

McMaster University
Department of Kinesiology
Kinesiology 3N03 – ERGONOMICS I: Workplace Injury Risk Assessment
Winter 2018

INSTRUCTOR: Peter J. Keir, PhD
IWC 212, Ext. 23543, email: pjkeir@mcmaster.ca

OFFICE HOURS: Drop in & by appointment

LECTURES: Mon.–Wed.–Thurs. 10:30 – 11:20 HSC/1A4

LABS: L01: Tuesday 3:30 – 5:20 IWC/A102G
L02: Monday 11:30 – 1:20 IWC/A102G
L03: Monday 8:30 – 10:20 IWC/A102G

TEACHING ASSISTANTS: Amanda Farias Zuniga, Brittany Bulbrook, Daanish Mulla

COURSE OBJECTIVES:

This course examines topics in occupational biomechanics and applied ergonomics. This course will lay the groundwork necessary to become a consulting ergonomist. Upon completion of this course, you will have developed:

- An appreciation of the role of biomechanics in occupational issues.
- Qualitative and quantitative skills to assess the risk of injury associated with workplace layout, tasks, and tools.
- The knowledge to identify specific tissues at risk.
- The ability to redesign operations to reduce the risk of injury.

LECTURE NOTES & READINGS: Avenue to Learn

Materials will be posted on Avenue to Learn throughout the semester. This may include documents with selected slides for upcoming lectures, resource materials, lab handouts and links to journal articles. Students are advised to check Avenue to Learn the day before each class, lab or exam, for materials that may be needed or relevant for that class, lab or exam.

SUGGESTED TEXT (strongly suggested if you plan to continue in this field):

Chaffin, D., Andersson, G. and Martin, B.J. Occupational Biomechanics, Third Edition, John Wiley, 1999.

GRADING

a)	Lab #1 - Upper Extremity	=	5%
b)	Lab #2 - Manual Materials Handling	=	5%
c)	Group Project Preliminary Report	=	5%
d)	Midterm Test (Feb. 15)	=	20%
e)	Group project report (due Apr. 9)	=	30%
f)	Final Examination	=	35%

GRADING NOTES:

1. If the mid-term exam is missed, the percentage allocated to the missed exam will be added to the final exam. There will be no make-up mid-term in this course.
2. Late assignment grades will be reduced by 10% per day.
3. Any appeal for grade revision must be (a) received within 7 days of the posting of the grade, (b) in writing, and (c) explicitly state why you believe the mark is in error. Note that resubmitted material will be re-graded in its entirety. An appealed grade may increase, decrease, or remain unchanged.

ASSIGNMENTS AND LABS

Lab #1: Workplace Analysis of the Upper Extremity (RULA, Strain Index, ACGIH HAL TLV)
January 22/23 Value: 5% **DUE: Feb. 6/7 (in Lab)**

Lab #2a: Biomechanical Software – 3DSSPP & Jack - Computer Lab
To be submitted with Lab 2

Lab #2: Analysis of Injury Risk in Load Handling Tasks
February 5/6 Value: 5% **DUE: Feb. 13/14 (in dropbox)**

GROUP PROJECT:

Preliminary Outline – 5% of final grade

Final Report - 30% of final grade

Project groups will each have 4 students. *By January 23rd, you must submit a sheet with the names of each group member.* Find an occupational task (or tasks) that places the low back or the upper limbs at some risk of injury (this task can be anything from an industrial job, some manual job on campus, a task you perform as a component of your part-time job, etc.). You **must** consult with the course instructor to verify that your selected task(s) are appropriate for the project. You should have *some* idea of a project topic when you submit your group.

Note: you must analyze a job with upper limb and low back concerns.

Your group will play the role of an ergonomics consulting company being hired by a company to improve the workplace. Each group will submit one "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. Students should use appropriate assessment tools discussed in this course to strengthen their report. *Note:* Everyone in a group will normally receive the same mark for the project. However, the instructor reserves the right to assign a higher or lower mark to individuals who have done much more or much less than their share of the project, by consensus of their group.

DROP BOXES

Course drop boxes are located on the second floor of the IWC near IWC 224 (please do not place assignments in the administrative drop box located outside IWC 219C).

POLICY REGARDING DEFERRED TESTS AND EXAMS

Students who miss the term test or final exam for legitimate reasons such as illness may be allowed to write a deferred or "make-up" test. Due to the nature of this course, there will be no "make-up" test for a missed midterm exam, rather the marks allotted to the midterm will be moved to the final exam. In all instances, appropriate documentation must be submitted to the Office of the Associate Dean, Faculty of Science.

