Department of Mechanical Engineering - University of Alberta

ENGM 558: ERGONOMICS AND WORK DESIGN

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Hours: Wednesdays; 12:00 – 14:00 and by appointment

Laboratory: Auditing and Integration of Management Systems (AIMS) Research Lab
Phone: (780) 492-8684
Web-page: www.uofaweb.ualberta.ca/quality

Class Time & Location: Wednesdays; 17:00 – 20:00; Room ETLC 1-018

Course Description:

Course Objectives:
This course is aimed at providing students with a basic background in work design and ergonomics. Its purpose is also to augment the University of Alberta Engineering Management (EM) program offerings in Industrial Engineering (IE) with the coverage of these two fundamental areas of IE. Since both areas are covered in a single course, a broad overview of the related theory and practice will be given. Topics related to the study of human factors in industrial engineering, systems approach in work study, tools and techniques for work design, anthropometry, psychology and physiology in work design, workplace factors, information resources and interactions, usage of physical resources and tools, environmental factors, motion and time study, work measurement and sampling, as well as standards, will be surveyed.

Academic Regulations:
“The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behavior (online at www.governance.ualberta.ca) and avoid any behavior which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offense and can result in suspension or expulsion from the University.” (GFC 29/09/03)

“Policy about course outlines can be found in Section 23.4(2) of the University Calendar.” (GFC 29/09/03)

Textbook & Course Material:
The following textbook is mandatory for this course:
This book will be used extensively in the course, including the lectures, assignments and other coursework. A customized version of the textbook is available in the bookstore. The book website, containing useful links and software, is: www.mhhe.com/niebel-freivalds. The hard-cover version can also be purchased. However, you are advised to purchase the customized version, as it is less expensive.

Another very useful, especially for ergonomics-related topics, book is Sanders, M.S., McCormick, E.J. (1993), Human Factors in Engineering and Design, 7th edition, McGraw-Hill. Although it will be often referenced in class, this book is not required.

Some coursework may require access to ergonomic and safety standards. Information on the access to these standards will be provided in the first class. One standard, namely CSA Z1000: 2006, is a mandatory reading for the course (lecture IX).

Handouts with lecture outlines (see “Lecture Plan” on page 2) will be provided in class.
Lecture Plan*:

<table>
<thead>
<tr>
<th>NO.</th>
<th>LECTURE TITLE</th>
<th>DATE</th>
<th>TEXTBOOK CHAPTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Human Factors in Industrial Engineering</td>
<td>07/09/11</td>
<td>1</td>
</tr>
<tr>
<td>GL1</td>
<td><em>Guest Lecture: Library (Mr. Randy Reichardt)</em></td>
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<tr>
<td>II</td>
<td>Tools in Work Design and Ergonomics: Part 1</td>
<td>14/09/11</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Tools in Work Design and Ergonomics: Part 2</td>
<td>21/09/11</td>
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<tr>
<td>GL2</td>
<td><em>Guest Lecture: Experiments (Dr. Kajsa Duke)</em></td>
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<tr>
<td>IV</td>
<td>Analysis of Work</td>
<td>28/09/11</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>Design of Physical Work</td>
<td>05/10/11</td>
<td>4</td>
</tr>
<tr>
<td>VI</td>
<td>Design of Work Resources</td>
<td>12/10/11</td>
<td>5</td>
</tr>
<tr>
<td>VII</td>
<td>Design of Work Environment</td>
<td>19/10/11</td>
<td>6</td>
</tr>
<tr>
<td>-</td>
<td>No Class – Project &amp; Assignment Work</td>
<td>26/10/11</td>
<td></td>
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<tr>
<td>VIII</td>
<td>Design of Cognitive Work</td>
<td>02/11/11</td>
<td>7</td>
</tr>
<tr>
<td>IX</td>
<td>Occupational Health and Safety</td>
<td>09/11/11</td>
<td>8</td>
</tr>
<tr>
<td>X</td>
<td>Decision Making in Work Design</td>
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<td>9</td>
</tr>
<tr>
<td>XI</td>
<td>Human Errors</td>
<td>16/11/11</td>
<td></td>
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<tr>
<td>XII</td>
<td>Psychological Aspects</td>
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<td>18</td>
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<tr>
<td>XIV</td>
<td>Work Sampling</td>
<td>30/11/11</td>
<td>14</td>
</tr>
<tr>
<td>XV</td>
<td>Other Work Design Considerations</td>
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<td>16-17</td>
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</table>

* This plan is tentative.

