

- Course Number and Title: M E 405. Special Topics: Material Degradation and Protection
- Catalog Description: N/A
- Credit Hours: 3 Credits (3)
- Prerequisite(s) / Corequisite(s): Prerequisite(s): CHME 361
Corequisite(s): None
- Required: Elective for BSME Degree
- Course Availability: N/A
- Instructor (Usual): Dr. Vimal Chaitanya (See <https://mae.nmsu.edu/people/faculty.html>)
- Textbook:
 1. McCafferty, E., *Introduction to Corrosion Science*, Springer, 2010 (ISBN-10: 1441904549 or ISBN-13: 978-1441904546)
 2. Jones, D., *Principles and Prevention of Corrosion*, 2nd Ed., Pearson, 1995 (ISBN-10: 0133599930 or ISBN-13: 978-0133599930)
 3. Hertzberg, R.W., Vinci, R.P., and Hertzberg, J.L., *Deformation and Fracture Mechanics of Engineering Materials*, 5th Ed., 2012 (ISBN-10: 0470527803 or ISBN-13: 978-0470527801)
- Course Learning Objectives: After completing this course, a student should be able to:
Understand how and why material properties can degrade when they are exposed to conditions such as high temperatures, corrosive environments, repetitive loading (fatigue), and sustained loading at high temperatures (creep).
- Topics Covered:
 - Electrochemical Principles of Corrosion
 - Thermodynamics of Corrosion and Pourbaix (E-pH) Diagrams
 - Kinetics of Corrosion (polarization, mixed potential theory, Tafel constants)
 - Passivity
 - Forms of Corrosion
 - Techniques of Corrosion Prevention
 - High Temperature Oxidation (Protective and Unprotective Oxide Film)
 - High Temperature Deformation due to Creep (Temperature-Stress-Strain Rate relationships)
 - Degradation Mechanisms and Maps
 - Parametric Relations for Creep and Micro-mechanisms of Creep Rupture
 - Cyclic Stress and Cyclic Strain Controlled Fatigue
 - Fatigue Crack Initiation and Propagation Mechanisms
 - 13. Fatigue Life Estimations and Avoidance of Fatigue Damage

