The Hashemite University
Faculty of Science
Course Outline

Department: Chemistry.	
Year : 2021/2022	**Semester :** *Summer Semester*

Course Information	
Course Title	**Special Topics – Electroanalytical Chemistry**
Course Number	110103497.
Course Credits	3.
Designation	Elective.
Course Time	Sun, Mon, Tue, Wed: 10.40 – 11.55
Instructor	***Dr. Ayman A. Issa*.**
MS Teams	Team: Special Topics - Electro-Analytical - Summer_2021/2022
E-mail	**aymani@hu.edu.jo**
Webpage	**http://staff.hu.edu.jo/aymani**

Course Description (Catalog):

This course includes special topics in Analytical and Physical chemistry.

Text Book and References	
Text Book	Skoog, Holler, and Crouch; Principles of Instrumental Analysis, Cengage Learning, 2016, 7th Edition. (6th or 5th Editions can also be used).
References	1. Bard, A and Faulkner L., *Electrochemical Method: Fundamentals and Applications*, Wiley and Sons, NY, 2nd Ed., 2001. 2. Brett, C. and Brett, M., *Electrochemistry: Principles, Methods, and Applications*, Oxford Univ. Press, Oxford, 1993. 3. D. Sawyer, A. Sobkowiak, and J. Roberts, *Electrochemistry for Chemists*, 2nd Ed., Wiley and Sons, NY, 1995 4. Any library book related to Electroanalysis or Electroanalytical Chemistry or one of the discussed topics in this course; including Coulometry and Voltammetry

Grading Plan		
Assessment Type	**Expected Date**	**Weight**
Mid-Term Exam	August 15, 2022	25%
Homeworks	To be announced later – 2-3 HWs for every Chapter	15%
Quizzes	Expected Every Lecture	10%
Short Report	Deadline: August 18, 2022	10%
Final Exam	September 3 – 8, 2022	40%

Notes:

- *All **homeworks** **MUST** be submitted via **MS-Teams Assignments** within a maximum of **Three Days**, unless you have been told otherwise.*
- *Absence from Mid-Term exam must be followed by an acceptable excuse; where a high-level **Make-up exam** will be held. Otherwise, the grade of **ZERO** will be given.*

Teaching and Learning Methods
Lectures using On-Board Projector and WhiteBoard **Discussion** lectures will be given after each chapter/topic. **Quizzes** (oral and written) will be given during lectures and after each chapter. Quizzes will be Online. **Homeworks** are required from each student and will be submitted and graded via *MS-Teams Assignments, on-paper, or E-mail (As you will be previously told).* **Report**: Each student will deliver a short report regarding one of electroanalytical methods or a recent application of an electroanalytical technique. Some suggested topics will be supplied later. *Note: The subject should be approved before writing*.
All material and references will be available on Moodle Website http://mlms.hu.edu.jo **Another copy is available on in the course's Team on MS-Teams – in "FILES" tab**. Other relevant material will be added on-time in the course's Team on MS-Teams.

Course Contents	Questions from 7th Edition
Topics	**Homeworks**
Introduction and Basic Concepts of electroanalytical chemistry: Oxidation Reduction reactions, electrochemical cells and thermodynamics, electrode potentials, introduction to the double layer theory and mass transfer mechanisms, and polarization.	**HW 1 – Ch. 22** *Announced in Lecture* **HW 2 – Ch. 22** *22-5, 22-7* **HW 3 – Ch. 22** *22-11, 22-17*
Potentiometric Methods: Cells, reference electrodes, indicator electrodes, and potentiometric titrations.	**HW 4 – Ch. 23** *23-15, 23-19* **HW 5 – Ch. 23** *23-24*
Coulometric Methods: Electrolysis, potentiometric coulometry, and coulometric titrations.	**HW 6 – Ch. 24** *24-5, 24-6* **HW 7 – Ch. 24** *24-8, 24-10* **HW 8 – Ch.24** *24,4*
Voltammetric Methods: Cells, working electrodes, Linear scan voltammetry, rotating disk electrodes, polarography, cyclic voltammetry and anodic stripping techniques.	**HW 9 – Ch. 25** *25-10, 25-11.* **HW 10 – Ch. 25** *25-13.*
Chronoamperometry: A very concise introduction to chronoamperometry and chronocoulometry.	**HW 11** *Announced Later.*
Kinetics of Electrode Reactions: Electrochemical kinetics, electrified interfaces and the double layer theory, Mass transport.	**HW 12 - Optional** *Announced Later*
Chemically Modified Electrodes: An introduction to CME. Types of modifiers, reasons and advantages. Some real applications of platinum-modified electrodes.	**HW 13 - Optional** *Announced Later*

❖ **Course Objectives:**

This course aims at studying basic principles of electroanalytical chemical cells and thermodynamics. It also aims at studying electrode potentials, double layer theories, mass transport, and polarization. The course aims at learning various techniques as potentiometric, coulometric, chronoamperometric and voltammetric techniques and some of their applications. It further aims at studying some advanced topics like chemically modified electrodes and electrode kinetics. The course asks each student to write his own short report about a recent electroanalytical application from modern literature.

❖ **Specific Outcomes of Instruction (Course Learning Outcomes):**

After completing this course, the students will be able to:

	Course Learning Outcomes (CLO)	(SO*)
CLO1	Discuss general ideas about electrochemical cells.	a, b
CLO2	Discuss general ideas about electrode kinetics, double layer theory, mass transport and polarization in various electrochemical cells.	a
CLO3	Learn how to calculate the potential of the electrochemical cell.	a
CLO4	Learn about the basic principles of potentiometry.	a, b, e
CLO5	Learn about the basic principles of coulometry.	a, b, e
CLO6	Learn about the basic principles of chronoampermetry.	a, b, e
CLO7	Learn about the basic principles of many voltammetric techniques as well as their applications	a, b, e
CLO8	Discuss basic ideas about chemically modified electrodes	a, b, e
CLO9	Write a short report about a recent application or an electrochemical technique. These reports will be discussed by the students.	a, b, d, e, f
CLO10	Perform and discuss home-works, questions, and assignments on various topics during the semester.	a, b, d, f

*(SO) = Student Outcomes Addressed by the Course.

❖ **Student Outcomes (SO) Addressed by the Program:**

#	Outcomes Description Chemistry Student Outcomes	Contribution
(a)	An ability to identify, formulate, and solve broadly defined technical or scientific problems by applying knowledge of mathematics and science and/or technical topics to areas relevant to the discipline.	H
(b)	An ability to formulate or design a system, process, procedure or program to meet desired needs.	H
(c)	An ability to develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.	--
(d)	An ability to communicate effectively with a range of audiences.	L
(e)	An ability to understand ethical and professional responsibilities and the impact of technical and/or scientific solutions in global, economic, environmental, and societal contexts.	H
(f)	An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.	L
H = High, **M** = Medium, **L** = Low		

General Notes: (Attendance Policy) students are expected to attend every class and arrive on time in compliance with HU regulations. In case you find yourself in a situation that prevents you from attending class or exam, you have to inform your instructor. If you miss more than 7 classes, you cannot pass the course. Makeup excuses will be accepted only for very limited justified cases, such as illness and emergencies. Missing a quiz or an exam without an acceptable excuse will result in a grade of zero.

Good Luck !

Dr. Ayman Issa

17.7.2022