Evaluation Details:

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>WEIGHT</th>
<th>DUE DATE</th>
<th>COVERAGE</th>
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</thead>
<tbody>
<tr>
<td>Quizzes</td>
<td>18%</td>
<td>One (6%): September 28th, 17:00-17:30</td>
<td>Lectures I-III + GL2</td>
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<tr>
<td></td>
<td></td>
<td>Two (6%): November 2nd, 17:00-17:30</td>
<td>Lectures IV-VII</td>
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<tr>
<td></td>
<td></td>
<td>Three (6%): November 23rd, 17:00-17:30</td>
<td>Lectures VIII-XII</td>
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<tr>
<td>Team Project</td>
<td>25%</td>
<td>Overview: (5%): October 12th, 17:00</td>
<td>Further details are provided on page 3.</td>
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<td>Presentation (5%): November 30th, 18:30</td>
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<td>Report (15%): December 7th, 17:00</td>
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<tr>
<td>Individual Assignment</td>
<td>17%</td>
<td>Outline (5%): October 5th, 17:00</td>
<td>Further details are provided on page 3.</td>
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<td>Final (12%): November 16th, 17:00</td>
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<tr>
<td>Final Examination</td>
<td>40%</td>
<td>December 7th, 17:00-20:00</td>
<td>All course material</td>
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<tr>
<td>Total</td>
<td>100%</td>
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NOTE 1: The assignment must be done individually, without seeking or receiving help from anyone else. This policy will be strictly followed in the course. The project is done in teams of three students. Project marks will be assigned to the team. Therefore, all students on the same team will receive the same project marks. Please submit your individual and team work on time, since a penalty of 10% per each day of lateness, counted starting from the deadline at 17:00, is planned to assure a fair evaluation in the course. Evaluation schemes for all components of the project and the assignment will be provided in class or on the course E-Class webpage a week before the due date for the related component or earlier in the course.

NOTE 2: The quizzes and the final exam are “closed book”-type tests. The quizzes may contain a combination of multiple-choice, true-false, circle-the-correct-answer, and fill-in-the-blank questions. The final exam may contain a combination of multiple-choice, true-false, circle-the-correct-answer, short-answer and long-answer questions. Sample questions for the quizzes and the final exam will be provided in class or on the course E-Class webpage a week before the test date or earlier in the course.
**Evaluation Policy:**
*Student evaluation will be performed and expressed in raw marks (out of 100% for each evaluation component) during the course delivery. Mark total for the course will be obtained by assigning component weights given above to the marks obtained in the course, and summing up the weighed marks. The letter grade system will then be applied to the final total mark only. The application of the grade system will be based on a combination of absolute accomplishment and relative performance in class. The final grade will remain unofficial until approved by an appropriate university body.*

**Assignment Information:**
The assignment is aimed at elaborating on a specific ergonomic or work design problem or topic that you are particularly interested in. You are encouraged, within the first three weeks of the course, to define this problem or topic based upon your own ideas and interests, and then consult with the professor through e-mail regarding its appropriateness for the assignment. Subsequently, you will need to provide a comprehensive account of how this problem is addressed in research and practice in the form of a short research paper. The assignment therefore involves conducting a literature survey and your own analysis of the various papers and books found on the chosen ergonomic or work design problem or topic. The “Outline” should contain concise, but illustrative, answers to the “5W+H” questions regarding the chosen problem or topic [“Why (e.g., are you studying this problem or topic?) / Where (e.g., is this problem appearing or this topic studied?) / When (e.g., was this problem discovered or is this topic prevalent?) / Who (e.g., is influenced?) / What (e.g., does this problem or topic involve?) + How (e.g., is this problem or topic being addressed?)”], as well as an analysis of several [three to five] representative papers found on the problem or topic. The “Outline” should be provided on the maximum of three pages of double-spaced text (lines and paragraphs), Times New Roman font size 12, with the list of references that can be placed on the last (i.e., fourth) page (and is thus not included in the three-page maximum). The “Final” assignment should contain the full account of your analysis of the problem or topic, with a 100-word abstract, introduction and conclusions as the mandatory sections. The “Final” assignment should be provided on the maximum of six pages of text (any figures and tables included), with the list of references that can be placed on the last (i.e., seventh) page (and is thus not included in this six-page maximum). As a guide, the list of references should contain no less than 10 different references to papers or books.