Students who miss a Registrar-scheduled final exam can apply to the Associate Dean's office for permission to write in the deferred final exam schedule. In all cases, appropriate documentation must be submitted to the Office of the Associate Dean, Faculty of Science, for consideration of deferred examination permission. Under no circumstances will the instructor re-schedule a final exam for individual students.

McMASTER STUDENT ABSENCE FORM

If you are absent from the university for a minor medical reason, lasting fewer than 3 days, you may report your absence, without documentation, using the McMaster Student Absence Form (as long as the missed work is worth less than 25% of the final course grade). The MSAF can only be used once per term. Absences for a longer duration or for other reasons (eg. religious, personal) must be reported to the Faculty of Science Associate Dean's office, with documentation, and relief from term work may not

necessarily be granted. When using the MSAF, report your absence to pjkeir@mcmaster.ca. Contact the instructor immediately (normally within 2 working days) by email/telephone/in person to learn what relief may be granted for the work you have missed, and relevant details such as revised deadlines, or time and location of a make-up exam.

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar “Requests for Relief for Missed Academic Term Work”. Please note these regulations have changed beginning Fall 2015

ACADEMIC INTEGRITY

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences (e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript reading "Grade of F assigned for academic dishonesty", and/or suspension or expulsion from the university). It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at: <http://www.mcmaster.ca/univsec/policy/AcademicIntegrity.pdf>

The following illustrates only three forms of academic dishonesty:

- Plagiarism (e.g. submission of work that is not one's own or for which other credit has been obtained)
- Improper collaboration in group work.
- Copying or using unauthorized aids in tests and examinations.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone (905) 525-9140 ext. 28652 or email sas@mcmaster.ca. For further information, consult McMaster University's Policy of Academic Accommodation of Students with Disabilities. <http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-StudentsWithDisabilities.pdf>

ON-LINE LEARNING RESOURCES

Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor

USE OF COURSE MATERIALS

Course materials provided by the instructor are for use by students registered in this class only. Under no circumstances are these materials to be shared, posted or sold to a third party without permission from the instructor. This includes, but is not limited to, online posting of instructor provided lecture/lab notes, online lectures, recordings of lectures, or any lab materials on a website other than the Avenue site designed for the course.

MODIFICATIONS TO COURSE

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

FEEDBACK

It helps us improve our services when we hear from our students about what we can do better. A feedback process brings to our attention situations in which we may not have adequately considered accessibility and allows us to better plan for accessibility in the future.

KINESIOL 3N03: Ergonomics I
Tentative Topical Outline & Assignments – Winter 2018
Updated Dec. 13, 2017

Date	#	Topic	Assignment
R Jan. 4	1	Introduction	OB: Ch. 1 (p.1-15); Norman & Wells (1990)
M Jan. 8	2	Approaches for Assessment	
W Jan 10	3	Measurement;	
R Jan. 11	4	RULA	McAtamney et al (1993);
M Jan. 15	5	Strain Index	Moore & Garg (1995). [OB: 393-433, 300-305]
W Jan 17	6	ACGIH TLV for HAL	
R Jan. 18	7	MMH - Snook (Psychophysics)	Snook & Ciriello (1990) [OB: 91-101]
Jan 23/24		Lab #1 - Upper Extremity	
M Jan. 22	8	Biomechanics of Lifting	[OB: 224-252 (Ch. 6)] [Kine 2A03 notes]
W Jan. 24	9	Computer models	
R Jan. 25	10	MMH - Physiology	
Jan 28/29		Computer Lab	Lab #1 – Due.
M Jan. 29	11	NIOSH	Waters et al. (1993) [OB: 315-327]
W Jan. 31	12	Mital / Integration	[Mital (1997); OB: Ch.8]; Waters (1998); Dempsey (1998)
R Feb. 1	13	Q&A	
Feb 6/7		Lab #2 - Manual Materials Handling	
M Feb. 5	14	Checklists; Rating Scales (RPE, RPD)	[Keyserling et al (1993)] Group Project outline - Due.
W Feb. 7	15	Strength/Endurance	[OB: 101-125, 393-398, 42-53]
R Feb. 8	16	Q&A	
M Feb. 12	17	MAE	Lab #2 – Due.
W Feb. 7	18	Q&A	
R Feb. 15	19	MIDTERM EXAM	
Feb. 19-23		READING WEEK	NO CLASSES
M Feb. 26	20	Midterm revisit plus Report Writing	
W Feb. 28	21	Report Writing;	
R Mar. 1	22	Tissue Mechanics	[OB: Ch.2]
M Mar. 5	23	Upper Extremity Injuries	Armstrong & Silverstein (1987)
W Mar. 7	24	Upper Extremity Injuries #2	[OB: 252-261]
R Mar. 8	25	Low Back Mechanics,	McGill & Norman (1997) [OB: 224-252]
M Mar. 12	26	Low Back Injury & Injury avoidance	[OB: 510-519]
W Mar. 14	27	Workplace redesign	Grant & Habes (1995)
R Mar. 15	28	Q&A	
M Mar. 19	29	Tool Design	[OB: 393-453]
W Mar. 21	30	Work Methods	
R Mar. 22	31	Office Ergonomics	
M Mar. 26	32	Economics;	[OB: 355-391, 454-456]
W Mar. 28	33	Legislation	
R Mar. 29	34	Project Q&A	
M Apr. 2	35	Vibration	[OB: Ch. 12]
W Apr. 4	36	Pre-employment Selection	Chahal et al (1992) [OB: 501-513]
R Apr. 5	37	Last Minute Project Q&A	
M Apr. 9		Last Day (Wrap up)	Project Due in class
Apr. 11-26		FINAL EXAM	Scheduled by Registrar's Office

