جامعة الإسراء
ISRA UNIVERSITY

# Course Syllabus

***According to JORDAN National Qualification Framework (JNQF)***

# Course Name: Electroanalytical Chemistry

# Course Number: 11013134

## General Course Information:

| | |
|---|---|
| Course title | **Electroanalytical Chemistry** |
| Course number | **11013134** |
| **Credit hours** | **3** |
| **Education type** | **[Online (Synchronous, Asynchronous)], [Hybrid (Face-to-Face, Online (Synchronous, Asynchronous)], OR [Face-to-Face]** |
| Prerequisites/corequisites | **High school certificate, scientific track** |
| Academic Program | **Bachelor** |
| Program code | **01** |
| Faculty | **Science** |
| Department | **Chemistry** |
| Level of course | **Third year** |
| Academic year /semester | **2021/2022- Second semester** |
| Awarded qualification | **Bachelor degree in chemistry** |
| Other department(s) involved in teaching the course | **N/A** |
| Language of instruction | **English** |
| Date of production/revision | **March 20, 2022** |

## Course Coordinator:

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|---|---|
| **Coordinator's name** | **Dr. Abed Abdel Qader** |
| **Office No** | **Basement of Engineering Building** |
| **Office Phone extension number** | **2607** |
| **Office Hours** | **11:00-1:00 Sunday, Tuesday, Thursday.** |
| **Email** | **abed.abdelqader@iu.edu.jo** |

## Other Instructors:

| | |
|---|---|
| **Instructor name** | |
| **Office No** | |
| **Office Phone extension number** | |
| **Office Hours** | |
| **Email** | |

## Course Description *(English/Arabic)*:

| | |
|---|---|
| **English** | Oxidation-reduction reactions; galvanic cells; standard electrode potential; oxidationreduction titrations; applications of redox titrations; potentiometric methods; electrogravimetry; coulometry; voltammetry; polarography. |
| **Arabic** | |

## Textbook: *Author(s), Title, Publisher, Edition, Year, Book website.*

1. Fundamentals of Analytical Chemistry,D.A. Skoog, D.M.West, F.J. Holler, S.R. Crouch. Brooks Cole, New York.2013.9 th Edition

**References:** ***Author(s), Title, Publisher, Edition, Year, Book website.***


1. D.C. Harris, Quantitative Chemical Analysis, 9th Ed., W.H. Freeman and Co., New York, NY, 2015.


## Course Educational Objectives (CEOs):

| | |
|---|---|
| **1.** | **A review of basic Chemistry and classic methods of analysis** |
| **2.** | **Study the oxidation and reduction** |
| **3.** | **Analysis the chemical data** |
| **4.** | **Study the Potentiometry** |
| **5.** | **Study the Electrogravimetry and Coulometry** |
| **6.** | **Study the Voltammetry** |
| **7.** | **A review of basic Chemistry and classic methods of analysis** |

## Intended Learning Outcomes (ILO's):

| **1.** | **Subject Intended learning outcomes (ILOs) describe what students are expected to know and be able to do at the end of the course. These outcomes are related to the knowledge, skill and competence that students acquire:** | **Relationship to CEOs** | **Contribution to PLOs** | **Bloom Taxonomy Levels*** | **Descriptors**** |
|---|---|---|---|---|---|
| **2. A** | **Knowledge and Understanding:** | | | | |
| **3. A1** | **Able to apply the knowledge of basic electrochemistry to concepts involving energy storage and conversion.** | **1, 2,** | **a, d** | **K** | **K** |
| **4. A2** | **Apply Nernst equation and doing potentiometric calculations.** | **1, 3, 4** | **c** | **K** | **S** |
| **5. A3** | **Apply some common electrochemical methods to electrochemical systems and explain which type of information that can be obtained with these techniques** | **5, 6** | **a** | **App** | **C** |
| **6. B** | **Intellectual skills:** | | | | |
| **7. B1** | **Develop their logical and critical thinking through problem solving.** | **2** | **d** | **E** | **S** |
| **8. C** | **Subject specific skills:** | | | | |
| **9. C1** | | | | | |
| **10. D** | **Transferable skills:** | | | | |
| **11. D1** | | | | | |

***Bloom Taxonomy Levels**

| Level # | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **Level Name** | **Knowledge** | **Comprehension** | **Application** | **Analysis** | **Evaluation** | **Synthesis** |

