

MIE 1714 Failure Analysis- Course Description

Engineering is the science of predictive modelling based on application of Physical Laws, and prototyping to verify designs. This applies to all fields. Good Engineering prevents Failure. The course centers on the Theory of Failure Analysis and how it directs engineering activity: design, research, quality systems, continuous improvement, innovation, new knowledge creation, systemic failure, and business management.

Specific attention is paid to preventive failure analysis and using industry recognized tools to achieve this. All advanced industries are governed by quality systems, which use the Theory of Failure Analysis as their foundation. However, failure analysis is poorly understood with the effect being that most designs, processes, project plans, etc. are released based on too much intuition, ego, and “should”. This lack of understanding and emphasis only comes to light during rearward-looking root cause investigation of Failures (minor or catastrophic, financial or loss of life) where the question is asked, “Where was this considered in the risk assessment (failure analysis)?” The performance and value of engineers can be greatly increased if they understand how their engineering knowledge fits into the preventive failure analysis paradigm. Students who successfully complete this course will understand failure analysis well enough to use it as a paradigm for analyzing any plan (design, project, process, procedure) to ensure its success. They will be able to complete a process flow, use the standardized Failure Mode Effect Analysis (FMEA) tool to complete formal, highly effective failure analysis, and to evaluate existing controls and develop more effective controls. Ultimately, students will be able to apply and scale the methodology from the most focused technical process detail to the broadest long-term business plan...and never again rely on “should”.

Class Format The first portion of each class will be devoted to introducing and explaining the concept listed in the schedule. The second section will be spent understanding the concept by studying a notable and interesting real life case study and performing formal analysis of the failure. Students are also encouraged to contribute case studies from their own experience or current events

Class #1 Introduction to the Theory of Failure Analysis

Class #2: Industry Quality Systems Overview

Class #3: The Failure Mode Effect Analysis (FMEA)- Overview & Process Flow

Class #4: FMEA- Controls, Preventive and Detection

Class #5: FMEA- Process FMEA

Class #6: FMEA- Design FMEA

Class #7: FMEA Midterm Exam

Class #8: Midterm Take Up & Individual Failure Analysis Project Introduction

Class #9: Use of FMEA by Engineers in Organizations

Class #10: Failure Analysis in Non-Traditional Industries- Healthcare, Software, HR, Project Management

Class #11: Failure Analysis in Research, Knowledge Creation, and Innovation

Class #12: Review, Final Exam Prep

Class #13: Final Exam