

Introduction to Physical Ergonomics and Human Factors

Course Syllabus (Winter 2019)

Course Description

This 8-week, asynchronous online course teaches students how to identify the components of occupational tasks that can contribute to musculoskeletal injury and/or fatigue, quantify the risks associated with those components using the most relevant ergonomics assessment tools, and to integrate that information into conclusions regarding the acceptability of the risk. The course will use physical ergonomics as an example of evidence-based practice by not only covering the analysis tools, but also explaining their scientific basis and outlining their strengths and limitations for various work scenarios. Students will also be introduced to the concepts of optimal task design and gain experience writing reports that summarize their findings and effectively support their conclusions. This course will challenge students to assess many practical examples from a wide variety of workplace sectors, including manufacturing, health care, agriculture and others, and interpret data from sources that will not always agree, so that decisions can be made and defended. Students will learn about the various biomechanical, psychophysical, physiological and epidemiological criteria used in physical ergonomics, and how they can be integrated during the process of decision making.

Course Learning Outcomes

By the end of the semester session students will:

1. Recognize, identify and prioritize the physical hazards within occupational task elements that contribute to the risk of work-related musculoskeletal disorders.
2. Learn the most current biomechanical, psychophysical and physiological approaches and criteria used to quantify physical exposures and assess risk within occupational tasks
3. Identify and apply the appropriate ergonomic risk assessment tool(s) to occupational tasks, citing relevant resources
4. Measure and/or calculate the inputs and outputs for various ergonomics tools and interpret them appropriately
5. Gain experience with addressing the ethics of physical ergonomics analyses and interpretation.
6. Calculate the acceptable loads based on the target populations selected.
7. Analyze, synthesize and interpret the outputs of multiple ergonomic risk assessment tools (approaches) to make a definitive decision about the injury and/or fatigue risk associated with a task
8. Write reports summarizing all the relevant findings and providing recommendations regarding task acceptability. Support all decision with data and relevant sources and be able to debate and defend decisions.
9. Create new task designs to mitigate risks and integrate other factors such as efficiency and practicality for tasks that have been analyzed. Task design includes not only the physical workstation, but also the tools and equipment, procedures, and materials used to accomplish tasks.

Instructor Information

Professor: Jim Potvin

Office hours: By phone or Zoon, by advance appointment through email.

Contact: via the Canvas course mail tool or via email
jpotvin@berkeley.edu



Jim received a B.H.K. in Kinesiology from the University of Windsor (1986) and a M.Sc. (1988) and Ph.D. (1992) in biomechanics from the University of Waterloo. He was a professor for 23 years at the University of Guelph, University of Windsor and McMaster University, where is he now a Professor Emeritus. He is also the owner of Potvin Biomechanics Inc. Jim researches in the areas of biomechanics and physical ergonomics. His basic research focuses on the study of joint mechanics and muscle fatigue and his applied research focuses on developing valid ergonomic methods to quantify injury risk in the workplace; including the assessment of manual materials handling tasks and the evaluation of risk of upper limb disorders. Jim has supervised over 70 graduate students and employed 60 graduates and published over 80 scientific articles.

Course Format & Schedule

The course will be taught via narrated PowerPoint lectures, guided readings, problem sets, two assignments and facilitated discussions. Additionally, an ergonomics project will provide each student with an opportunity to apply their skills in analyzing a real occupational task. The first three weeks of the course will focus on an introduction to physical ergonomics and the risks and assessment of manual materials handling tasks (ie. lifting, lowering, pushing, pulling and carrying). Weeks 4 and 5 will focus on the injury risks and assessment of tasks placing demands on the upper extremities. The last two weeks will introduce students to the use of biomechanics software in ergonomics, the assessment of demands on the neck and the evaluation of occupational vibration.

Week 1: Introduction to Physical Ergonomics and Manual Materials Handling

- Introduction to Physical Ergonomics
- The Concepts of Demand, Capacity & Risk
- Manual Materials Handling Risk Factors & Injuries

Week 2: Manual Materials Handling - Analysis Tools (Part 1)

- Psychophysics & Manual Materials Handling
- The Physiology of Manual Materials Handling
- The Revised NIOSH Lifting Equation (RNLE)

Week 3: Manual Materials Handling - Analysis Tools (Part 2)

- The Mital Tables for Manual Materials Handling
- Cumulative Spine Loading
- Deeper Dive into the Research Behind Manual Materials Handling Tools.