## ** Descriptor (National Qualification Framework Descriptors): K : Knowledge, S: Skill, C: Competency.

## Program Learning Outcome (PLOs):

| **Program Learning Outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviours that students acquire as they progress through the program. A graduate of the (_____) program will demonstrate:** | | **Descriptors**** | | |
|---|---|---|---|---|
| | | **K** | **S** | **C** |
| **1.** | Describe the fundamental scientific principles and theories across the four subfields of chemistry (Organic, inorganic, analytical and physical). | K | | |
| **2.** | Identify and confirm chemical compounds structures as well as determine chemical composition. | K | | |
| **3.** | Establish and concludes mechanisms of physical and chemical processes in addition to the ability of mastering qualitative and quantitative determination. | | | C |
| **4.** | Solve the scientific problems using different mechanisms and procedures based on critical thinking. | | S | |
| **5.** | Conduct scientific experiments in chemistry. | | | C |
| **6.** | Commitment and interest in lifelong learning, and collaborate effectively with other people in a team. | | | C |
| **7.** | Prepare logical, organized and concise written reports, and oral and poster presentations that effectively communicate chemical content to other scientists. | | S | |
| **8.** | Commitment to the ethical principles of chemical research. | | | C |
| **9.** | Find information about chemistry through databases and information | | S | |
| **10.** | Evaluation of calculations in chemistry experiments and information analysis using computer software. | | | C |
| **11.** | Demonstrate safety laboratory techniques. | | S | |

**** Descriptors according to the national qualifications framework (K: knowledge, S: skill, C: Competency)**

## Weekly Schedule *(please choose the type of teaching)*

☐ **Face to Face**

☐ **Hybrid** *(**2 Lectures** Face – To - Face **+1 Lecture** Asynchronous)*

☐ **Hybrid (*1 Lectures* Face – To - Face *+1 Lecture* Asynchronous)**

✓ **Online** *(**2 Lectures** Synchronous **+1 lecture Asynchronous**)*

| **Week** | **First Lecture (*Online*)** | **Second Lecture (*Online*)** | **Third Lecture (*Online*)** | **Ach. ILOs** | **Ach. PLOs** | **Descriptors **** |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| 1-3 | Introduction to Electrochemistry: Oxidation-reduction reactions, electrochemical cells, electrode potentials, the potential of electrochemical cells, the laws of electrolysis. | Introduction to Electrochemistry: Oxidation-reduction reactions, electrochemical cells, electrode potentials, the potential of electrochemical cells, the laws of electrolysis. | Introduction to Electrochemistry: Oxidation-reduction reactions, electrochemical cells, electrode potentials, the potential of electrochemical cells, the laws of electrolysis. | A1 | a,d | K |
| 4-6 | Applications of Standard Electrode Potentials: Equilibrium constants for oxidation-reduction reactions, redox titration curves, oxidation-reduction titrations, potentiometric endpoint detection. | **Applications of Standard Electrode Potentials: Equilibrium constants for oxidation-reduction reactions, redox titration curves, oxidation-reduction titrations, potentiometric endpoint detection.** | Applications of Standard Electrode Potentials: Equilibrium constants for oxidation-reduction reactions, redox titration curves, oxidation-reduction titrations, potentiometric endpoint detection. | B1 | d | C |
| 7-8 | Applications of Oxidation/Reducti on Titrations: Auxiliary oxidizing and reducing reagents, applications of standard reductants, applications of standard oxidants, some specialized oxidants. | Applications of Oxidation/Reducti on Titrations: Auxiliary oxidizing and reducing reagents, applications of standard reductants, applications of standard oxidants, some specialized oxidants. | Applications of Oxidation/Reduction Titrations: Auxiliary oxidizing and reducing reagents, applications of standard reductants, applications of standard oxidants, some specialized oxidants. | A2 | c | S |
| 9-11 | Potentiometry: General principles, reference electrodes, liquid-junction potentials, indicator electrodes, types of metallic indicator | Potentiometry: General principles, reference electrodes, liquid-junction potentials, indicator electrodes, types of metallic indicator | Potentiometry: General principles, reference electrodes, liquid-junction potentials, indicator electrodes, types of metallic indicator electrodes, membrane | A3 | a | C |

