UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

ELITE Master's Program

# APS1090H1F2024 Risk Engineering

## Course Outline

## Introduction

The insurance and risk transfer industry is changing. Traditional risk models are largely procedural or actuarial based on a historical data set and assumptions that no longer reflect changes in climate, technology, economy or society. The associated risk models codified these processes using increasingly unreliable assumptions, leading to the miscalculation of risk. At the same time, highly codified procedures reduced the need for technically qualified engineers who understood the nature of the risks inherent in infrastructure, plant and operations. The industry needs to better understand engineering advances, new technology and innovation—engineers don't communicate the associated risks in a way that the industry understands, and the industry does not know what to ask or look for. However, intelligent risk transfer is essential for any business transition, including new technologies.

Today, insurers need to understand new technologies and operations in a rapidly changing risk context, and can't rely on any particular transfer model or analytical approach. The industry again needs qualified engineers who can understand the technical risks. However, an engineer's technical formation does not typically include an understanding of risk transfer models or how to inform them. This course bridges the gap between understanding new engineering risks and underwriting practice. It is a new course developed in response to direct requests and in partnership with insurers.

This course is beneficial for those considering rewarding global careers in engineering finance and risk transfer with a focus on climate resilience and economic transition. It is also invaluable to engineering graduates seeking work in the finance of large engineering projects.

## Content

In this course, students will:

- Learn the risk transfer process and how it's applied to underwriting, credit enhancement and transition planning;
- Explore each approach to commercial risk management;
- Learn how an insurer can understand the risks involved and their financial transfer in an insured-insurer partnership;
- Learn an evidenced first principles approach known as risk-based assessment (RBA) and how to apply it;
- Examine the RBA process in greater detail, including its use of primary data collection using open sources through to the interpretation of physical and transition risks;
- Explore the effects of climate and technological change over successive risk horizons;
- Learn compliance requirements concerning climate risk and ESG reporting standards; and
- Learn how to adapt and apply RBA to transition planning, risk strategy development and equity projection parameters.

## Course Designation

**APS1090 Risk Engineering** starts 9 Sep 2024. The course lectures and discussions will run on Mondays from 09:00 to 12:00. The course is evenly split between lectures and tutorials. This subject lends itself best to in-person teaching, where we can all benefit from everyone's experiences and perspectives presented through open forum discussion.

## Contact:

Dr. Alec Hay will be available by appointment throughout the semester. Contact should be made by email. alec.hay@utorono.ca

## Evaluation

Course Evaluation involves three assignments, one project and a written exam.

- Three [individual] written assignments, 10% of total course marks each, (total 30%)

The assignments are short individual essays examining: risk reporting compliance standards, corporate perceptions and behaviours towards risk and decision-making, and industry trends. Students are required to present an argument that is evidenced, objective and shows a clear line of reasoning. Essays should demonstrate critical thinking and a systems understanding of the subject in its dynamic context.

- RBA [team] Project, 50% of total course marks. (50%)

The RBA project will be conducted in groups to investigate real client situations to inform climate-related risks and transition strategy development. The project questions are drawn from a broad range of organizations, including BOMA, municipalities, trade associations, and individual corporations. (It will not include LCA, ERM speculative risk, or corporate finances). The project groups will ideally be of mixed disciplines, between 4 and 6 students in size.

The project report, audit trail and findings will be assessed together with the presentation to the client tea, and course marks assigned on the whole. There must be a clear line of logic and validation from source material through risk evaluations and assessment to the risk-sequenced strategy and recommendations presented in a way that supports client decision-making (cost, time, carried risk, tangible benefits, potential for unforeseen consequences, and client actions/responsibilities) and is intelligible to a busy client.

- Final [individual] exam, two short essay answers out of five scenario questions, 20% of total course marks. (20%) The questions will present a series of scenarios which the students assess and working from fundamental concepts and tools describe how they would approach the challenge to produce a viable solution.

## Materials

There is one required text for this course "Risk: A Very Short Introduction" by Fischhoff and Kadvany. The essence of this reference is about risk perspective and understanding, influences and evidence.

Strongly recommended reading includes: Sustainable Infrastructure: Principles into Practice" by C Ainger & R Fenner, "ICE Companion to Engineering Management" by Hughes et al., and "Financing Infrastructure Projects: A practical guide." By Merna and Al-Thani. The essence of these books is the evidence-based approach to understanding operations in context and projecting trends for plausible scenarios.

Address course questions and (correspondence) course work submissions to me at alec.hay@utoronto.ca