هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title:	Electroanalytical Methods
Course Code:	CHM 1238
Program:	Bachelor of Science in Chemical Laboratories
Department:	Chemistry
College:	Science
Institution:	Imam Mohammed Ibn Saud Islamic University
Version:	1446-10 v1
Last Revision Date:	17 September 2024

Table of Contents

A. General information about the course:

-1. Course Identification

1. Credit hours: 4 (3, 3, 0)					
4(3 Lectures, 3 Lab, 0 Tutorials)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 4/ Second year					
4. Course general Description:					
The course contains the different electrochemical methods that can be used in analytical chemistry. It includes electrochemical cells, electrode potential and different types of electroanalytical methods. It also includes poteniometry, coulometry, conductometry, voltammetry and amperometry.					
5. Pre-requirements for this course (if any)**:**					
Classical Analytical Chemistry- CHM 1230					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
By the end of completion of this course students will be to: ✓ Know the different types of electrochemical cells and electrodes. ✓ Calculate the cell potential and electrode potential. ✓ Recognize how to perform direct potentiometry and potentiometric titration. ✓ List voltammetry and its different types. ✓ state amperometry and its different types. ✓ Differentiate between coulometry and conductometry.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	90	100%
2	E-learning	0	0
3	Hybrid • Traditional classroom • E-learning	0	0
4	Distance learning	0	0

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**45**
2.	**Laboratory/Studio**	**45**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		90

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To recognize the basic knowledge of the electroanalytical chemistry**	**K1; K2**	• Six hours weekly, containing lectures and laboratory activities • A Private study, including a Homework	**Direct:** • exams, Quizzes • Homework Laboratory Reports • Participation
1.2	**To define how to perform direct potentiometry and potentiometric titration**	**K2; K4**	• Two hours weekly, containing lectures • A Private study, including a Homework	**Direct:** • exams, Quizzes • Oral Discussion • Laboratory Reports • Participation
1.3	**To list voltammetry and its different types**	**K4**	Lectures and laboratory experiments.	**Direct:** • Participation, • Quizzes and MCQs, • laboratory reports
2.0	**Skills**			
2.1	**To differentiate the different types of amperometry, and**	**S1; S3**	• Lecturing, group discussion	**Direct;** Short quizzes Exams,

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	coulometry and conductometry		Laboratory experiments performance	Solved problems marks Homework assignment and laboratory reports
2.2	**To Calculate the cell potential and electrode potential**	**S1; S3**	Brain storming and self-study	**Direct;** • Quizzes laboratory reports
2.3	**To demonstrate skills to participate in class by asking questions and giving answers.**	**S3**	• Group discussion • laboratory experiments.	**Direct;** • Homework assignment, • Examination Laboratory report
2.4	**To diagram and explain experimentally obtained data during laboratory classes and field tasks and illustrate oral and network communication and technical writing skills**	**S3; S4**	• Seminars • Laboratory • Encourage students to use blackboard and electronic mail to submit works and assignments.	**Direct;** • Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	**Values, autonomy, and responsibility**			
3.1	**Appraise teamwork and create awareness to maintain scientific integrity during assessments, projects, and mini-projects.**	**V2**	• Group discussion, assignments, and homework • Lab-reports • Virtual labs and demonstrations	**Direct;** • Oral tests, lab performance, Reports and sheets of Marks • Assignments and homework marks
3.1	**Show personal values and attributes such as honesty, empathy and respect for others**	**V1, V2**	• Teamwork and class discussions	**Direct** • lab reports • Mini projects

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to electroanalytical chemistry (electrochemical cell, potential of the cell, electrode potential, Nernst equation, current in electrochemical cells)**	**9**
2.	**Potentiometry (reference electrode, metallic indicator electrode, membrane electrode, ion-selective electrode, direct potentiometry and potentiometric titration)**	**9**
3	**Voltammetry (excitation signals, instrumentation, cyclic voltammetry, pulse voltammetry, stripping voltammetry, linear sweep voltammetry and application of voltammetry)**	**9**
4	**Amperometry (types of electrodes, instrumentation, types of amperometry and applications)**	**12**
5	**Conductometric and conductometric titrations**	**6**
No	**List of Experiments**	**Contact hours**
1	Potentiometric titration of strong acid and strong base	3
2	Potentiometric titration of weak acid and strong base	3
3	Potentiometric titration of strong acid and weak base	3
4	Determination of dissociation constant of weak acid using potentiometric titration	3
5	Analysis of polyprotic acid using potentiometric titration	3
6	Potentiometric titration of KmnO4 with Fe (II): Redox titration	3
7	Potentiometric titration of K2Cr2O4 with Fe (II): Redox titration	3
8	Iodimetry using potentiometric titration	3
9	Conductometric titration of strong acid and strong base	3
10	Analysis of vinegar using conductometric titration	3
11	Analysis of strong acid and weak base using conductometric titration	3
12	Analysis of phosphoric acid using conductometric titration	3
13	Voltammetry	3
14	amperometry	3
15	Revision and Lab. Reports overview	3
Total		**90**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm 1	6th/7th week	10 %
2.	Midterm 2	11th/12th week	10 %
3.	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
4.	Laboratory	All the semester	30 %
5.	Final Exam	16thweek	40 %
6.	Total	All weeks	100 %

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, **Fundamentals of Analytical Chemistry**, Cengage Learning; 9th edition (January 1, 2013), ISBN-10 : 0495558281, ISBN-13 : 978-0495558286 J. Mendham, **Vogel's Quantitative Chemical Analysis**, Prentice Hall; 6th edition (January 1, 2000), ISBN-10 : 0582226287, ISBN-13 : 978-0582226289
Supportive References	1. Gary D. Christian, Purnendu (Sandy) Dasgupta , Kevin Schug, **Analytical Chemistry**, ASIN : B00I8XF5JC, Wiley; 7th edition (September 27, 2013). 2. Douglas A. Skoog , F. James Holler, Stanley R. Crouch, ***Principles of Instrumental Analysis,*** ASIN : 1305577213, Cengage Learning; 7th edition (January 1, 2017), ISBN-10 : 9781305577213, ISBN-13 : 978-1305577213 **3.** Francis Rouessac (Author), Annick Rouessac, **Chemical Analysis: Modern Instrumentation Methods and Techniques** English Edition, Wiley; English edition (January 15, 2000), ISBN-10 : 0471981370, ISBN-13 : 978-0471981374
Electronic Materials	• **Blackboard**

Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs**
Technology equipment (projector, smart board, software)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other equipment (depending on the nature of the specialty)	• **Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cylinders)** • **Appropriate fine chemicals and solvents (distilled Water ammonium nitrate)** • **Analytical balance (3 digits), Set gas laws with the glass jacket Data acquisition set for gas laws with glass jacket, PC, Windows® 95 or higher, calorimeter, thermometer, Filter papers , clamps, stands**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of Students assessment	**Program Leaders**	**Direct:** Course e-Portfolio. **Indirect:** Course report.

Assessment Areas/Issues	Assessor	Assessment Methods
Quality of learning resources	**Students** **Faculty (Academic Advisory)** **Program Leaders**	**Indirect:** Second examiner checklist-Course report. **Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review. **Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
The extent to which CLOs have been achieved		
Lab Performance	**Students**	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**COUNCIL OF DEPARTMENT OF CHEMISTRY**
REFERENCE NO.	**3 (NO. 1/3)**
DATE	**5/3/1446- 8/09/2024**