| | | | | | | |
|---|---|---|---|---|---|---|
| | electrodes, membrane electrodes, crystalline-membrane electrodes, gas sensing probes, instruments for measuring cell potentials, direct measurement and potentiometric titrations, the detection of equilibrium constants for acid-base neutralization, internal standard method, and potentiometric titrations. | electrodes, membrane electrodes, crystalline-membrane electrodes, gas sensing probes, instruments for measuring cell potentials, direct measurement and potentiometric titrations, the detection of equilibrium constants for acid-base neutralization, internal standard method, and potentiometric titrations. | electrodes, crystalline-membrane electrodes, gas sensing probes, instruments for measuring cell potentials, direct measurement and potentiometric titrations, the detection of equilibrium constants for acid-base neutralization, internal standard method, and potentiometric titrations. | | | |
| 12-13 | Bulk Electrolysis: Electrogravimetryand Coulometry: The effect of current on cell potential, types of polarization, modes of mass transfer, electrogravimetric methods of analysis, electrogravimetric calculations, types of coulometric methods, current efficiency , controlled-current and controlled potential coulometry, coulometric titrations, instrumentation, potentiostats, coulometer and cells. | Bulk Electrolysis: Electrogravimetryand Coulometry: **The effect of current on cell potential, types of polarization, modes of mass transfer, electrogravimetric methods of analysis, electrogravimetric calculations, types of coulometric methods, current efficiency , controlled-current and controlled potential coulometry, coulometric titrations, instrumentation, potentiostats,** | Bulk Electrolysis: Electrogravimetryand Coulometry: The effect of current on cell potential, types of polarization, modes of mass transfer, electrogravimetric methods of analysis, electrogravimetric calculations, types of coulometric methods, current efficiency , controlled-current and controlled potential coulometry, coulometric titrations, instrumentation, potentiostats, | A3 | a | C |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | **coulometer and cells.** | coulometer and cells. | | | |
| 14-15 | Voltammetry: Cyclic voltammetry, Basic principles and applications | **Voltammetry: Cyclic voltammetry, Basic principles and applications** | Voltammetry: Cyclic voltammetry, Basic principles and applications | A3 | a | C |
| 16 | **Final exam** | | | | | |

* **K: Knowledge, S: Skills, C: Competency**

## Teaching Methods and Assignments:

**Development of ILOs is promoted through the following teaching and learning methods:**

- **Interactive videos**
- **Practice Labs**
- **Discussion Forums**
- **Quizzes**
- **Other Interactive online activities**
- **Reports**

## Course Policies:

A- Attendance policies:

The maximum allowed absences is 15% of the lectures.

B- Absences from exams and handing in assignments on time:

Midterm exam can be retaken based on approval of excuse by the instructor's discretion.

Not handing assignment on time will incur penalties.

C- Academic Health and safety procedures

D- Honesty policy regarding cheating, plagiarism, and misbehaviour:

Cheating, plagiarism, misbehaviour will result in zero grade and further disciplinary actions may be taken.

E- Grading policy:

- All homework is to be posted online through the e-learning system.
- Exams will be marked within 72 hours and the marked exam papers will be handed to the students.
- Online Activities (Course Videos, Practice labs, Discussion Forums, Quizzes) **___%**
- Midterm **___%**
- Final Exam **___%**

F- Available university services that support achievement in the course: **E-Learning Platform, Labs, Library.**

## Required equipment:

- **PC / Laptop with webcam and mic**
- **Internet Connection**
- **Access to the IU E-Learning Platform at: https://elearn.iu.edu.jo/**
- **E-learning plan**
- Satisfaction questionnaires for online and face-to-face learning
- Software for e-learning

- Training

## Assessment Tools implemented in the course:

- Final Exam
- Midterm Exam
- Quizzes
- Homework
- Practice Labs
- Discussion Forums
- Periodic reports for learning assessment
- Improvement plans for online or face-to-face teaching
- Others:…….

## Responsible Persons and their Signatures:

| | | | |
|---|---|---|---|
| **Course Coordinator** | **Dr. Abed Abdel Qader** | **Completed Date** | **20/3 /2022** |
| | | **Signature** |  |

| | | | |
|---|---|---|---|
| **Received by** (Department Head) | **Dr. Manal khabbas** | **Received Date** | 22 / 03 /2022 |
| | | **Signature** |  |