work collaboratively and constructively in teams with responsibility to perform a specific experiment or preparing a report on the spectrophotometric and electrochemical processes,	Class discussion and research activity	Cross questions after finishing laboratory work

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework or activities.	--	10 %
2	Midterm Exam.	8	20 %
3	Practical Exam.	11	30 %
4	Final Exam. (2hours Exam)	12	40 %
5	**Total**		100%

***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 :

- **We have faculty members to provide counseling and advice.**
- **Office hours: During the working hours weekly.**
- **Academic Advising for students.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, ***Analytical Chemistry***, 7th edition, WILEY (2014) • Douglas A. Skoog, Donald M. West, James F. Holler and Stanley R. Crouch, ***Analytical Chemistry***, 7th edition, Springer (2014) • Dhruba Charan Dash. *Analytical Chemistry* (2017) PHI Learning Private Limited.
Essential References Materials	Lecture hand outs available on the coordinator website
Electronic Materials	• **http://www.chemweb.com** • **http://www.sciencedirect.com** • **http://www.rsc.org**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Classrooms capacity (30) students.** • **Providing hall of teaching aids including computers and projector.**
Technology Resources (AV, data show, Smart Board, software, etc.)	• **Room equipped with computer and projector and TV.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **No other requirements.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	Direct
Extent of achievement of course learning outcomes	Peer Reviewer	Direct
Quality of learning resources	Program Leaders	Direct

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	
Reference No.	
Date	20-10-2021

Head of Chemistry Department

Dr Moataz Morad