

**United States Naval Academy
Mechanical Engineering Department**

Catalog Description: EM456 Corrosion and Corrosion Control **Credit:** 3 (2-2-3)

Designation: Selected Elective, engineering major

Senior, elective course that emphasizes both the fundamentals of corrosion science, as well as the engineering involved in preventing corrosion. An introduction to the principles of electrochemistry will be presented in order to understand the mechanisms associated with the various forms of corrosion. Select corrosion mitigation techniques will also be presented, with emphasis on the marine environment. Common experimental techniques for corrosion evaluation and materials selection will be presented and demonstrated.

Prerequisites: EA222 Materials for Aerospace Engineers, EM313- Materials Science, EM452 – Engineering Materials, EN380-Naval Materials Science & Engineering or ER313 Nuclear Materials Science

Corequisites: None

Textbook: Principles and Prevention of Corrosion, Denny A. Jones, Second Edition

Course Director: Professor Michelle G. Koul

Course Content:

No	Topic(s) or Subtopic(s)	Hours
1	Thermodynamics of Corrosion	12
2	Kinetics of Corrosion	6
3	Passivity	4
4	Polarization to Measure Corrosion Rates	4
5	Galvanic Corrosion	4
6	Pitting and Crevice Corrosion	8
7	Cathodic Protection	4
8	Materials Selection and Design	4

Assessment Methods:

		YES	NO
A.	Quizzes		X
B.	Homework	X	
C.	Exams	X	
D.	Laboratory Reports		X
E.	Oral Presentations		X
F.	Design Reports/Notebooks		X
G.	Prototypes/Demonstrations	X	
H.	Projects	X	
I.	Other	X	

Course Outcomes¹

1. Understand how the thermodynamic driving forces for corrosion are related to electrochemical potential (A,B,C,G).
2. Utilize a Pourbaix diagram to determine the stability of a material as a function of potential and pH(A,B,C).
3. Understand how the kinetics of a corrosion process is measured and how it relates to actual material loss (A,B,C,G).
4. Describe the appearance of the various forms of corrosion and the mechanism(s) involved in initiation and propagation (A,B,C,G,H).
5. List and describe corrosion mitigation techniques particular to the marine environment (A,B,C,H).
6. List and describe standard experimental techniques used to evaluate corrosion susceptibility and corrosion mitigation techniques (A,B,C,G,H).
7. Select materials and design structures to avoid catastrophic failures or high life cycle costs associated with corrosion (A,B,C,G,H).

¹ Letters in parenthesis refer to the assessment methods listed in the previous section.

	Course Outcomes						
Program Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(a)	X	X	X	X	X	X	X
(b)	X		X	X	X	X	X
(c)			X	X	X	X	X
(d)							
(e)	X		X	X		X	X
(f)						X	X
(g)							
(h)					X		X
(i)							
(j)					X		X
(k)		X		X		X	

Date of Latest Revision: 01 NOV 2017, Professor Michelle G. Koul