هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	**Analytical Electrochemistry**
Course Code:	**CHEM 314**
Program:	**Bachelor in Chemistry**
Department:	**Chemistry**
College:	**College of Science**
Institution:	**Jazan University (JU)**

Table of Contents

A. Course Identification

1. Credit hours: 3hr	**Workload:** 189 **ECTS:** 6.8
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**6th level / 3rd year**
4. Pre-requisites for this course (if any)**:**	**None**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom** ✓ **Lab work**	30 30	100%
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	30
2	**Laboratory/Studio**	30
3	**Tutorial**	
4	**Others** (specify)	
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

Course Title	*Course Number*	*Contact Hours (CH)*		*Credit unit (CU)*	*Year*	*Level*	*Pre-requisite*
		Lec.	*Prac.*				
Analytical Electrochemistry	**CHEM 314**	**2**	**2**	**3**	**3**	**6th**	**-**

Course objectives: They are to identify the following.

- Basic principles of analytical electrochemistry and electro-analytical methods
- Using some electro-analytical techniques in chemical analysis
- Experimental applications of some electro-analytical methods

Syllabus: A-Theoretical contents

Basic principles, concepts, instrumentation and applications of some electro-analytical methods such as potentiometry including ion selective electrodes, electrogravimetry, coulometry, conductometry, voltammetry including polarography and amperometric titrations.

Syllabus: B-Practical contents

Selected experiments related to electro-analytical methods

*See attachment

2. Course Main Objective

The course is designed to study the basic principles and experimental applications of some electro-analytical methods and their usage in chemical analysis.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Demonstrate a broad understanding and critical view of the principles, classification and application of electro-analytical methods. (P)	**K.1**
1.2	Describe correctly the essential facts, principles and theories dealing with electro-analytical methods. (P)	**K.2**
2	**Skills :**	
2.1	Demonstrate ability in critical thinking, numeracy, analytical reasoning, use graphs, charts for solving problems related to electro-analytical methods. (P)	**S.1**
2.2	Apply their experimental basics and skills to use laboratory equipment, modern instrumentation, and classical techniques for carrying out experiments in various fields of electro-analytical methods and to write a report representing the scientific data. (P)	**S.2**
2.3	Examine lab safety background to follow proper procedures and regulations for safe handling and use of chemicals. (P)	**S.3**
2.4	Make effective use of communication, and online technology about chemistry topics in order to improve their basic knowledge in writing	**S.4**

CLOs		Aligned PLOs
	(report and paper/ poster) with a good verbal and clear scientific language. (I)	
3	**Values:**	
3.1	Work as a group leader in cooperation with other colleagues (P)	**V.1**

C. Course Content

No	List of Topics	Contact Hours
1	Basic principles and terminology of electrochemical cells	4
2	Ion selective electrodes, principles, fabrication, and uses	4
3	potentiometry and potentiometric titration.	5
4	Electrogravimetry and coulometry	4
5	Conductometry and conductometric titration	4
6	Voltametry, polarography	5
7	Amperometric titration	2
8	Revision	2
9	Selected Experiments related to course topics.	30
Total		60

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	Demonstrate a broad understanding and critical view of the principles, classification and application of electro-analytical methods. (P)	Lecture / Group work discussion	Written examinations, HW and quizzes
1.2	Describe correctly the essential facts, principles and theories dealing with electro-analytical methods. (P)	Lecture / Group work discussion	Written examinations, HW and quizzes
2.0	**Skills**		
2.1	Demonstrate ability in critical thinking, numeracy, analytical reasoning, use graphs, charts for solving problems related to electro-analytical methods. (P)	Lecture / Group work discussion	Problem-solving exercises
2.2	Apply their experimental basics and skills to use laboratory equipment, modern instrumentation, and classical techniques for carrying out experiments in various fields of electro-analytical methods and to write a report representing the scientific data. (P)	Lab demonstrations / whole group and small group discussion	Practical assignments and laboratory reports

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.3	Examine lab safety background to follow proper procedures and regulations for safe handling and use of chemicals. (P)	Lab demonstrations	Safety exam
2.4.	Make effective use of communication, and online technology about chemistry topics in order to improve their basic knowledge in writing (report and paper/ poster) with a good verbal and clear scientific language. (I)	Technology-enabled learning	Seminar or report or project
3.0	**Values**		
3.1	Work as a group leader in cooperation with other colleagues (P)	lab demonstrations / whole group and small group discussion	laboratory reports