Week 4: Upper Extremity (Part 1) - Injuries, Risk Factors & Analysis Tools

- Upper Extremity Risk Factors & Injuries
- RULA - The Rapid Upper Limb Assessment
- Strength Data for the Hand, Wrist & Forearm
- Upper Extremity Psychophysical Data

Week 5: Upper Extremity (Part 2) - Analysis Tools

- The Maximum Acceptable Effort (MAE) Equation
- ACGIH TLV for Upper Limb Localized Fatigue
- Recommended Cumulative Recovery Allowance (RCRA) Method
- HandPak Software

Week 6: The Biomechanics of Manual Materials Handling

- Review of Biomechanics Concepts
- Occupational Biomechanics Software (Part 1)
- Occupational Biomechanics Software (Part 2)

Week 7: Manual Arm Strength & Upper Extremity Task Design

- Upper Extremity Strength Predicted with Software
- The Arm Force Field Method
- Neck Ergonomics
- Occupational Vibration

Course Grading

Grading will have five components:

1. Participation in class discussions (**10%**)
2. The first assignment will challenge you to use the manual materials handling tools taught in Weeks 2 & 3, for a variety of lifting, lowering, pushing, pulling and/or carrying tasks, and make and defend decisions on the acceptability of jobs based on an integration of the results (**15%**)
3. The second assignment will challenge you to use the upper extremity tools and published data taught in Weeks 4 & 5, for a variety of hand, wrist and/or forearm intensive tasks, and make and defend decisions on the acceptability of jobs based on an integration of the results (**15%**)
4. A group project to conduct an original ergonomic analysis of a manual materials handling task. Each student will do their own project but will collaborate as a part of a team of 3 students, sharing ideas on the best assessment tools to use and redesign options. Each student will submit a written report of their assessment and recommended redesign. The grade will include participation in collaboration with your team (**25%**).
5. Final exam that will assess mastery of use of the ergonomics analysis tools, integration of results to make final decisions on task acceptability, grasp of the scientific basis and limitations of each tool, and concepts of (re)designing the workplace (**35%**)

Course Requirements

Required Course Materials

Microphone/headset for your computer

Videos and other resources are found on weekly course pages. A weekly course reader in pdf format which includes video transcripts and course readings will also be available on the course site for you to download.

Text Book

There is no required text book for this course.

Required Readings, Optional Readings & Reference Material

During this course, you will be provided with links to PDF files of articles and other materials from the UC Berkeley Library Collection. Please make sure you understand and follow the [University of California Library Conditions of Use](#).

Completion of Course Modules

Students are expected to complete all modules, including viewing all lectures; completing all required readings and individual activities; and fully participating in class activities.

Participation in Course Activities and Discussions

A question will be posted on Canvas each week for class discussion. Students should complete lectures and readings in advance of responding. All students are required to post an initial response by Saturday Noon each week. This will be graded on a 0-10 scale based on effort and thoughtfulness.

By the following Monday 5pm students are also requested to post one thoughtful Peer Response to another student's initial comment. This will be also be graded on a 0-10 scale based on effort and thoughtfulness. Students should pick a post that has not already received more than one peer response and either:

- (a) Identify one area in which they agree with their classmate's analysis. Offer additional substantive support from the readings or their own experiences with this topic. Or:
- (b) Identify one area in which they disagree with their classmate's analysis. Respectfully explain the disagreement and defend the alternative viewpoint using support from course materials or personal experience with this topic.

Practice Problem Sets

The ergonomics analysis course material will be reinforced through practice problem sets with solutions provided. There are no marks attributed to these, and they do not need to be submitted, but they will give you practice with the same types of analyses and decision making that will be included in the two assignments, the ergonomics project and the final exam.

