

ME 5100/6100, OEHS 6761 – ERGONOMICS

University of Utah
Department of Mechanical Engineering
Fall Semester, 2017
Lecture: Monday and Wednesday 4:10-6:00 pm
Lecture Location: 2230 WEB
Lab Location: 2230 WEB

The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the instructor and to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD) to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification. For more information about college policy and procedures, refer to: College of Engineering Academic Guidelines: <https://www.coe.utah.edu/academics>

COURSE DIRECTOR:

Andrew Merryweather, PhD
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Email: a.merryweather@utah.edu
Office: 1674 MEK

CREDITS: 3 semester credit hours

FACULTY: Dr. Merryweather and guest lecturers.

TEXT AND COURSE MATERIALS: Ergonomics course notes supplemented by PowerPoint presentations, OSHA publications, articles and other relevant material will be provided during the semester on Canvas as necessary.

SUGGESTED REFERENCE MATERIAL (If you want to expand your knowledge - definitely not required for exams)

Biomechanics in Ergonomics 2nd Edition, Shrawan Kumar. ISBN 0-8493-7908-3
Occupational Biomechanics 4th Edition, Don B. Chaffin. ISBN 0-471-72343-6

OFFICE HOURS: MONDAY, WEDNESDAY: 3:00-4:00 PM and by appointment.
Drop in at other times is fine, but try to let me know ahead of time if possible.

Lab TAs: Nicolas Brown, 2215 MEB, nicolas.n.brown@gmail.com

The TA has agreed to be available by email pretty much anytime, or by appointment. The TA is responsible for the grading of the labs. Please email or meet with Dr. Merryweather on questions about lecture material, exams, etc.

COURSE DESCRIPTION: This course is an introduction to the discipline of Ergonomics and focuses on industrial applications. Ergonomics is the science that studies the interaction between workers and the workplace. This course will focus on how poorly designed workstations, work methods, and tools can result in undesirable outcomes, particularly injuries to the upper extremities and low back. This course will emphasize physical ergonomics (musculoskeletal disorders and biomechanics) and focuses on the use of lecture material to identify and address ergonomic issues illustrated in the labs and homework. Information processing and cognitive aspects of ergonomics (psychological ergonomics) will be addressed briefly.

COURSE OBJECTIVES: Upon completion of this course, students will:

1. Have an understanding of basic human physical capabilities and limitations.
2. Understand basic musculoskeletal injury causation theory.
3. Be able to identify and suggest abatements for various ergonomic risk factors.
4. Be able to design a work place layout for a specific worker anthropometry or worker population.
5. Be able to design or redesign a manual manipulation task to minimize the trauma potential for upper extremity cumulative trauma disorders.
6. Be able to apply, interpret and make task redesign recommendations based on the output from upper extremity analysis tools such as the Rodgers Model, Strain Index, RULA, ACGIH Hand Activity Level, and checklists.
7. Be able to compute moments and muscle forces resulting from external loads to the body.
8. Understand the implications of muscle forces and the corresponding joint compressive forces on the body, particularly to the low back.
9. Be able to quantify the low-back compressive force, shoulder moment, and energy expenditure rate for a manual material handling task.
10. Be able to use the multi-task NIOSH Revised Lifting Equation to quantify the stresses in a manual material handling task, propose cost effective task redesigns, and determine the most appropriate secondary analysis tool(s).
11. Understand musculoskeletal modeling advantages and disadvantages.
12. Be familiar with the data provided on an OSHA 300 Log.
13. Be able to modify existing ergonomic tools for application to disabled and elderly populations.
14. Be able to propose an effective overall plant ergonomics program.

EVALUATION OF STUDENT PERFORMANCE:

<u>Evaluation:</u>	
LABS (40, 40, 70)	150
PROJECT REPORT	200
EXAM 1	100
EXAM 2	150
<u>EXAM 3</u>	<u>100</u>
TOTAL	700

LABS: There will be three lab assignments. Students will be scheduled for either a Monday or a Wednesday lab session and only need to attend that day. Students may work together but, unless otherwise specified, all lab assignments are to be completed and turned in on an individual basis by each student. Duplicate prints of the same work is the same as copying someone else's work and is not allowed. The TAs will grade the labs. Questions on grading should first be discussed with the TA who graded the lab and then with Dr. Merryweather. Students may resubmit lab assignments for re-grading within one week of their return to the student. Both the original and the resubmitted lab must be turned

in. The score on the re-graded lab will be multiplied by .8. For example, a student receiving a 20 on a lab assignment worth 40 points who resubmits it and receives 35 points will receive a final score of 28 ($.8 \times 35 = 28$).

