Course Specifications

Course Title:	Electrochemistry
Course Code:	4022143-3
Program:	Chemistry - Industrial Chemistry
Department:	Department of chemistry
College:	Faculty of Applied Science
Institution:	Umm Al-Qura University

Table of Contents

A. Course Identification

1. Credit hours: 3 (2 theoretical +practical)
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: 4th level/second year
4. Pre-requisites for this course (if any)**: Chemical Kinetics -Thermodynamics**
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**	28	87.5%
2	**Blended**		
3	**E-learning**	4	12.5%
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	32
2	**Laboratory/Studio**	42
3	**Tutorial**	
4	**Others** (specify)	
	Total	74
Other Learning Hours*		
1	**Study**	10
2	**Assignments**	4
3	**Library**	4
4	**Projects/Research Essays/Theses**	4
5	**Others** (specify)	
	Total	22

* 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

This course covers the basic theory and application of electrochemical science: General electrochemical concepts, Introduction to electrochemistry, thermodynamics, electrode potentials, galvanic and electrolytic cells, basic concepts in Corrosion, types of corrosions and corrosion protection, Mixed potentials, Corrosion rates, Polarization curves.

Experimental work illustrating selected parts of the theoretical content.

2. Course Main Objective

- **List types of electrodes and types of electrochemical cells.**
- **Types of standard electrodes and compare them.**
- **Write Nernst equation and solve related problems.**
- **List Faraday's laws and solve relevant problems.**
- **Compare forms of corrosion**
- **List types of fuel cells**

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	To know terminology of electrochemistry	K1
1.2	To Write Nernst equation for determination of cell potential	K2
1.3	To list some applications of galvanic cells	K5
1.4	To mention types of electrodes	K3
1.5	To know the forms of corrosion	K5
1.6	To mention types of fuel cells	K5
2	**Skills :**	
2.1	To compare types of electrochemical cells and the	S1
2.2	To solve Problems on Nernst equation	S5
2.3	To solve problems on Faraday's laws	S5
2.4	To predict an assembly of galvanic cell	S2
2.5	To compare types of fuel cells	S1
2.6	To compare methods of inhibition of corrosion	S7
3	**Competence:**	
3.1	The ability to work in a team to perform a specific experimental tasks.	C1
3.2	The ability to work independently to handle chemicals	C2
3.3	The ability to communicate results of work to classmate and participation in class or laboratory discussions	C2
3.4	The ability to debate and dialogue with clear scientific method.	C3
3.5	The ability to present or explain scientific topic.	C4

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to electrochemistry-Types of electrochemical series Standard redox potentials	4
2	Cell potential	2
3	Electrode potential and Nernst equation.	2
4	Electrochemical series	2
5	Mid-Term exam	2
6	Standard electrode potentials- Hydrogen and oxygen electrodes	2
7	Concentration cells	2
8	Applications on cell potential	4
9	Second exam	2

10	Batteries and Fuel cells	2
11	Forms of corrosion	4
12	Corrosion Inhibition	2
13	Final exam	2
Total		**32**

Laboratory Part:

No	List of Topics	Contact Hours
1	Daniell Cell	3
2	Concentration cells	3
3	Electrodeposition at electrodes	3
4	Measurements of cell potential	3
5	Determination of solubility of sparingly soluble salt	3
6	Electroplating	3
7	Measurements of some electrochemical parameters from Tafel Plots	3
8	Determination of the corrosion inhibition efficiency of some inhibitors using Tafel plots	3
9	Determination of corrosion rates using weight loss method	3
10	Determination of the corrosion inhibition efficiency of some inhibitors using weight loss method	3
11	Determination of corrosion rates using thermometric method	3
12	Determination of the corrosion inhibition efficiency of some inhibitors using thermometric method	3
13	Revision	3
14	Final exam	3
Total		**42**

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 know terminology of electrochemistry	Lectures	Quiz
1.2	To Write Nernst equation for determination of cell potential	Lectures	Quiz
1.3	To list some applications of galvanic cells	Lectures	Quiz
1.4	To mention types of electrodes	Lectures	Quiz
1.5	To know the forms of corrosion	Lectures	Quiz
1.6	To mention types of fuel cells	Lectures	Quiz
2.0	**Skills**		
2.1	To compare types of electrochemical cells and the	Lectures	Mind map
2.2	To solve Problems on Nernst equation	Lectures	Quiz
2.3	To solve problems on Faraday's laws	Lectures	Quiz
2.4	To predict an assembly of galvanic cell	Lectures	Perform a practical experience
2.5	To compare types of fuel cells	Lectures	Mind map
2.6	To compare methods of inhibition of corrosion	Lectures	Exam

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.0	**Competence**		
3.1	The ability to work in a team to perform a specific experimental tasks.	Scientific discussion	Projects and seminar
3.2	The ability to work independently to handle chemicals	Scientific discussion	presentation
3.3	The ability to communicate results of work to classmate and participation in class or laboratory discussions	Scientific discussion	posters
3.4	The ability to debate and dialogue with clear scientific method.	Scientific discussion	long and short essays
3.5	The ability to present or explain scientific topic.	Scientific discussion	posters

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Class activities, Attendances and Duties	Throughout the Term	10%
2	Mid-Term Exam	5-8	20%
3	Practical Exam.	14-15	30%
4	Final Exam.(2 hours exam)	End of the Term	40%

***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: Office hours for Faculty member

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Electrochemistry Principles, Methods and Applications, Christopher M. A. Brett, Maria Oliveira Brett, Oxford University Press, 2005.
Essential References Materials	**1-** A.J. Bard ,L.R. Faulkner, Electrochemical Methods , Fundemental and Applications,2010 John Wiley & Sons **2-** Handbook of Electrochemistry, Cynthia Zosk, Elsevier, 2011. **3-** Handbook of Corrosion Engineering (Chinese), Pierre R. Roberge, McGraw-Hill, 2005. **4-** Corrosion Basics: An Introduction, Pierre R. Roberge, NACE International, 2006
Electronic Materials	Power point lectures, Videos.
Other Learning Materials	Web sites.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms, laboratories and Labs.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show, Smart Board and software.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

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

Received by: Dr. Ismail Althagafi **Department Head**

Signature:  **Date: 20/12/2019**