**MSE 112**
**Corrosion**
**Spring 2017**

Instructor: Professor Thomas M. Devine
Office: Room 224, Hearst Mining Building
Email: devine@berkeley.edu

Lectures: Tues. and Thurs 11:00am-12:30pm
Office Hrs: Monday 2:00-3:00pm; Thursday 2:00-3:00pm

GSI: Yifan Jiang
Email: y.jiang@berkeley.edu
Office Hrs: 9:00 – 11:00am, Tuesday and Thursday; Room 350, Hearst Mining Building

| | Topic | Reading Assignment |
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| 1. | Electronic Structure of Atoms and Metals | Chapter 1 |
| 2. | Electronic Structure of $H_2O$ and Aqueous Solutions | Chapter 2 |
| 3. | Structure of Interface between Metal and Aqueous Solution | Chapter 2 |
| 4. | Measurement of Interface Potential Difference | Chapter 2 |
| 5. | Reference Electrodes | Chapter 2 |
| 6. | Kinetics of Red-ox Reactions | Chapter 3 |
| 7. | Reduction Reactions that Accompany the Oxidation of Metals in Aqueous Solutions | Chapter 3 |
| 8. | Measurement of Anodic and Cathodic Polarization Curves | Chapter 3 |
| 9. | Determination of Corrosion Potential and Corrosion Rate | Chapter 3 |
| 10. | Use of Polarization Curves to Analyze Corrosion Phenomena; Influence of pH and $P(O_2)$ | Chapter 4 |
| 11. | Galvanic Corrosion | Chapter 4 |
| 12. | Cathodic Protection | Chapter 4 |
| 13. | Formation of Solid Corrosion Products | Chapter 5 |
| 14. | Pourbaix Diagrams | Chapter 5 |
| 15. | Corrosion Inhibitors | ZZhang at al. |
| 16. | Passivity | Chapter 6 (Mott and Cabrerra) |
| 17. | Identity of Iron's Passive Film | Chapter 6 Nagayama/CohenI |
| 18. | Properties of Iron's Passive Film<br>Ionic and Electronic Conductivities | Nagayama/CohenI<br>Nagayama/CohenII |
| 19. | Passive Film of Chromium | Bjornkvist et al.<br>Okuyama et al |
| 20. | Stainless Steels | Newman et al. |
| 21. | Localized Corrosion – Crevice Corrosion | Chapter 7 |

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| 22. | Localized Corrosion – Pitting Corrosion | Chapter 7 |
| 23. | Localized Corrosion – Intergranular Corrosion | Chapter 7 |
| 24. | Environmentally Assisted Cracking – Stress Corrosion Cracking- Phenomena | Chapter 8 |
| 25. | Environmentally Assisted Cracking – Stress Corrosion Cracking- Slip Dissolution Model | Chapter 8 |
| 26. | Environmentally Assisted Cracking – Stress Corrosion Cracking- Film Induced Cleavage Model | Chapter 8 |
| 27. | Environmentally Assisted Cracking – Hydrogen Assisted Cracking | Chapter 8 |
| 28. | Environmentally Assisted Cracking – Corrosion Fatigue | Chapter 8 |

**Reading** All reading assignments will be posted on b-space. Most of the reading assignments come from a set of notes prepared by TMD.

**Homeworks** – There will be one problem set per week covering Topic Nos. 1-14. For Topic Nos. 15-28 there will be approximately one problem set every two weeks.

**Exams** There will be a Mid-term exam covering Topics 1-14 on Thursday, March 9.

The Final Exam (Exam Group 13) is scheduled on Thursday, May 11, 2017, 8:00am-11:00am

**THE MID-TERM EXAM AND FINAL EXAM MUST BE TAKEN ON THE SCHEDULED TIMES AND DATES.**

**Grading** The grade for the course will consist of the Final Exam (50%), the Mid-term Exam (35%) and Homework (15%).