Course Notes

UN 0701 ENGINEERING RISK AND RELIABILITY

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NSERC-UNENE Industrial Research Chair
Risk-Based Life Cycle Management of Engineering Systems

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GENERAL INFORMATION

The University Network of Excellence in Nuclear Engineering (UNENE) in partnership with the Natural Sciences and Engineering Research Council (NSERC) established the Industrial Research Chair in Risk-Based Life Cycle Management of Engineering Systems at the University of Waterloo in September 2004.

The five-year research program is chaired by Dr. Mahesh Pandey in the Department of Civil and Environmental Engineering and will run from 2004 to 2009.

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Preface

This course gives a broad treatment of the subject of engineering decision, risk, and reliability. Emphasis is on

1. The modelling of engineering problems and evaluation of system performance under conditions of uncertainty.
2. Systematic development of design criteria, explicitly taking into account the significance of uncertainty.
3. Logical framework for risk assessment and risk-benefit tradeoffs in decision making.

The necessary mathematical concepts are developed in the context of engineering problems.

The objectives of this course are

- To review and learn the fundamental concepts of probability theory and reliability analysis
- To survey general knowledge and acquire a context and perspective about risk and reliability analysis in engineering
- To learn the essential physical principles on which nuclear reactors are based and to be able to apply them to understand, calculate and predict the operation of reactors
- Apply combination of good engineering and good science

Learning objectives for this course are

- To understand the concepts of data analysis and reliability computation
- To understand and be able to formulate reliability analysis problems
- To be able to solve basic risk and reliability related problems

Attendance for this course requires a degree in general engineering or science. It is expected that the students have a basic knowledge of probability and statistics and are comfortable with mathematics as covered in undergraduate engineering or science. Familiarity with engineering computations using MS-Excel is also encouraged prior to taking the course.

The course will consist of two major assignments, worth 30 % each, and a take-home exam, equivalent to 40 % of the total course grade.

Additional references for the course are as follows:

- Probability and Statistics textbook used in an engineering program (typically at 2nd year level)
- Ang, A.H-S. and W.H. Tang. 1975. *Probability Concepts in Engineering Planning and Design, Volume I - Basic Principles*. John Wiley & Sons, New York.
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