Assignments

Assignment #1. Quantification of Low Back Injury Risk during Manual Lifting: (15%)

This assignment will provide students with hands-on experience in the analysis, reduction and interpretation of data provided by the various tools available for assessing the low back demands of manual lifting tasks, including the Liberty Mutual MMH Tables, Liberty Mutual Metabolic Equations & Revised NIOSH Lifting Equation (in Week 2), and Mital Tables & LiFFT Tool (in Week 3). Students will be provided with task scenarios with the necessary measurements and task data to perform a variety of ergonomics analyses. The lab report will require that the results be interpreted, with regard to the strengths and weaknesses of each tool, so that educated decisions can be made regarding the risk involved with specific tasks. You will be asked to make definitive decisions on the acceptability of each task and support these decisions with data. The specific procedures and requirements of this lab will be distributed later. Note: each student must hand in their own independent lab with their own write-up and interpretation.

Assignment #2: Quantification of Upper Limb Tasks for Injury Risk: (15%)

This assignment will be similar to Assignment #1 but will be used to give you experience with the analysis of upper extremity tasks using various tools taught, including: RULA, strength data from the literature (in Week 4), HandPak, the MAE equation, ACGIH TLV and RCRA method (in Week 5). Again, a report will be written providing decisions of acceptability for each task and supporting those decisions. The specific procedures and requirements of this lab will be distributed later. Note: each student must hand in their own independent lab with their own write-up and interpretation.

Ergonomics Project (25%)

Each student will complete their own ergonomics project. You must find a business or company that is willing to let you come into their environment and perform an ergonomics analysis. You can also use the company/companies you work with/for. You must consult with the course instructor to verify that your selected task is appropriate for the project. By the beginning of Week 3, you must submit a description of the company you will be working with and the task you will assess.

You will play the role of an ergonomics consulting company being hired by a company to improve the workplace. Each student will submit a professional Ergonomics Report to summarize their findings. This report is expected to be professional and it is mandatory that a second copy be submitted to the company you worked with. Students are encouraged to use any of the assessment tools discussed in this course to strengthen their report.

Find a task that requires the use of the manual materials handling tools you have learned

- lift, lower, push, pull and/or carry
- make sure there is something you can do to improve the task
- if the worker does many things, you can choose a specific component of their task

You will perform a full analysis of this task, with the tools you have been taught, specifically on manual materials handling up to the end of Week 3 and write up a report quantifying the risk and presenting the findings. You will need to start the project early, and work consistently on it throughout the semester. More detail will be given about the report format, once the course starts.

Report Format: Font - 11 pr Times Roman or Arial, Margins - 1 inch on all sides; Page numbering - mandatory; Tables & Figures - clearly labelled, should fully explain the figure or table. Please single space your reports (no double spacing).

Deadlines

Deliverable	Points	Start	Due Date
Submit description of Ergonomics Project		Week 1	Jan 21 st by 5pm PST
Assignment #1	15%	Start of Week 4	Jan 28 th by 5:00 PST
Assignment #2	15%	Start of Week 6	Feb 11 th by 5pm PST
Ergonomics Project Report	25%	Start of Week 7	Feb 24 th by 11:59 pm PST

Final Exam

Details about the length of the exams and the materials you will be allowed to use during the exam will be posted on the course site.

Course Communication

As we move through the course materials, we want to hear how the course is going for you, your questions as well as how your personal and professional experiences add to our conversation. You can learn a lot from discussing the material in this course with each other and we encourage you to take advantage of the interactive components of the course to learn from each other.

Announcements

Announcements will be posted on the home page of the course site. Please check regularly for updates. You can also adjust your settings in Canvas so that announcements are emailed to you at the time they are made.

Course mail

Course announcements will also be sent out through Canvas' notification system. The default is to receive announcements via the Course Mail system, so make sure to check your Course Mailbox for message or wherever you receive notifications.

Office hours

Weekly office hours are held with your instructors on Thursdays from 12:00-1:00 pm (PST) from January 10th to February 21st. Login details for the online video conference call will be provided. If you are unable to be present, you are welcome to email your instructors through Canvas with private questions or group discussions boards.

Policies

Due Dates

Please check the online course calendar for assignments and dates due.

