ENGG 4510 Assessment of Engineering Risk
Winter 2015

UNIVERSITY of GUELPH

School of Engineering

1 Instructional Support

1.1 Instructor

Instructor: Ed McBean, Ph.D., P.Eng., P.E.
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Email: emcbean@uoguelph.ca
Office hours: TBA on Courselink or by appointment

1.2 Teaching Assistant

GTA	Email	Office Hours
Maya Atieh	matieh@uoguelph.ca	TBA on Courselink

2 Learning Resources

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG*4510 Courselink site. You are responsible for checking the site regularly.

2.2 Required Resources

1. E. McBean. Course Notes (text in process of being developed), 2014

2.3 Recommended Resources

1. E. McBean, and F. Rovers, 1998, "Statistical Procedures for Analysis of Environmental Monitoring Data and Risk Assessment, Prentice-Hall Publishing Co. Inc., Englewood Cliffs, New Jersey

2.4 Additional Resources

Lecture Information: All the lecture notes will be posted on the web page (weeks #1-#12).

Recommended Texts for additional sources of information

1. McBean, E., and Rovers, F., Statistical Procedures for Analysis of Environmental Monitoring Data and Risk Assessment, Prentice-Hall Publishing Company, 1998
2. Asante-Duah, Kofi, Risk Assessment in Environmental Management, John Wiley and Sons, New York, 1998
3. Hubert, J.J., Environmental Risk Assessment, Dept of Mathematics and Statistics, University of Guelph, 2004

Assignments: Four or five assignments will be distributed throughout the term. Answers to the assignments will be posted on the web as solutions (no marks are given to the assignments).

Exams: Some midterms and finals of previous years are posted as samples of exams. Some of the solutions will also posted for your convenience.

2.5 Communication & Email Policy

Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. **It is your responsibility to check the course website regularly.** As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

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3 ASSESSMENT

3.1 Dates and Distribution

Assignments: 0%

There will be approximately 4 assignments distributed throughout the semester. These will be given out approximately two weeks prior to the date the solutions are posted on the courselink website. The assignments will be mostly computational in nature. The nature of the assignments will closely follow the lecture material and provide the student opportunities to go deeper into the

material presented in class.

Quizzes: 10% periodically throughout the term

Project: 25%

Note: Both paper and electronic copies are to be submitted

A course project will be of the student's choice and is intended to allow the students to explore an area of risk assessment either beyond the normal scope of the course or explore an area covered in the course in much greater depth.

Projects must be identified by the 3rd week of the course and be approved by the course instructor. An outline of the project must be submitted no later than the 5th week of the course. Some of the projects will be presented during the last few weeks of the lecture period during the normally scheduled class time. Details of the project requirements and specific grading criteria will be handed out later in the course but may include both a written report and a presentation to the class.

Midterm test 25%

A midterm examination will be held in approximately the middle of the teaching term and assess knowledge of the first half of the course.

Final Exam: 40%

A final examination will be held during the examination period following the teaching term.

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade: In order to pass the course, you must pass both the exam course portions of the course. Students must obtain a grade of 50% or higher on the exam portion of the course.

Missed midterm test: If you miss the midterm test due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be added to the final exam. There will be no makeup midterm test.

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4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.1 Course Description

The world seems a very hazardous place. Every day, the newspapers announce that some chemical has been found to be carcinogenic, or some catastrophic accident has occurred.

Humans have always sought to eliminate unwanted risks to health and safety. However, there is acknowledgement by scientists, engineers, and others who have thought carefully about risk, that the real problem is not the unachievable task of making technologies and lifestyles risk-free, but the more subtle problem of determining how to make the many causative features of risk appropriately safe.

Politicians, engineers and scientists frequently become disturbed when they discover that the question "how safe is safe enough?" has no simple answer. In response, this course develops the bases by which we can assess and manage risk in engineering. In this respect, engineering risk assessment has become an increasingly important tool as risk assessments are being performed in application to the spectrum of issues including such concerns as

- hazardous waste cleanups,
- permitting activities for water and air discharges,
- input to brownfield remediation,
- fate and transport of chemicals and pathogens in the environment,
- flood protection in water resources, and,
- establishment of environmental quality standards and guidelines, reflecting principles of fate and transport.