**Project Information:**
The project is aimed at applying and synthesizing the concepts and techniques learned in the course to a system or topic of your choice. Please note that, due to the ethics regulations that cover “Research with Human Subjects”, you are not allowed to have any contact with any persons outside your group in order to obtain any information about or to be used in your project. The “Overview” should contain concise, but illustrative, answers to the “5W+H” questions regarding the project and should demonstrate the work done on the project up to the due date. As a guide, the “Overview” can be several (i.e., four to five) pages long. Each “Presentation” is expected to last nine minutes, with one minute designated for questions from the other teams, for the total of 10 minutes per team. The “Report” illustrates all work done on the project. As a guide, the “Report” can be 10 to 15 pages long, but there is no minimum or maximum number of pages specified.
Student Feedback:
Your questions, comments and suggestions regarding the course, as well as the teaching and learning processes and related outcomes, will be greatly appreciated. To book an appointment with the professor, ask a question or provide a comment or a suggestion, please use the phone number, the fax number, or the e-mail address provided on page 1 of the course outline. Electronic means of communication are preferred. Please send your questions from the University of Alberta account with “ENGM 558” in the message subject. You can also provide comments, complaints, compliments and/or suggestions for course improvement anonymously.

Standards Application:
This course is delivered based on and in the spirit of the principles contained in the ISO 9001: 2008 (quality management system), ISO 10001: 2007 (customer satisfaction codes of conduct) and ISO 10002: 2004 (complaint-handling process) standards. For example, your questions about the course will be answered in accordance with the “Response Code” for student satisfaction, and the review of course material will follow the “Review Code”. Both codes were established as per ISO 10001. Your comments, complaints, compliments and suggestions for course improvement will be acknowledged as per the time limit set in the “Response Code”, and processed in accordance with a system established to follow ISO 10002. The application of these standards in ENGM 558 is a part of a research study conducted by your professor and his colleagues. More information on this study is provided on pages 5-6 of the course outline.

Response Code:
- I will respond to any inquiry regarding the course within 24 hours of receiving it, or I will provide:
  - to the inquirer – an explanation, the response and a chocolate bar of at least 100 grams or another type of a snack (as selected by the inquirer), and
  - to all students (appearing in the class when the chocolate bar or the snack is given to the inquirer) – a small chocolate.
- This code is valid 24 hours a day, 7 days a week, for e-mailed inquires sent from September 7 to December 7, 2011, inclusive, from a University of Alberta account, with “ENGM 558” in the message subject.
- I cannot guarantee the 24-hour response for inquiries sent from October 20 to 30, 2011, or in cases of natural or technical events outside of my control.
- The dates mentioned above each start at 00:00:00 hours and end at 23:59:59 Mountain Time.
- Please let me know through e-mail in the case that I did not respond to your inquiry within the promised time.

