Department of Chemistry, UC Irvine, Spring 2019

Instructor
Professor Shane Ardo (ardo@uci.edu, x4-3796, 2131 NS2)
Office Hours: W 3 – 4 pm (2131 NS2) and F 12:30 – 1:30 pm (2131 NS2)

Teaching Assistant
Gaurav Jha (jag@uci.edu, Penner Labs in 2138 NS2)
Office Hours: M 5 – 6 pm (2138 NS2)

Meeting times
Lecture: TTh, 9:30 – 10:50 am (1170 SSPA (Social Science Plaza A))
Final Exam Period is Thurs. 6/13 at 8 – 10 am (presentations occur during this time)
No Class on Tues. 6/4 (during Exam B); and Class on Thurs. 5/30 starts at 9 am

"Discussion" Lab: M 1 – 2:50 pm (591 RH (Rowland Hall)) or M 3 – 4:50 pm (591 RH)
No Classes on Mon. 4/1 (1st week) and Mon. 5/27 (holiday)
Hands-on Activities (bring PPE and laptop; absences excused in advance)

Course Objectives
• To understand and explain the theory behind fundamental electrochemical processes
• To be able to design, perform, troubleshoot, and analyze electrochemical experiments
• To quantitatively and qualitatively assess problems, and empirical data from the literature
• To summarize and explain seminal and recent electrochemical literature and technologies

Required Resources
Electrochemical Methods: Fundamentals and Applications (2nd edition)
Chapters Covered: A: 1, 15, 4, 5; B: 2, 13, 3, 6; Extra: 12, 9, 10, 16, 17, 18
Journal Articles and Additional Problems/Answers on course website
Bio-Logic software (http://www.bio-logic.net/softwares/ec-lab-software/)

Topics Covered
A1,15 Review+ (Nomenclature, Balancing equations, Electrodes, Potentiostats, Diagrams)
A4,5 Mass Transfer (Nernst–Planck equation (migration, diffusion, convection), Fick’s laws of
diffusion, Cottrell equation, Anson plot, Ultramicroelectrode (UME))
B2 Thermodynamics (Electrochemical potential, Nernst equation, Underpotential deposition (UPD),
Liquid-junction potential, Donnan potential, pH probe, Ion-selective electrodes (ISEs))
B1,3 Charged Interfaces (Ionic activity, Diffuse double layer and models, Boundary layer)
B3,6 Electron Transfer Kinetics (Marcus–Gerischer theory, Butler–Volmer equation, Tafel equation,
Catalysis and volcano plots, Cyclic voltammograms, Randles–Sevcik equation)
Misc. Methods (Potential/Current step/sweep/pulse, Hydrodynamic RDE, Impedance spectroscopy,
Scanning probe electrochemistry, Spectro-/Photo-electrochemistry)

Grading
40% Assignments (5): Activity write-up and several related problems due one week after odd-numbered activities (Mondays, at start of lab: 4/15, 4/29, 5/13, 5/27; and Fri. 6/14 by 5 pm)
20% Exam A (in-class; Tues. 5/14)
20% Exam B (take-home; 24 hours; available Fri. 5/31 at 5 pm through Tues. 6/4 at 11:59 pm)
20% Presentation (12 min + 3 min for questions; in pairs; occur during the last class period (Thurs.
6/6) and during the final exam period (Thurs. 6/13))

Course Policies
Late assignments and make-up exams are not accepted, although I will regrade exams.
UCI Policy on Academic Integrity and Honesty: http://senate.uci.edu/academic-integrity/