Chemistry 459/549 – Fall 2020
Electroanalytical Chemistry

Instructor:

Dr. Kate M. Waldie, kate.waldie@rutgers.edu
Office hours: By Appointment, via Webex

Lectures: Tuesday & Thursday 9:15-10:35 AM, via Webex

Course Website: via Canvas at https://canvas.rutgers.edu

Textbooks: (Optional)

1. Electrochemical Methods: Fundamentals and Applications, 2nd Edition
   Allen J. Bard, Larry, R. Faulkner
2. Electrochemistry, 2nd Edition
   Carl H. Hamann, Andrew Hamnett, Wolf Vielstich
3. Laboratory Techniques in Electroanalytical Chemistry, 2nd Edition
   Peter T. Kissinger, William R. Heineman
4. Analytical Electrochemistry, 3rd Edition
   Joseph Wang

Synopsis:

This one-semester course serves as an introduction to the principles of electrochemistry and their application to studying redox systems. Topics will include potentiometry, chronoamperometry, voltammetry, hydrodynamic methods, bulk electrolysis, coupled chemical processes, and spectroelectrochemistry. Practical considerations for electrochemical experiments and specific examples of applications in the literature will also be covered.

Course Format:

The grading for this course will be broken down as follows:

Assignments	50 %
Term Paper	35 %
Presentation	15 %

Five problem sets will be throughout the course. Each problem set must be turned in at the start of lecture (9:15 AM) on its respective due date. You may collaborate with each other on the problems, but each student must independently write and turn in their own problem set.

The term paper for this course should be a critical review of one or more research articles in the field of electrochemistry. The term paper should include an introduction to the topic, a discussion of the electrochemical techniques and data analysis, your perspective on the significance of the article(s), and your critical evaluation of the works. The term paper may also include a discussion of unresolved issues and proposals for future research opportunities. The term paper should be concise: 8 pages maximum. At least one research article should be published in a major journal. Your article(s) selection for your term paper must be indicated on your 3rd problem set. The last week of class will be reserved for student presentations on the topic of your term paper.

Course Schedule:

Week #	Lecture #	Date	Topics
1	1	09/01	Course Syllabus, Waldie Group Research, Introduction to redox reactions
	2	09/03	The Electrochemical Cell, Faraday's Law
2	**Labor Day NO CLASS**		
	3	09/10	Thermodynamics, Reference Electrodes, Nernst Equation
3	4	09/15	Liquid Junctions Potentials, Potentiometry
	5	09/17	pH Electrodes, Selective Electrodes
4	6	09/22	**PS 1 DUE** Double Layer Structure and Capacitance
	7	09/24	Double Layer Structure and Capacitance
5	8	09/29	Kinetics of Electrode Reactions
	9	10/01	Kinetics of Electrode Reactions
6	10	10/06	**PS 2 DUE** Mass Transfer
	11	10/08	Mass Transfer
7	12	10/13	Practical Considerations
	13	10/15	Chronoamperometry
8	14	10/20	**PS 3 DUE** Chronoamperometry
	15	10/22	Potential Sweep Methods
9	16	10/27	Potential Sweep Methods
	17	10/29	Potential Sweep Methods
10	18	11/03	**PS 4 DUE** Electrocatalysis
	19	11/05	Electrocatalysis
11	20	11/10	Heterogeneous Systems
	21	11/12	Heterogeneous Systems
12	22	11/17	**PS 5 DUE** Hydrodynamic Methods
	23	11/19	Ultramicroelectrodes
13	24	11/24	Spectroelectrochemistry
	Thanksgiving Break NO CLASS		
14	25	12/01	Electrochemical Surface Area
	26	12/03	**Term Paper DUE** Industrial Electrochemical Reactions
15	27	12/08	Student talks
	28	12/10	Student talks