Review Code:
- If the results of any quiz or any component of the assignment and the project are not reviewed during the first class following the due date of the corresponding quiz or assignment / project component, an explanation will be announced in this class, while the corresponding reviews will be conducted and chocolates will be provided to all students in the class following the announcement.
- This code does not apply in cases of unforeseen natural or technical events.
- Please let me know through e-mail in case of any enquiry about this code.
## Study Title:
Application of Quality Standards in Engineering Courses

### Principal Investigator:
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### Co-Investigator:
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University of Alberta  
Edmonton, Alberta, T6G 2G8  
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### Research Information:

**Purpose, Background and Benefits**

This study is aimed at the development, application and evaluation of various quality methodologies in engineering education. Specifically, international standards for quality management and customer satisfaction systems, as well as statistical quality tools, will be used throughout the delivery of this course. The main objectives of the research are to provide more effective assurances of quality in the course delivery to you and different other stakeholders of engineering education, and to facilitate improvements in the teaching process and in the teaching and learning performance overall.

**Description**

To study the application of the ISO 10001 standard for customer satisfaction codes of conduct, several such codes will be implemented in the course, including the “response code” which guarantees the professor’s and/or the teaching assistant’s response to your questions and comments within a certain time period, as well as the “schedule code” and the “review code”, which relate to the timely coverage of course topics. Your questions, comments and feedback regarding the course delivery and content will be processed in accordance with the ISO 10002 standard on complaint handling for customer satisfaction. The data collection for this part of the study involves recording the time when you posed your question, the time when the response was made, the time when particular course topics were covered in class, as well as your questions, comments, suggestions, complaints and/or compliments. Your feedback may also be collected through optional written surveys. The overall framework for the course quality management will be provided by the ISO 9001 standard for quality management systems.

**Voluntary Character**

You are under no obligation to participate in this study. The participation is completely voluntary, and your choice whether to participate or not will bear no consequences or effects on your mark in this course or your relationship with the instructor and/or the teaching assistant.
Research Information (Continued):

Confidentiality

Study participants will not be individually identified in any published or presented material.

To ensure confidentiality, the following procedure will be implemented for the information collected through e-mail. Any questions, comments and feedback sent by e-mail, including your name and e-mail address, may be forwarded to the research assistant and will be retained in electronic format on the recipient’s and research assistant’s office computers and/or his/her/their designated folders of the university server. Fourteen days after the last day of classes in the term in which the course was given, all e-mails and other personal information related to this research study will be deleted from the recipient’s and research assistant’s computers and his/her/their designated folders. Summary information, including the date and time of each e-mail, the date and time of the corresponding response(s), the nature of the questions, comments, suggestions, complaints and/or compliments related to the course delivery and content, as well as an anonymous unique identifier for the sender, will be retained electronically in a designated folder of the office computers of the study investigators for five years after the last day of classes of the term in which the course was offered. After this period, all files containing the summary information will be destroyed. The unique identifiers mentioned will be matched to specific students during the academic term in which the course is delivered. The encoding scheme used and all personally-identifiable information will be deleted fourteen days after the last day of classes of that academic term.

The part of this study conducted by means of questionnaires, surveys and written comments is completely anonymous. If you choose to participate, please do not write any personally-identifiable information, such as your name or student number, on any questionnaire, survey or written comment submitted. Please leave your questionnaires, surveys and written comments in the designated box in the classroom or on the instructor’s console. Written comments can also be left anonymously in the instructor’s or teaching assistant’s departmental mailbox. Data collected during the study will be accessible to the investigators only and kept for five years in a cabinet located in the Auditing and Integration of Management Systems Research Laboratory (6-27 Mechanical Engineering Building). After this period, all questionnaires, surveys and written comments will be destroyed.

Consent to Participate

If you decide to participate, your e-mailed questions sent to the professor and/or the teaching assistant, your written answers to questionnaires and surveys, and/or your written comments will constitute your written consent to participate in this study.

If you decide not to participate, please send an e-mail to the professor with the sentence: “I decline to participate in the QSEC study” or leave your questionnaires, surveys and written comments in the designated box or on the professor’s console with the statement: “Declined to participate”.

Further Information

If you have any further questions regarding this study, please do not hesitate to contact me and/or the study investigators (Dr. Stanislav Karapetrovic and Dr. John Doucette). Any questions or concerns regarding the ethical considerations in conjunction with this study should be directed to Dr. James Miller, Chair of the Engineering Faculty Ethics Committee, at 492-4443. Dr. Miller has no direct involvement with this project.