NOTES: 1. "OB" = Occupational Biomechanics by Chaffin, Andersson & Martin, 1999. 2. references in square brackets are readings available at the library or from the instructor

READINGS:

Introduction

1. Chaffin, D.B., Andersson, G.B. & Martin, B.M., Chapter 1, Occupational Biomechanics, Third Edition, John Wiley, 1999, pp. 1-15.
2. Norman, R. and Wells, R. Biomechanical aspects of occupational injury. Proceedings of the 23rd Annual Conference of the Human Factors Association of Canada. Ottawa, Ontario, Canada, 1990.

Manual Materials Handling: Snook, NIOSH Equation & Comparisons

3. Snook, S.H. & Ciriello, V.M.. The design of manual handling tasks: revised tables of maximum acceptable weights and forces. *Ergonomics* 34(9):1197-1213, 1991.
4. Waters, T.R., Putz-Anderson, V., Garg, A., and Fine, L.J. Revised NIOSH equation for the design and evaluation of manual lifting tasks. *Ergonomics* 36(7):749-776, 1993.
5. Dempsey, P.G. A critical review of biomechanical, epidemiological, physiological and psychophysical criteria for designing manual materials handling tasks. *Ergonomics* 41(1):73-88, 1998.
6. Waters, T.R., Putz-Anderson, V., and Baron, S. Methods for assessing the physical demands of manual lifting: A review and case study from warehousing. *Am.Ind.Hyg.Assoc.J.* 59:871-881, 1998.
[Mital, Nicholson & Ayoub A GUIDE TO MANUAL MATERIALS HANDLING, 2nd ed., 1997, Taylor & Francis. Steacie Reserves: T 55.3 L5 M58 1997]

Upper Extremity Assessment Methods

7. McAtamney, L. and Corlett, E.N. RULA: a survey method for the investigation of work-related upper limb disorders. *Appl.Ergonomics* 24(2):91-99, 1993.
8. Moore, J.S. and Garg, A. The strain index: a proposed method to analyze jobs for risk of distal upper extremity disorders. *Am.Ind.Hyg.Assoc.J.* 56:443-458, 1995.

Injury Prevention & Disorders

9. Armstrong, T.J. and Silverstein, B.A. Upper-extremity pain in the workplace - Role of usage in causality. In: *Clinical Concepts in Regional Musculoskeletal Illness*, Grune & Stratton, Inc. 1987, p. 333-354.
10. McGill, S.M. and Norman, R.W. Low back biomechanics in industry: The prevention of injury through safer lifting. In: *Current Issues in Biomechanics*, ed. Grabiner, M. Champaign, IL, Human Kinetics, 1992, p. 69-120.

Ergonomic Intervention

11. Grant, K. and Habes, D. Summary of studies on the effectiveness of ergonomic interventions. *Appl.Occup.Environ.Hyg.* 10(6):523-530, 1995.

Vibration

12. Chaffin, D.B., Andersson, G.B. & Martin, B.M., Chapter 12, Occupational Biomechanics, Third Edition, John Wiley, 1999, pp. 463-500.

Pre-employment Screening

13. Chahal, P., Lee, S.W., Oseen, M., Singh, M., and Wheeler, D.L. Physical fitness and work performance standards: A proposed approach. *Int.J.Ind.Ergonomics* 9:127-135, 1992.