**ES 9185 - RISK ASSESSMENT AND MANAGEMENT IN ENGINEERING SYSTEMS**

**COURSE OUTLINE – Summer 2015**

**Instructor:**

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**Graduate Coordinator:**

Ashley Jokhu (TEB 477); Telephone: 519-661-2111 ext: 88352; Email: ajokhu@uwo.ca

**Class Schedule:**

Classroom Location for **both** sections: **Social Science Center (SSC) 3014**

<table>
<thead>
<tr>
<th>Class #</th>
<th>Date</th>
<th>Section #1 (AM)</th>
<th>Section #2 (PM)</th>
<th># Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Class Time</td>
<td>Office Hours</td>
<td>Class Time</td>
<td>Office Hours</td>
</tr>
<tr>
<td>1</td>
<td>June 12, 2015</td>
<td>9 am to 1 pm</td>
<td>2 pm to 6 pm</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>June 19, 2015</td>
<td>9 am to 12:30 pm</td>
<td>12:30 pm to 1:30 pm</td>
<td>3.5</td>
</tr>
<tr>
<td>3</td>
<td>June 26, 2015</td>
<td>9 am to 12:30 pm</td>
<td>12:30 pm to 1:30 pm</td>
<td>3.5</td>
</tr>
<tr>
<td>4</td>
<td>July 3, 2015</td>
<td>9 am to 12:30 pm</td>
<td>12:30 pm to 1:30 pm</td>
<td>3.5</td>
</tr>
<tr>
<td>5</td>
<td>July 10, 2015</td>
<td>9 am to 12:30 pm</td>
<td>12:30 pm to 1:30 pm</td>
<td>3.5</td>
</tr>
<tr>
<td>6</td>
<td>July 17, 2015</td>
<td>9 am to 12:30 pm</td>
<td>12:30 pm to 1:30 pm</td>
<td>3.5</td>
</tr>
<tr>
<td>7</td>
<td>July 24, 2015</td>
<td>9 am to 12:30 pm</td>
<td>12:30 pm to 1:30 pm</td>
<td>3.5</td>
</tr>
<tr>
<td>8</td>
<td>July 31, 2015</td>
<td>9 am to 12:30 pm</td>
<td>12:30 pm to 1:30 pm</td>
<td>3.5</td>
</tr>
<tr>
<td>9</td>
<td>Aug 7, 2015</td>
<td>9 am to 12:30 pm</td>
<td>12:30 pm to 1:30 pm</td>
<td>3.5</td>
</tr>
<tr>
<td>10</td>
<td>Aug 14, 2015</td>
<td>9 am to 1 pm</td>
<td>2:30 pm to 6:30 pm</td>
<td>4</td>
</tr>
</tbody>
</table>

**Total Teaching Hours** | **36**

<table>
<thead>
<tr>
<th>Review Session</th>
<th>Date</th>
<th>Class Time</th>
<th>Office Hours</th>
<th>Class Time</th>
<th>Office Hours</th>
<th># Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug 21, 2015</td>
<td>2:30 pm to 5:30 pm</td>
<td>---</td>
<td>2:30 pm to 5:30 pm</td>
<td>---</td>
<td>3</td>
<td></td>
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</tbody>
</table>

**Note:** Students **must** attend their specific class section (i.e. #1 AM or #2 PM) as well as office hours (i.e. #1 AM or #2 PM).
Description:

This course introduces the concepts and general principles of risk analysis, assessment and management in engineering systems. The course discusses the qualitative risk identification methods and the quantitative risk assessment methods and techniques. It also explains in a detailed approach the risk management strategy and the process of managing risks, starting by the identification stage, and followed by the initial assessment and the response and mitigation stage. The risk management regime and the contingency management components are identified. The risk management tools and techniques are clarified through considering the risk and value management by different implemented case studies related to different Engineering fields. The principles of risk modeling will be introduced. Managing financial risks in major projects will be illustrated through case studies. Break-Even, sensitivity and risk decision models will be discussed by examples.