PROJECTS: Dr. Merryweather will provide more detailed information during the semester. The term projects are intended to provide students with the opportunity to apply the ergonomic information and analytical tools presented in the class to “real world” situations. Unless other arrangements are made with Dr. Merryweather, students registered for ME 5100 will work in groups of 3 or 4 and students registered in ME 6100 or OEHS 6761 will work in groups of 2. The projects generally relate to the use of the tools and techniques used in the first part of the course. Projects will generally involve the application of ergonomic analysis methods to the industrial/office/home setting. For ME seniors in ME 4000/4010 it is encouraged (but not required) that the project relate to ergonomic analysis of the senior design project. Copies of three term projects from past years are on canvas. A proposal (one paragraph description) for the project and names/majors of group members must be submitted by each group (not from each person in the group) on or before Wed. 18 October. These will be reviewed by Dr. Merryweather and returned/remailed within a week or so of receipt. An alternative to the project is competing in the nation Ergonomics Competition (<http://auburnengineers.com/node/229/>). For more details about this option for your project, please contact Dr. M.

EXAMS: Exams 1 and 2 will include a section containing short-answer type questions and a larger section dealing with analysis and calculations. Exam 3 will be multiple choice. All three exams are open notes and open computer. Only material from class may be accessed or referred to during the exams and, of course, information exchange between students during the exam is academic misconduct and is prohibited. As a minimum, academic misconduct will result in a score of “0” on the exam, which will almost certainly result in failure in the course and a report of academic misconduct to the appropriate department. The exams will cover all text/handout material and all material/information discussed in class. This includes, for example, answers to class questions, guest lectures, Merryweather "war stories", etc.

Grading Scale (percentage cut point may be adjusted down, but not up):

94-100%	A
90-93%	A-
87-89%	B+
84-86%	B
80-83%	B-
77-79%	C+
74-76%	C
70-73%	C-
67-69%	D+
64-66%	D
60-63%	D-
<60%	E

(total course scores >93.50, >89.50, >86.50, etc. will be rounded up)

**COURSE SCHEDULE
ERGONOMICS
ME EN 5100/6100, OEHS 6761
Fall Semester, 2017**

Week	Beg	Day	Module	KEY TOPIC
1	21-Aug	Mon	1,2	Introduction, Anthropometry
		Wed	2,3	Anthropometry (cont.), Musculoskeletal Modeling and Injury Theory
2	28-Aug	Mon	4	UEMSDs
		Wed	4	UEMSDs (cont.) - Sign up for Lab
3	4-Sep	Mon		No Class-MLK BIRTHDAY HOLIDAY
		Wed	4	UEMSDs (cont.)
4	11-Sep	Mon		Lab 1 - UEMSDs
		Wed		Lab 1 - UEMSDs
5	18-Sep	Mon	5	Seated Work and VDTs
		Wed	6	Controls/Displays and Human Factors
6	25-Sep	Mon		Lab 2 – Controls/Displays (Lab 1 Due)
		Wed		Lab 2 – Controls/Displays (Lab 1 Due)
7	2-Oct	Mon	7	Manual Material Handling
		Wed		Exam 1 (Modules 1-6, handouts)
8	9-Oct	Mon		No Class-FALL BREAK
		Wed		No Class-FALL BREAK
9	16-Oct	Mon	7, 8	Manual Material Handling (cont.) (Lab 2 Due)
		Wed	8	Manual Material Handling (cont.), Energy and Fatigue (Lab 2 Due)
10	23-Oct	Mon		Kinematics and Biomechanics of Ergonomics
		Wed	9	NIOSH Revised Lifting Equation
11	30-Oct	Mon	9	NIOSH Revised Lifting Equation (cont.) (Project proposals Due)
		Wed		NIOSH Revised Lifting Equation (cont.)
12	6-Nov	Mon		Lab 3 - Manual Materials Handling
		Wed		Lab 3 - Manual Materials Handling
13	13-Nov	Mon	11	Noise (PP and notes) Vibration (notes only) (<i>Guest Lecture</i>) (Lab 2 returned)
		Wed		Exam 2 (Modules 7-9, handouts, guest lectures)
14	20-Nov	Mon	12	OSHA and Ergonomics
		Wed	13, 14	ADA, Disabled Rehabilitated Population
15	27-Nov	Mon	15	Developing an Ergonomics Program, Cases and Legal Issues (Lab 3 Due)
		Wed		OSHA Health Response Team and Ergonomics, Worker's Comp and Ergonomics (<i>Guest Lectures</i>) (Lab 3 Due)
16	4-Dec	Mon		Contemporary Issues - Ergonomics in Design
		Wed		Exam 3 (Modules 11-15, handouts, guest lectures,) (Projects Due)
17	12-Dec	Tue		Final Exam (3:30pm -5:30 pm)

NOTE: Lectures and guest presentations may be changed to accommodate guest lecturers' schedules.