Electrochemistry
The University of Toledo
Department of Chemistry and Biochemistry
CHEM 6320, 8320-001 (CRN: 22935, 22936)

Instructor: Jon R. Kirchhoff
Email: jon.kirchhoff@utoledo.edu
Office Hours: (M, T, W, 9-10 am; T, 2-3 pm and by appointment)
Office Location: BO 2024
Office Phone: (419) 530-1592

Term: Spring 2019
Class Location: BO 1005
Class Day/Time: MW 10-11:50 am
Lab Location: n/a
Lab Day/Time: n/a
Credit Hours: 4

COURSE/CATALOG DESCRIPTION
A fundamental study of electrochemical concepts, methods, instrumentation and applications.

COURSE OVERVIEW
A range of topics of fundamental importance to modern electrochemistry methods will be presented. Initial topics will focus on fundamental electrochemical concepts prior to the study of more complicated theories, techniques, instrumentation, and applications.

STUDENT LEARNING OUTCOMES
This class will provide the student with a fundamental review of the basic concepts of electrochemistry. The student will also obtain a working knowledge (i) of the understanding of various electroanalytical methods, (ii) of the physical phenomena behind electrochemical techniques, (iii) to utilize electrochemical methods to investigate chemical systems, and (iv) to apply electrochemical methodology to research problems. At the end of the semester each student will be able to read an article or attend a seminar involving electrochemistry and understand the experimental concepts and results under discussion.

TEACHING STRATEGIES
Lecture based with class participation, homework assignments, and class presentations.

PREREQUISITES AND COREQUISITES
Prerequisite: Permission of the department

REQUIRED TEXTS AND ANCILLARY MATERIALS
There is no formal text for this course. Material described in this course can be found in the following books, which have been placed on reserve in Carlson Library. Additional handouts and literature papers will also be provided on specific topics.


TECHNOLOGY REQUIREMENTS

None

UNIVERSITY POLICIES

Academic Accommodations

The University of Toledo is committed to providing equal opportunity and access to the educational experience through the provision of reasonable accommodations. For students who have an accommodations memo from Student Disability Services, it is essential that you correspond with me as soon as possible to discuss your disability-related accommodation needs for this course. For students not registered with Student Disability Services who would like information regarding eligibility for academic accommodations due to barriers associated with a potential disability, please contact the Student Disability Services Office.

ACADEMIC POLICIES

As a graduate student in my course and enrolled at The University of Toledo you should be familiar with the policies that govern the institution’s academic processes, for example, Academic Dishonesty, Enrollment Status, and Grades and Grading. For more information and additional policies please see, https://www.utoledo.edu/graduate/files/Graduate%20Student%20Handbook%202018-2019.pdf

Students are expected to follow the guidelines of student conduct at The University of Toledo. For more information, see http://www.utoledo.edu/studentaffairs/conduct/students/student.html

COURSE EXPECTATIONS

It is expected that students attend class, participate in discussions, take notes, read background materials, and complete all required assignments. Please refer to the Missed Class Policy at http://www.utoledo.edu/policies/academic/undergraduate.

Use of cell phones or laptop computers during class is not allowed. Calculators should be brought to class for in class assignments.
GRADING

Grades will directly reflect the student's performance. There will be no make-up exams. Only valid medical excuses will be considered for missed work. See the instructor for any questions regarding grades and absences.

The following evaluation scheme will be used (500 total points)

<table>
<thead>
<tr>
<th>Exam #1</th>
<th>February 20</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam #2</td>
<td>April 10</td>
<td>100</td>
</tr>
<tr>
<td>In Class Assignments</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Article Write-Up/Class Presentation</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Final Exam</td>
<td>Monday April 29, 2019 (10:15 am-12:15)</td>
<td>100</td>
</tr>
</tbody>
</table>

Grade Assignments

<table>
<thead>
<tr>
<th>90 - 100% of total points</th>
<th>A range</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 - 89%</td>
<td>B range</td>
</tr>
<tr>
<td>70 - 79%</td>
<td>C range</td>
</tr>
<tr>
<td>60 - 69%</td>
<td>D range</td>
</tr>
<tr>
<td>&lt;60%</td>
<td>F</td>
</tr>
</tbody>
</table>

Midterm grades will be entered and are used to assist students with determining where they stand academically in the course. Attendance is also recorded during Midterm grading to meet state and federal laws regarding financial aid disbursement. Please note, if you are not attending class it could impact your financial aid (scholarships, grants, loans or Federal Work Study). If you decide you are not going to attend this class (or any other class you have registered for), you must formally withdraw (drop) from the course. You can do this by logging onto the myUT portal, clicking on the “Student” tab, and then under My Toolkit clicking on Register/Drop/Withdraw. For more information about add/drop dates please visit the Registrar’s Office online at: [http://www.utoledo.edu/offices/registrar/registration_dates.html](http://www.utoledo.edu/offices/registrar/registration_dates.html).

The deadline for withdrawing from class is Friday March 29th.

COMMUNICATION GUIDELINES

Students will communicate directly with the instructor in person, during office hours or by email.

STUDENT SUPPORT SERVICES

Consult with instructor for specific needs.
COURSE SCHEDULE

Course Outline and Topics

Introductory Material
  Concepts and Terms
  Galvanic and Electrolytic Cells
  The Nernst Equation
  Diffusion
  Heterogeneous Electron Transfer

Potentiometric Methods
  Indicator Electrodes
  Reference Electrodes
  Potentiometric Titrations
  Ion Selective Electrodes
    Glass Electrodes
    Solid State Electrodes
    Gas Sensing Electrodes
  Biosensors
    i-Stat Technology
  Microelectrodes, In Vivo Measurements

Voltammetric Methods
  Instrumentation and Electrodes
  Scanning Techniques
  Potential Step Techniques
  Pulsed techniques
  Stripping Voltammetry
  Rotating Disk Electrochemistry

Modified Electrodes
  Advantages, Construction and Applications

Amperometric Methods
  Theory
  Sensor Applications

Thin-Layer Electrochemistry
  Optically-Transparent Electrodes
  Spectroelectrochemistry

Microelectrodes
  Types and Fabrication
  Properties and Characteristics

Electrochemical Detection for Separations
  Liquid Chromatography
  Capillary Electrophoresis

Coulometry

Bulk Electrolysis
  Electrosynthesis

Carbon and New Materials

Other Topics as Time Permits