Risk management is not about predicting the future. It is about understanding a project and making a better decision regarding the management of that project, tomorrow. To achieve this aim a systematic approach is followed to identify the risk sources, then quantify their effects (risk analysis), hence develop management responses to risk, and finally to provide for residual risk in project estimates. These stages comprise the process of risk management. Risk management can be one of the most creative tasks of project management. The benefits of risk management can be summarized as follows:

- Project issues are clarified, understood and considered from the start;
- Decisions are supported by thorough analysis;
- The definition and structure of the project are continually monitored;
- Clearer understanding of specific risks associated with a project.
- Build-up of historical data to assist future risk management procedures.

Various case studies related to different engineering fields will be discussed.

Course General Objectives:

- To develop understanding of the general principles of risk management and increases the participants awareness on risk management implementation in the industry.
- To enable participants and future risk assessors to visualize the risk management strategy and enable them to find solutions to respond to these risks within their engineering projects or business growth.
- To enable the participants to examine the potential pitfall along with the project’s overall time, cost and quality targets, enables them to consider risk efficiency.
After completing this course students should be able to:

- Learn the principles of risk assessment and management and how and when it can be implemented towards achieving project objectives
- Develop the sense in identifying the hazards and risks sources and explore sufficient knowledge in creating the risk assessment and management model incase such hazards turned to be future risks
- Become familiar with the different risk assessment techniques and decision models
- Participants will have confidence in assessing project risks and responding for such risks with the most efficient mitigation strategies
- Develop the experience in the risks calculations and taking decisions towards wise risk management strategies
- Develop high awareness to deal with risk environment and its exposures
- Through the case studies participants will visualize the efficient systematic approach of classifying the risks, calculating the risks factors for their projects which will help them in managing their projects smoothly

Main Topics:

1. Nature of risk and its definition
2. Introduction to risk management
3. Risk assessment and management definitions and concepts
4. Risk vs. uncertainty
5. Risk assessment life cycle
6. Risk management vs. project management
7. Benefits of risk management
8. Risk analysis and management
9. Risk efficiency
10. Role of risk management in engineering systems
11. Decision making in risk management
12. The risk management strategy
13. The process of managing risks
14. Identification and initial assessment
   - Controllable and uncontrollable risks
   - Brainstorming
   - Interviews
   - The Delphi technique
   - Expert systems
• Questionnaires
• Combined approach
• Qualitative assessment
• Classification and reference
• Description of the risk
• Risk trigger
• Relationship to other risks
• Potential impact
• Likelihood of occurrence

15. Risk Management Response and Mitigation
• Risk avoidance
• Risk reduction
• Risk transfer
• Residual or retained risk

16. Detailed quantitative assessment of risk
• A brief introduction to statistics
• Methods of risk assessment
• Simple assessment
• Probabilistic analysis
• Multiple estimating using risk analysis
• Break-even analysis
• Sensitivity analysis
• Decision trees models
• Monte Carlo Simulation
• Latin Hypercube sampling
• Accident models

17. The Risk Management Regime
• Reporting
• Contingency management

18. Risk classification

19. Aggregating individual project risks

20. Internal, specific and external risks

Note: The depth and coverage of the above topics will vary.
**Required Textbook:** None.

**References:**


**Evaluation:**

1) Assignments 20%
2) Group Case Study and Presentation 20%
3) Final Project 20%
4) Final Examination 40%

**Total 100%**

1) **Assignments**

Two (2) assignments will be assigned. More details will be shared in class. Students may work in pairs or in a group of up to five (5) members in total. For this portion of the course, students may “self-select” their groups.

2) **Group Case Study and Presentation**

Student will work in groups to apply Risk Management & Assessment to engineering cases.