From the assessment of the magnitude of engineering risks, the course examines how decisions are made to manage the risks to acceptable levels for health, safety and the environment. One of the differentiating keys to engineering assessment and management of risk is to understand the context of finite amounts of data that are typically available, and how the engineering principles apply, in understanding what the data mean (e.g. how reliable are the data). Risk assessment and management considerations in engineering are evolving rapidly, despite the associated uncertainties in assessment methodologies and data limitations. Elements of applications in both developed and developing countries will be presented.

4.2 Course Aims

The course will progress through the following material:

- introduce the concepts of risk as understood by the general public through their perceptions, and understand how risk assessments conducted in a scientific way, can give the correct picture to the general public, to establish the context for engineering risk assessment and management;
- cover basic statistical concepts which are essential for understanding environmental data, determining which data might still be needed for decision-making, examine distributional assumptions of data and how these are used to characterize inputs to risk assessment methodologies;

- describe exposure assessments in human health and the environment, considering bio-accumulation, bio-magnification, ecological modeling, and dose-response methodologies as inputs to engineering risk assessments and management;
- quantitatively characterize risk associated with engineering issues as inputs to human health and the environment;
- the students will be exposed to a variety of examples that demonstrate concepts which have gone into building risk assessment methodologies for engineering assessment; and,
- develop understanding of risk communication and management strategies including acceptable risk, legislation on risk assessment, and deficiencies in engineering risk assessment processes.

4.3 Learning Objectives

Students who successfully complete the course will be able to:

- use the knowledge of everyday risks in society, to establish the context of risk assessment and management of engineering risk, as it pertains to human health and the environment;
- assemble, interpret, and analyze environmental data as a basis from which risk assessments can be developed, including fate and transport concerns associated with engineering risk concerns;
- identify strategies which can be used to determine if the collection of additional data are warranted. Questions as to how many additional data points have value, are considered;
- develop concepts, and then build the concepts/techniques into engineering risk assessment, for application to simple and complex environmental fate and transport issues;
- understand how to access various data sources from epidemiology and toxicology as inputs to engineering risk assessments; and,
- develop plans for appropriate engineering risk assessment and management, reflecting legal, economic, and socioeconomic considerations

4.4 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1, 2, 4, 5	Quizzes, Exams
2. Problem Analysis	-	Quizzes, Exams, Project
3. Investigation	3, 4, 5	Project
4. Design	2, 3, 4, 5	Project
5. Use of Engineering Tools	2, 3, 4	Project
6. Individual and Teamwork	3, 4, 5	Project
7. Communication	-	Project

8. Professionalism	-	-
9. Impact of Engineering on Society and the Environment	3, 4, 5	Project, Exams
10. Ethics and Equity	-	-
11. Economics & Project Management	3, 4, 5	Project
12. Life-Long Learning	5	-

4.5 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink/D2L but these are not intended to be stand-alone course notes. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and project.

4.6 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and tutorials. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

4.7 Relationships with other Courses & Labs

This course assumes the student has had a basic course in statistics

5 TEACHING AND LEARNING ACTIVITIES

5.1 Timetable

Lectures:

Tuesday	4:00 – 5:30	MINS 300
Thursday	4:00 – 5:30	MINS 300

Tutorials:

Monday	1:30-2:30

5.2 Course Topics and Schedule

Week No.	Topics to be Covered (some variations in order of presentation are to be expected)
1	Background to engineering exposure risks to human health, safety and to the environment
2	Engineering risk assessment methodologies for human health and the environment
3	Methodologies for risk communication and management
4	Fundamentals of statistics and probability
5	Bayesian probability and implications to false positives
6	Receptor impacts - ecological and human
7	Engineering exposure assessments and dose response information
8	Databases and information sources
9	Case studies
10	Larger views of risk including developing world considerations.

5.3 Other Important Dates

Tuesday, January 6 2015: First day of class

6 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

6.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide.

The School of Engineering has adopted a Code of Ethics that can be found at:
http://www.uoguelph.ca/engineering/undergrad-counselling-ethics

7 ACCESSIBILITY

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible

For more information, contact CSD at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: http://www.uoguelph.ca/csd/

8 RECORDING OF MATERIALS

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9 RESOURCES

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs: http://www.uoguelph.ca/registrar/calendars/index.cfm?index