Electroanalytical Chemistry 26:160:549– Fall 2022

Rutgers, The State University of New Jersey-Newark

Syllabus

Lecture: Thursday, 6:00-9:00 pm, Smith Hall, Room 240
Professor: Dr. Huixin He (LSC II, Room 219 B)
Email: huixinhe@newark.rutgers.edu
Office Hours: By appointment

The course Synopsis

This course introduces the fundamentals of electrochemistry and commonly used electro-analytical methods, such as cyclic voltammetry, liner sweeping voltammetry with rotating disk-ring electrodes, stripping voltammetry, pulse voltammetry techniques, and AC impedance spectroscopy. Some experimental demonstrations will be designed to improve the basic understanding these techniques. Frontiers research in various fields using these electrochemical techniques will be discussed.

Learning goals of this course

After taking this course, the students should be able to

- Understand the basic concepts of electrochemistry and common electrochemical techniques
- Understand what physical chemical properties of a material can be studied with the commonly used electrochemical techniques.
- Design experiments so that a physical chemical property of a material can be determined by one or two electrochemical techniques.
- Design electroanalytical methods for both quantitative and qualitative measurements.

Recommended textbooks and references

- Some literatures will be provided during the class.
- Understanding Voltammetry: Problems and solutions by Richard G Compton, Christopher Batchelor-McAuley, and Edmund J F Dickinson (optional)

Prerequisites: Undergraduate physical chemistry I and II, Undergraduate analytical chemistry lecture and labs.
Tentative Class Schedule:

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lecture</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sept. 1</td>
<td>Lecture 1</td>
<td>Introduction: Basic Concepts</td>
</tr>
<tr>
<td>2</td>
<td>Sept. 8</td>
<td>Lecture 2</td>
<td>Kinetics of Electrode Reaction, lab demon</td>
</tr>
<tr>
<td>3</td>
<td>Sept. 15</td>
<td>Lecture 3</td>
<td>Kinetics and Cyclic Voltammetry (CV)</td>
</tr>
<tr>
<td>4</td>
<td>Sept. 22</td>
<td>Lecture 4</td>
<td>Micro and Nanoelectrodes</td>
</tr>
<tr>
<td>5</td>
<td>Sept. 29</td>
<td>Lecture 5</td>
<td>Midterm I, Pulse voltammetry Techniques</td>
</tr>
<tr>
<td>6</td>
<td>Oct. 06</td>
<td>Lecture 6</td>
<td>Pulse voltammetry Techniques (Continue)</td>
</tr>
<tr>
<td>7</td>
<td>Oct. 13</td>
<td>Lecture 7</td>
<td>Stripping Voltammetry Techniques</td>
</tr>
<tr>
<td>8</td>
<td>Oct. 20</td>
<td>Lecture 8</td>
<td>Methods involving forced hydrodynamics</td>
</tr>
<tr>
<td>9</td>
<td>Oct. 27</td>
<td>Lecture 9</td>
<td>Midterm II, AC Impedance Spectroscopy</td>
</tr>
<tr>
<td>10</td>
<td>Nov. 3</td>
<td>Lecture 10</td>
<td>AC impedance Spectroscopy (continue)</td>
</tr>
<tr>
<td>11</td>
<td>Nov. 10</td>
<td>Lecture 11</td>
<td>Electrochemical Controlled SPM vs. Scanning Electrochemical microscopy</td>
</tr>
<tr>
<td>12</td>
<td>Nov. 17</td>
<td>Lecture 12</td>
<td>Student Presentation</td>
</tr>
<tr>
<td>13</td>
<td>Nov. 24</td>
<td>Lecture 13</td>
<td>No class</td>
</tr>
<tr>
<td>14</td>
<td>Dec. 1</td>
<td>Lecture 14</td>
<td>Overview</td>
</tr>
<tr>
<td>Final Exam</td>
<td>Dec. 8</td>
<td>6:00-9:00 pm</td>
<td>Final Exam</td>
</tr>
</tbody>
</table>

Last lecture ends on Wednesday, Dec. 14 for our school, so that the last lecture for this course will be Thursday, Dec. 8.

