Spring 2017

Dr. ANNA BRAJTER-TOTH
CHM 6153 ELECTROCHEMICAL PROCESSES
LEI 104
M, W, F 3rd period 9:35 -10:25 am
Office SISLER A 228; 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 yes organic/polymer) as well as engineering, materials and life sciences.*
The emphasis of this class is on "real life" applications of electrochemistry with focus on analysis. In order to critically pursue applications decribed in the literatyre, the class is designed to provide essential background in physical concepts and theory of electrochemistry. Current (no pun here!) problems will be emphasized in discussions of applications.

In addition to in class lectures, **class presentations by the students in the class are part of the course. This format will be used** to review key concepts and applications using literature references. The articles for class presentations will be selected by the students working in groups. The presentations can be tailored to your interests. I will help with the choices to make them best suited for class presentations. Guidelines for the presentation format (power point) and duration will be given in class.

Class participation is strongly encouraged.

Recommended Reading: The reference text is: ***Bard and 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 used in class lectures. Use books as references and be cautious of on-line sources (such as Wikipedia) which are best for spot checking purposes.

Grading: The grade in this class will be based on the two take home exams and the take home final, written homeworks and class presentations. Homeworks will have problems and some will be in the form of literature reviews. Guidelines for all will be given in class. The homeworks and exams will be posted on-line.

Each exam including the take home final is worth 25% of the course grade. The homeworks and the oral presentations are worth 25% of the final grade and count equally. The FINAL will be posted at the end of classes and is due on the date scheduled for the class final. The final will be comprehensive and will be based on recent literature.

LECTURE SCHEDULE: The exam dates and approximate dates of class presentations and homeworks are shown in the syllabus. The due dates for exams and homeworks will be announced and will be typically few dates after the homeworks and exams are posted.

1/4 Introduction
1/6 Measurements Overview
1/9 Measurements Overview

1/11 EChem Cells **HOMEWORK 1**
1/13 Principles of Instrumentation - Op Amps
1/16 **MLK HOLIDAY**
1/18 OP Amp Functions
1/20 Potentiostat **HOMEWORK 2**
1/23 Electrode Processes Overview/Kinetics
1/25 EChem Kinetics - Homo vs. Heterogeneous
1/27 Rate Theory in EChem **HOMEWORK 3**
1/30 Rate Theory of EChem Processes
2/1 Practical Kinetic Info - How To Get It?
2/3 **PRESENTATIONS**
2/6 **PRESENTATIONS HOMEWORK 4**
2/8 Bulk Electrolysis **EXAM 1 (DATE TBA)**
2/10 Constant Potential Bulk Electrolysis
2/13 Constant Current Bulk Electrolysis
2/15 **PRESENTATIONS**
2/17 **PRESENTATIONS HOMEWORK 5**
2/20 Overview of Potential Step Methods
2/22 Diffusion and Fick's Laws
2/24 Large Amplitude Potential Step Methods
2/27 Chronoamperometry
3/1 Chronocoulometry and Double Layer Effects
3/3 Applications of Chronoculometry and Adsorption
3/4 -10 **SPRING BREAK**
3/13 Potential Sweep Methods **HOMEWORK 6**
3/15 Cyclic Voltammetry
3/17 Diagnostic Power of Cyclic Voltammetry
3/20 Double Layer and Charging Current Electrode Materials
3/22 Dc Polarography Reversible and Irreversible Processes
3/24 **PRESENTATIONS**
3/27 **PRESENTATIONS**
3/29 **PRESENTATIONS EXAM II (DATE TBA)**
3/31 Hydrodynamic Methods; Rotating Disk Electrode
4/3 Electrode Materials and Modified Electrodes
4/5 Analytical Pulse Potential Step Techniques
4/7 Ultramicroelectrodes and Nanoelectrodes
4/10 Spectroelectrochemistry and EC-MS
4/12 Fuel Cells **HOMEWORK 7**
4/19 Final WILL BE POSTED due Monday 4/24