

Spring 2022

**CHM 6153 ELECTROCHEMICAL PROCESSES**

**UST 0101 M, W, F period 4 10:40-11:30 am**

**Instructor: Dr. Anna Brajter-Toth**

**Sisler A228; Office hours after class and by appointment**

**Course Content and Format:** *The material in this class is highly relevant to all areas of chemistry (analytical/physical, inorganic, and organic/polymer) as well as engineering, materials and life sciences.*

This class is structured to first introduce fundamentals of electrochemical processes, and electrochemical methods used in different areas of science and industry. Essential background in physical concepts and theory will be discussed. The class focus is however on “real life” applications and experimental design, with emphasis on electrochemical data analysis. One of the goals of this class is to allow you to follow electrochemistry research and literature with understanding.

In addition to in class lectures, in **class presentations by students**, using literature references, **are part of the course**. This format will be used to review concepts discussed in class. Presentations can be tailored to your interests. Guidelines for presentation format (power point) and duration will be given in class.

Class participation is strongly encouraged. Suggested homework problems will be given in class.

**Recommended Reading:** The reference text is: *A.J. Bard and L. R. Faulkner "Electrochemical Methods: Fundamentals and Applications."* This book is a comprehensive “textbook” of electrochemistry and is a good source of additional references, including other books and research articles. References to literature articles and reviews will be given in class and will be used in class lectures. Be cautious when using on-line sources (such as Wikipedia). If in doubt use books as references. Undergraduate Instrumental textbooks found in the library are a good reference for review of the basics.

**Class format:** class lectures will be given using the blackboard. Class notes will be provided for your review and as a study aid. You can annotate the class notes and use them as a study tool.

**Grading:** Class grade will be based on three exams and a final. Each exam, including the final, is worth 25% of the course grade.

**Exams:** Exam dates and topics that will be covered on the exams, and the exam format will be announced in class in advance. Take home exams will have a format that will be announced in class. The due dates of the take home exams will be announced in class.

**Homework:** Homework will be assigned to help you review the material. The dates of the HWs will be announced in advance. The HWs will be checked and returned with comments but will not be graded. Due dates for homework will also be announced in class and will be typically few dates after the homework is posted.

**Class presentations by students:** Dates and topics of class presentations will be announced in class in advance (see also below). The presentations will be given by groups of students.

**Final Exam:** Final exam is scheduled on April 28, 2022 and will be based on literature article(s).

**The list and order of the topics to be covered :**

Measurements Overview

Principles of Instrumentation; Review of Electrode Materials

Transport and Surface Processes; EChem Kinetics

Rate Theory of EChem Processes; Kinetics and Tafel Equation

Bulk Electrolysis

Potential Step Methods

Diffusion and Fick's Laws; Large Amplitude Potential Step Chronoamperometry

Large Amplitude Chronocoulometry; Double Layer Effects

Applications of Chronocoulometry; Adsorption

Potential Sweep Methods; Dc Polarography Reversible and Irreversible Processes

Cyclic Voltammetry; Double Layer and Charging Current

Hydrodynamic Methods; Rotating Disk Electrode

Ultramicroelectrodes, Nanoelectrodes; Modified Electrodes

Spectroelectrochemistry and EC-MS

Depending on interest and the progress of the class, the order of topics and the topics list may change. The changes will be announced in class. After a group of topics will be covered, research articles will be selected for class presentations to illustrate relevant applications.

The Syllabus will be updated with literature references during the semester.