Late Assignments

All assignments are due at the time and date indicated in Deadline table of this syllabus. Any assignment not received when due will be given an automatic 10% deduction for each day it is late (including weekends). At the Instructor's discretion, the penalty may be waived if extenuating circumstances (e.g. illness, death in the family etc) are communicated to the Instructor before the deadline. It is the student's responsibility to seek clarification regarding the requirements for any assignment if the student has questions or is unclear about those requirements. Please communicate in advance with instructors using Canvas Course Mail if you will not be able to meet course deadlines.

Course Evaluations

Course evaluations will be posted on the course site on Friday of Week 6 of the course and be available until the start of the final exam period. You will receive notification when evaluations are available. While participation in course evaluations is not graded, it is an important service to the instructor, program and the university. Your responses are anonymous and will not be available to the instructor until after final grades have been submitted. Your feedback is essential for understanding how courses offered by OOMPH can be improved and I thank you in advance for your participation and feedback

Grading Policies

93-100% =A	90-92.9%=A-	88-89.9%=B+	83-87.9%=B	80-82.9%=B-	78-79.9%=C+
73-77.9%=C	70-72.9%=C-	60-69%=D	<60%=F		

Student Support Contact Information

Technical Problems with Canvas

If you encounter any technical problems with Canvas such as problems opening the course site, accessing quizzes, discussions or submitting assignments or problems with mobile apps contact the Canvas 24/7 support from "Help" inside the course sites or directly using phone, chat or email:

- Canvas Support Hotline: 855-308-2758 (24/7)
- Chat: https://secure.livechatinc.com/licence/2695732/open_chat.cgi?groups=38
- Email: support@instructure.com

Broken Links, Missing Course Files

If you find any broken links or missing course files on the course site, please alert your course facilitators and identify the location of the problem on the course site.

Netiquette

In an online environment it is not possible to read your body language, tone of voice, or facial expressions. Therefore, a special set of rules has emerged for online communications (e.g., course

discussions) called Netiquette. Here are some basic Netiquette guidelines that should be followed in this course.

- Adhere to the same standards of behavior online that you follow in real life. Never mail or post anything you wouldn't say to your reader's face.
- Before posting to a discussion board, you should read prior messages to get a sense of the flow and language of the discussion. Keep your questions and comments relevant to the topic of the discussion.
- Don't be afraid to ask questions within the course discussion group, or to share what you know.
- If you post a different viewpoint, first acknowledge what someone else has said. If you disagree with someone, it is better to start a message by briefly restating what the other person has said in your own words. This lets the other person know that you are trying to understand him/her.
- Support the points you make with examples or evidence from lecture, readings and/or from your own professional experience.
- Email messages should be considered private and not shared with others or quoted without permission. However, whatever you post to a newsgroup or discussion board is public. You never know who might read what you posted.
- Consider that a post may be the first – and lasting - impression you make on someone: Make sure your postings contain correct information. Check your spelling.
- Do not use ALL CAPS. It gives the impression that you are shouting.
- Do not send "Me Too!" or "Thank You" etc. messages to the entire group. Send those directly to the original poster.
- Cite all quotes, references and sources and respect copyright and license agreements.

Accreditation

Certified Professional Ergonomists

Certified Professional Ergonomists may be eligible to earn up to 45 contact hours for this course. Visit http://www.bcpe.org/wp-content/uploads/BCPE_CoC_FAQs_April2016.pdf for more information.

Registered Nurses

Provider approved by the California Board of Registered Nursing, Provider Number 12983, for 45 contact hours.

Registered Environmental Health Specialists

This course has been approved for 45 contact hours, REHS. The Center for Occupational and Environmental Health (COEH) UC Berkeley is a Registered Environmental Health Specialist (REHS) Program Continuing Education Accreditation Agency approved by the California Department of Public Health.

Occupational Therapists

Occupational Therapists may be eligible to earn up to 45 contact hours for this course. Visit http://www.bot.ca.gov/board_activity/laws_regs/cc_regulations.shtml for more information.

Industrial Hygienists

ABIH® Diplomates may be eligible to earn up to 45 contact hours for this course.

Visit <http://www.abih.org/maintain-certification/cm-credit-education-events> for more information.

Safety Professionals

Certified Safety Professionals may be eligible to earn up to 45 contact hours for this event.

Visit <http://www.bcsp.org/Certifications/Recertification> for more information.