The instructor will randomly assign students into different groups to:

- Allow ample time (i.e. 15 to 25 minutes) for each group to present their projects followed by 10 to 15 minutes of a “Questions and Answers (Q&A)” session.
- Simulate a realistic work situation since employees rarely have the option of selecting their group members. Students will be challenged with the task of working with other individuals whom they may not normally work with.

Students will also discuss the effects and benefits of their efforts in class interactively.
3) Final Project

Student should select an area of his/her interest and write 10 to 12 pages (excluding references) of literature review of the application of Risk Assessment to that field. The area of interest can be consulted with the instructor.

Notes:
- Must be academic in style and content
- Must have a clear focus
- Must present ideas in a logical and well thought-out flow
- Arguments, analysis and conclusions must be based on clearly identified research and sources
- Must cite all references from other sources
- Must be typewritten (Times New Roman, Font 12; Double spaced; MS Word format)

4) Final Examination

Three (3) hours will be allocated for the Final Examination. A non-programmable calculator and two (2) letter-sized (i.e. 8.5” x 11”) aid sheets are allowed. You may use both sides of the sheets and make any notes you wish.

Course Notes:

Students are responsible for producing their own notes in class.

Late Assignments:

Late Assignments will not be accepted. If you miss any part of the course due to a medical condition (i.e. a valid medical certificate must be produced), the weight of the missed assignment(s) will be added to the Final Examination.

For example: If you missed the Group Case Study and Presentation due to a medical condition, then your Final Examination will be worth 60% [= 20% + 40%].

Note:

Students must pass the final exam to pass this course.
Students who fail the final exam will be assigned 48% if the aggregate mark is higher than 50%, or the aggregate mark. A minimum mark of 50% is required for the final examination.
**Communication Policy:**

1) **OWL** will be used in this course for the purposes of posting lecture slides, assignments, and conveying announcements.

2) Do **not** email “**general, class-related**” questions to the course instructor. Please post such questions to OWL so others can benefit from your questions and the replies. Questions posted to OWL will be answered within two (2) business days.

3) Do email “**specific, student-related**” questions to the course instructor.
   a. Please email such questions using your **Western University issued email address** (i.e. @uwo.ca), including “ES 9185 Section #1 (AM) or #2 (PM)” in the **subject line**.
   b. If I do not reply to your email within two (2) business days (it means I did not receive it), please resend your email.

**Repeating All Components of the Course:**

In accordance with Senate and Faculty Policy, students who have failed an Engineering course must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.

**Use of English:**

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for the improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

**Attendance:**

Any student who, in the opinion of the instructor, is absent too frequently from class in any course, will be reported to the Associate Chair (Graduate), after due warning has been given. On the recommendation of the Department concerned, and with the permission of the Associate Chair (Graduate), the student will be debarred from taking the regular examination in the course.

**Cheating:**

University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning (see Scholastic Offence Policy in the Western Academic Calendar).
**Plagiarism:**

Students must write their essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar). Western University has software for plagiarism checking. Students may be required to submit their work in electronic form for plagiarism checking.

**Conduct:**

Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others.

**Sickness and Other Problems:**

Students should immediately consult with the instructor or Associate Chair (Graduate) if they have problems that could affect their performance in the course. The student should seek advice from the Instructor or Associate Chair (Graduate) regarding how best to deal with the problem. Failure to notify the Instructor or the Associate Chair (Graduate) immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

**Notices:**

Students are responsible for regularly checking their Western University email and notices posted on OWL course website.

**Consultation:**

Students are encouraged to discuss problems with their instructor. Office hours will be arranged for the students to see the instructor. Other individual consultation can be arranged by appointment with the instructor.

**Accreditation (AU) Breakdown:**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Credit (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Science</td>
<td>80%</td>
</tr>
<tr>
<td>Engineering Design</td>
<td>20%</td>
</tr>
<tr>
<td>Total AU’s (25)</td>
<td>100%</td>
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</table>

April 17, 2014 /YA