MIE 1714 Failure Analysis

Department of Mechanical & Industrial Engineering

School of Graduate Studies, University of Toronto

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Instructor: Steven Coates, P.Eng

Email: scoates@rogers.com

Office hours: by appointment through email using "MIE 1714" as subject line

Course Description

The course centres 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. All of these systems (TS/IS/QS/) use the Theory of Failure Analysis as their foundation, which in turn creates the controls that manage all of the risk activities. 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". The critical failure analysis documentation is regarded as a paper requirement and often falls to young engineers to complete. This lack of understanding and emphasis only comes to light during rearward-looking root cause investigation of high impact outcomes (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 integrate results (failures, data, etc.) into failure analysis 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" as an engineering strategy.

Class Format

The first two hours of each class will be devoted to introducing and explaining the concept listed in the schedule. The final hour will be spent understanding the concept by looking at notable and interesting real life case studies. Students are also encouraged to contribute case studies from their own experience or current events.

Materials

There is no assigned textbook. Class specific reading materials will be provided via Blackboard.

Class Schedule

Class #1 (Week of September 11): 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- Failure Mode v. Effect v. Root Cause

Class #5: FMEA- Prevention v. Detection Controls

Class #6: FMEA- RPN & Recommended Actions

Class #7: FMEA Midterm Test

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

Class #9: Evaluating and Improving an Existing FMEA

Class #10: Failure Analysis in Non-Traditional Industries

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

Class #12: Individual Class Presentations Part 1

Class #13: Individual Class Presentations Part 2; Wrap Up

Evaluation

FMEA Midterm Test	20%
Failure Analysis Project- Individual Class Presentation	20%
Final Failure Analysis Project	60%