# MTEN 5868 - Failure Analysis Using the SEM

## Fall 2026 Syllabus, Section 01, CRN 43982,

Credit hours: 3

## Instructor

**Constantin Solomon**

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## Public Instructor Information

**Instructor Title:** Professor
**Instructor Professional Qualifications:**

Post-doctoral, Arizona State University, 2002-2007

Ph. D., Materials Science and Engineering, Kumamoto University, 2002

BS/MS, Mechanical Engineering, Gh. Asachi Technical University of Iasi, 1990

**Instructor Office Location:** Moser Hall, Room 2500
**Instructor Office Phone:** 330-941-1730

## Course Description

5868. Failure Analysis Using the SEM. Advanced methods in failure analysis of products and structures. Failure modes and mechanisms. Characteristics of fracture surfaces. Failure analysis investigations using the stereomicroscope and the Scanning Electron Microscope (SEM). Two hours lecture, three hours lab per week. Prereq.: 96 s.h. of degree credit and permission of instructor. 3 s.h.

## Course Readings

| Group | Title | Author | ISBN |
|---|---|---|---|
| Required | Metal Failures: Mechanisms, Analysis, Prevention | A. J. McEvily | 9781118163962 |
| Required | Engineering Failure Analysis | Elsevier journal | |
| Required | Journal of Failure Analysis and Prevention | Springer journal | |
| Required | Handbook for Technical Document Preparation | Mechanical Engineering Program, YSU | |
| Optional | Scanning Electron Microscopy and X-Ray Microanalysis | Goldstein, Joseph I.; Newbury, Dale E.; Michael, Joseph R.; Ritchie, Nicholas W.M.; Scott, John Henry J.; Joy, David C. | 9781493966745 |

Numerous electronic handouts (pdf documents) will be provided via Blackboard. Please read the material and understand the theory to actively participate in class.

The course readings are subject to change in the event of extenuating circumstances, research developments, current events, and/or to ensure better learning.

## Schedule of Topics and Assignments

| Week of | Reading(s) | Proposed Topic | Due/To Prepare for Class |
|---|---|---|---|
| 8/24 | Chapter 1 | Failure analysis | Homework due next lecture/ Readings, Question and Problems at the end of chapter |

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| 8/31 | Chapter 2 | Elements of elastic deformation | Homework due next lecture/ Readings, Question and Problems at the end of chapter |
| 9/7 | Chapter 3 | Elements of plastic deformation | Homework due next lecture/ Readings, Question and Problems at the end of chapter |
| 9/14 | Journal papers | Oral Presentation and Discussion of a Failure Analysis Paper | |
| 9/21 | Journal papers | Oral Presentation and Discussion of a Failure Analysis Paper<br>Test 1 | Test 1 - questions and problems from Chapters 1 to 3 |
| 9/28 | Chapter 4 | Elements of fracture mechanics | Homework due next lecture/ Readings, Question and Problems at the end of chapter |
| 10/5 | Chapter 4 | Elements of fracture mechanics | Homework due next lecture/ Readings, Question and Problems at the end of chapter |
| 10/12 | Chapter 5 | Alloys and coatings | Homework due next lecture/ Readings, Question and Problems at the end of chapter |
| 10/19 | Chapter 6 | Examination and reporting procedures | Homework due next lecture/ Readings, Question and Problems at the end of chapter |
| 10/26 | Introduction to scanning electron microscopy | Instrumentation, specimen preparation, electron beam-specimen interaction | Homework due next lecture |
| 11/2 | Introduction to scanning electron microscopy | Imaging, X-ray microanalysis<br>Test 2 | Homework due next lecture<br>Test 2 - questions and problems chapters 4 to 6 and scanning electron microscopy |
| 11/9 | Chapter 7 | Brittle and ductile fracture | Homework due next lecture/ Readings, Question and Problems at the end of chapter |
| 11/16 | Chapter 7<br>Chapter 10 | Brittle and ductile fracture<br>Fatigue | Homework due next lecture/ Readings, Question and Problems at the end of chapter |
| 11/23 | Chapter 10 | Fatigue | Homework due next lecture/ Readings, Question and Problems at the end of chapter |
| 11/30 | | Project - oral presentations | Project - engineering reports due in Blackboard, Monday, 11/30, 5:00 PM |
| 12/7 | | Final Exam, Friday, December 11, 2026, 10:30 AM - 12:30 PM | Comprehensive exam - questions and problems from all chapters |

The course schedule, policies, procedures, and assignments in this course are subject to change in the event of extenuating circumstances, by mutual agreement, and/or to ensure better learning.