2. Assessment Tasks for Students

#	Assessment task*		Week Due	Percentage of Total Assessment Score
.1	Homework		3	2%
.2	Quiz		5	2%
.3	Midterm Exam		11	15%
.4	Presentation		12	1%
.5	Practical work	Sheet	13	10%
		Lab report	11	2%
		Final Experiment	14	15%
		Activities and participation during Laboratory session	12	3%
.6	Quiz in safety		12	0%
.7	Final Exam		15	50%
.8	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:

Instructor will be available for academic counseling on daily basis for at 2h/day during office hours. The office hours are listed in the instructor time table and delivered to students in the first lectures in each semester. E-Mail is delivered to students for any help.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Undergraduate Instrumental Analysis, James W. Robinson, Eileen M. Skelly Frame and George M. Frame II, Taylor & Francis Group publisher, 7th edition (2014).
Essential References Materials	Analytical Electrochemistry , by Joseph Wang, John Wiley & Sons. **Publisher, 2nd edition** (2006)
Electronic Materials	- https://chem.libretexts.org/Courses/British_Columbia_Institute_of_Technology/Chem_2305/03%3A_Electrochemistry/3.01%3A_An_Introduction_to_Electroanalytical_Chemistry - https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Map%3A_Principles_of_Instrumental_Analysis_(Skoog_et_al.)/23%3A_Potentiometry - https://chem.libretexts.org/Under_Construction/Purgatory/Book%3A_Analytical_Chemistry_2.0_(Harvey)/11_Electrochemical_Methods/11.3%3A_Coulometric_Methods - https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Map%3A_Principles_of_Instrumental_Analysis_(Skoog_et_al.)/25%3A_Voltammetry. - https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Analytical_Sciences_Digital_Library/Active_Learning/In_Class_Activities/Electrochemical_Methods_of_Analysis/02_Text/7%3A_Electrochemical_Analytical_Methods/7.4%3A_Titrimetic_Methods_of_Analysis
Other Learning Materials	Tutorial videos and pictures. Some course contents and materials are posted on Black board sites

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	*1 Lecture room(s) for groups of 50 students* *1 Lab room(s) for groups of 25 students*
Technology Resources (AV, data show, Smart Board, software, etc.)	*Smart board, Data show, Black board, internet*
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Laboratory equipment such as pH-Meter, Conductometer, Ion selective electrodes, polarography apparatus. In addition to glassware, water bath, magnetic stirrer, Electronic balance and hot plate

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching and Assessment	Student	Likert-type Survey (CES) Indirect
Extent of achievement of course learning outcomes	Instructor & Course coordinator	Class room evaluation (direct & indirect)
Quality of learning resources	Program coordinator	Indirect

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Exam Quality assessment	Assessment committee	Indirect

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.	42 / 35 /102 112
Date	17 /09 /1442 Corresponding to 28 / 04 /2021

B-Practical contents

No.	Experiment Title	Required Chemicals	Required Glass Wear & equipment	Week
1	Safety measures	-	-	**1**
2	Some calculations and introduction for electroanalysis	-	-	**2**
3	Potentimetric titration of a strong acid using a strong base	HCl, NaOH and distilled water	Glass burette, beaker 100 mL and pH-meter	**3**
4	Potentimetric titration of a strong acid using a strong base (1^{st} and 2^{nd} derivatization)	-	-	**4**
5	Potentimetric titration of a strong base using a strong acid	HCl, NaOH and distilled water	Glass burette, beaker 100 mL and pH-meter	**5**
6	Potentimetric titration of a strong base using a strong acid base (1^{st} and 2^{nd} derivatization)	-	-	**6**
7	**Revision**	Depends upon the selected experiment	Depends upon the selected experiment	**7**
8	Potentimetric titration of a weak acid using a strong base	Acetic acid, NaOH and distilled water	Glass burette, beaker 100 mL and pH-meter	**8**
9	Potentimetric titration of a weak acid using a strong base(1^{st} and 2^{nd} derivatization)	-	-	**9**
10	Potentimetric titration of a strong base using a weak acid	Acetic acid, NaOH and distilled water	Glass burette, beaker 100 mL and pH-meter	**10**
11	Potentimetric titration of a strong base using a weak acid (1^{st} and 2^{nd} derivatization)	HCl, NaOH and distilled water	Glass burette, beaker 100 mL and pH-meter	**11**
12	Conductometric titration of a mixture of strong acid and weak acid using a strong base	HCl, Acetic acid, NaOH and distilled water	Glass burette, beaker 100 mL and pH-meter	**12**
13	**Revision**	Depends upon the selected experiment	Depends upon the selected experiment	**13**