Exams and quizzes:

Quizzes and Exams will be based on the lecture covered materials and the associated assigned reading materials. All the quizzes and exams will be given as closed book, closed note format. No electronic devices are allowed (except for a regular calculator). Quizzes will be given at random bases, either in the beginning or the end of a lecture. No make-up quiz, presentation and exams. In case any exam is missed for any reason, the score on the final exam will be used. If the final exam score is higher than the midterm exams, it will also be used to replace the lowest score of the midterm exams.

Grading:

**Random Quizzes 10%**
**Midterm I 20%**
**Midterm II 20%**
**Presentation 10%**
**Comprehensive final: 40%**

The final letter grades will be based on the following scale

- A  = 100-85
- B+ = 84-80
- B   = 79-70
- C+ = 69-65
C = 64-55
D = 54-45
F = 0-44

COVID-Safety Statement:

In order to protect the health and well-being of all members of the Rutgers-Newark community, masks must be worn by all persons inside campus buildings (e.g., classrooms) when in the presence of others, and in buildings in non-private enclosed settings (e.g., common workspaces, workstations, meeting rooms, classrooms, etc.). Masks should securely cover the nose and mouth. Masks must be worn during class meetings. Each day before you arrive on campus or leave your residence hall, you must complete the brief survey on the My Campus Pass symptom checker self-screening app found at: myRutgers Portal. Violations will be reported immediately with the COVID Observation Reporting Form.

Absences: Per the University’s Course Attendance policy (10.2.7), students are responsible for communicating with their instructors regarding absences. The Division of Student Affairs is available to verify extended absences: (973) 353-5063 or DeanofStudents@newark.rutgers.edu.

Academic Integrity Policy:

As an academic community dedicated to the creation, dissemination, and application of knowledge, Rutgers University is committed to fostering an intellectual and ethical environment based on the principles of academic integrity. Academic integrity is essential to the success of the University’s educational and research missions, and violations of academic integrity constitute serious offenses against the entire academic community. The entire Academic Integrity Policy can be found here: http://academicintegrity.rutgers.edu/academic-integrity-policy/

Accommodation Statement:

Rutgers University Newark (RU-N) is committed to the creation of an inclusive and safe learning environment for all students. RU-N has identified the following resources to further the mission of access and support:

- Students with Disabilities: Rutgers University welcomes students with disabilities into all of the University’s educational programs. The Office of Disability Services (ODS) is responsible for the determination of appropriate accommodations for students who encounter barriers due to disability. In order to receive consideration for reasonable accommodations, a student with a disability must contact ODS, register, have an initial appointment, and provide documentation. Once a student has completed the ODS process (registration, initial appointment, and documentation submitted) and reasonable accommodations are determined to be necessary and appropriate, a Letter of Accommodation (LOA) will be provided to the student. The student must give the LOA to each course instructor, followed by a discussion with the instructor. This should be completed as early in the semester as possible as accommodations are not retroactive. More information can be found at ods.rutgers.edu. Contact ODS: (973) 353-5375 or ods@newark.rutgers.edu.

- Religious Holiday Policy and Accommodations: Students are advised to provide timely notification to instructors about necessary absences for religious observances and are
responsible for making up the work or exams according to an agreed-upon schedule. The Division of Student Affairs is available to verify absences for religious observance, as needed: (973) 353-5063 or DeanofStudents@newark.rutgers.edu.

- Counseling Services: Counseling Center Room 101, Blumenthal Hall, (973) 353-5805 or http://counseling.newark.rutgers.edu/

- Students with Temporary Conditions/Injuries: Students experiencing a temporary condition or injury that is adversely affecting their ability to fully participate in their courses should submit a request for assistance at: https://temporaryconditions.rutgers.edu.

- Students Who are Pregnant: The Office of Title IX and ADA Compliance is available to assist students with any concerns or potential accommodations related to pregnancy: (973) 353-1906 or TitleIX@newark.rutgers.edu.

- Gender or Sex-Based Discrimination or Harassment: Students experiencing any form of gender or sex-based discrimination or harassment, including sexual assault, sexual harassment, relationship violence, or stalking, should know that help and support are available. To report an incident, contact the Office of Title IX and ADA Compliance: (973) 353-1906 or TitleIX@newark.rutgers.edu. To submit an incident report: tinyurl.com/RUNReportingForm. To speak with a staff member who is confidential and does NOT have a reporting responsibility, contact the Office for Violence Prevention and Victim Assistance: (973) 353-1918 or run.vpva@rutgers.edu