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| **logo University of Management & Technology**  School of Science  Department of Chemistry | | | | |
| CH-618 Advanced Electrochemistry | | | | |
| **Lecture Schedule** | Thursday (6:30 PM – 09:30 PM) | **Semester** | | Spring 2021 |
| **Pre-requisite** | BS Chemistry | **Credit Hours** | | 3 |
| **Instructor(s)** | Dr. Mohsin Javed | **Contact**  **Moodle Link** | | [mohsin.javed@](mailto:mohsin.javed@)umt.edu.pk  Extension. 3436 |
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| **Office** | 2nd Floor, South Block,  S3-32 | **Office Hours** | | See office door |
| **Course Description** | The study is about the overview of electrode processes, showing the way in which the fundamental components of the subject come together in an electrochemical experiment. Then there are individual discussions of thermodynamics and potential, electron-transfer kinetics, and mass transfer. Concepts from these basic areas are integrated together in treatments of the various methods. The effects of homogeneous kinetics are treated separately in a way that provides a comparative view of the responses of different methods. Next are discussions of interfacial structure, adsorption, and modified electrodes then there is a taste of electrochemical instrumentation which is followed by an extensive introduction to experiments in which electrochemistry is coupled with other tools. | | | |
| **Expected Outcomes** | Participants who successfully complete this course will be able to learn and understand the basic concepts of;   1. The electrode processes in an electrochemical approach. 2. Derive the equations of electrochemical phenomenon 3. Their applications to electro-analysis. 4. Voltammetry and its types 5. Stripping analysis | | | |
| **Reference book(s)** | 1. Christine Lefrou, Pierre Fabry, Jean-Claude Poignet, Electrochemistry, the Basics, with examples, 1st edition, 2012, Springer-Verlag Berlin Heidelberg 2. Vladimir S. Bagotsky, Fundamentals of Electrochemistry, 2nd edition, 2006, John Wiley & Sons 3. Allen J. Bard and Larry R. Faulkner, ELECTROCHEMICAL METHODS, Fundamentals and Applications, 2nd edition, 2010, John Wiley & Sons 4. Christine Lefrou, Pierre Fabry , Jean-Claude Poignet, Electrochemistry: The Basics, With Examples, Springer; Softcover reprint of the original 1st ed. 2012 edition (August 23, 2016) 5. [Carl H. Hamann](https://www.amazon.com/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Carl+H.+Hamann&text=Carl+H.+Hamann&sort=relevancerank&search-alias=books), [Andrew Hamnett](https://www.amazon.com/s/ref=dp_byline_sr_book_2?ie=UTF8&field-author=Andrew+Hamnett&text=Andrew+Hamnett&sort=relevancerank&search-alias=books), [Wolf Vielstich](https://www.amazon.com/s/ref=dp_byline_sr_book_3?ie=UTF8&field-author=Wolf+Vielstich&text=Wolf+Vielstich&sort=relevancerank&search-alias=books), Electrochemistry 2nd Edition, Wiley-VCH; (April 9, 2007) 6. D.R. Crow, Principles and Applications of Electrochemistry, 4th Edition, CRC Press, Published September 30, 1994 7. Toshio Fuchigami, Mahito Atobe, Shinsuke Inagi, Fundamentals and Applications of Organic Electrochemistry: Synthesis, Materials, Devices, Wiley (2014) | | | |
| **Grading Policy** | Quizzes 10 %  Assignments 05 %  Presentations 05 %  Mid Term 25 % | | Attendance & Class Participation Nil  Term Project 05 %  Final exam 50 %  Total 100 % | |

**Course Schedule**

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| **Week** | | **Lecture Plan** |
| 1 | | INTRODUCTION AND OVERVIEW OF ELECTRODE PROCESSES |
| 2 | | POTENTIALS AND THERMODYNAMICS OF CELLS |
| 3 | | KINETICS OF ELECTRODE REACTIONS |
| 4 | | MASS TRANSFER BY MIGRATION AND DIFFUSION |
| 5 | | BASIC POTENTIAL STEP METHODS |
| 6 | | POTENTIAL SWEEP METHODS |
| 7 | | POLAROGRAPHY AND PULSE VOLTAMMETRY |
| 8 | | METHODS INVOLVING FORCED CONVECTION (HYDRODYNAMIC METHODS) |
| 9 | | **Mid Term Exams** |
| 10 | | TECHNIQUES BASED ON CONCEPTS OF IMPEDANCE |
| 11 | | BULK ELECTROLYSIS METHODS |
| 12 | ELECTRODE REACTIONS WITH COUPLED HOMOGENEOUS CHEMICAL  REACTIONS |
| 13 | DOUBLE-LAYER STRUCTURE AND ADSORPTION |
| 14 | ELECTROACTIVE LAYERS AND MODIFIED ELECTRODES |
| 15 | ELECTROCHEMICAL INSTRUMENTATION, SCANNING PROBE TECHNIQUES |
| 16 | SPECTROELECTROCHEMISTRY AND OTHER COUPLED CHARACTERIZATION  METHODS |
| 17 | PHOTOELECTROCHEMISTRY |
| 18 | **End Term Exams** |

**\* -** Tentative