ME 5100/6100, OEHS 6761 – ERGONOMICS

University of Utah
Department of Mechanical Engineering
Fall Semester, 2019
Lecture: Monday and Wednesday 4:35-5:55 pm
Lecture Location: MEK 3550 MEK
Lab Location: 3550 MEK

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. For more information about college policy and procedures, refer to: College of Engineering Academic Guidelines: https://www.coe.utah.edu/semester-guidelines

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COURSE DIRECTOR:
Andrew Merryweather, PhD
Phone: 581-8118 (UU office)
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 <u>not</u> required for exams)**
**Introduction to Human Factors and Ergonomics 4th Edition, R.S. Bridger. ISBN 978-1498795944
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: Melynda Schreiber, 2215 MEB, m.schreiber@utah.edu
The TA has agreed to be available by email pretty much anytime, or by appointment. The TA is responsible for teaching the Labs and grading of the HW lab assignments. 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. Identify and know 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:

Evaluation:	
HW (20, 20, 20, 20, 20)	100
LABS (40, 40, 70)	150
PROJECT POSTER	50
PROJECT REPORT	100
EXAM 1	100
EXAM 2	150
EXAM 3	100
TOTAL	750

HOMEWORK: There will be 5 HW assignments. HW assignments will emphasize material covered in lectures and are related to assigned readings and other reference materials. Questions on grading should first be discussed with the TA who graded the assignment and then with Dr. Merryweather. Late work is not accepted for credit.

LABS: There will be three lab assignments. Labs are scheduled during regular class time and will occur in the classroom. 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 TA will grade the labs. Questions on grading should first be discussed with the TA who graded the lab and then with Dr. Merryweather. Late work is not accepted for credit.

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 workplace settings. 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) by the deadline posted on the course Canvas site. These will be reviewed by Dr. Merryweather and returned/remailed within a week or so of receipt. The project deliverables will be a *Poster File* (not printed) and a formal *Report*. Late work is not accepted for credit.

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 (similar to what is expected on a certification exam). All three exams are open notes and open Canvas. 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.

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)

Academic Integrity: Engineering is a profession demanding a high level of personal honesty, integrity and responsibility. Therefore, it is essential that engineering students, in fulfillment of their academic requirements and in preparation to enter the profession, adhere to the Department of Mechanical

Engineering Policy for Academic Misconduct. This policy is based upon the University of Utah's Policy 6-400: Code of Student Rights and Responsibilities. As part of the ME policy, students must review and acknowledge the "ME EN Academic Misconduct Policy" Both documents can be downloaded from the course Canvas page. **Students must provide acknowledgment of the MEEN Academic Misconduct policy via the Canvas Academic Integrity Module for this course before the end of the first week of class or they will be unable to access course content through the Canvas modules.**

COURSE SCHEDULE
ERGONOMICS
ME EN 5100/6100, OEHS 6761
Fall Semester, 2019

Week	Beg	Day	Module	KEY TOPIC	Due
1	19-Aug	Mon	1,2	Introduction, Anthropometry	
		Wed	2,3	Anthropometry (cont.), Musculoskeletal Modeling and Injury Theory	
2	26-Aug	Mon	4	UEMSDs	
		Wed	4	UEMSDs (cont.) - Sign up for Lab	HW 1
3	2-Sep	Mon		**No Class-LABOR DAY**	
		Wed	5	Standing and Seated Work	
4	9-Sep	Mon		Repetitive Tasks - Risk Assessment	
		Wed		Lab 1 - UEMSDs	
5	16-Sep	Mon	5	Controls/Displays and Human Factors	
		Wed	6	Control/Display	
6	23-Sep	Mon		Work Capacity, Stress, Fatigue and Recovery	
		Wed		Lab 2 – Controls/Displays	Lab 1
7	30-Sep	Mon		Exposure Measurement and Task Design - Exam 1 Review	HW 2
		Wed		**Exam 1** (Modules 1-6, handouts)	
8	7-Oct	Mon		**No Class-FALL BREAK**	
		Wed		**No Class-FALL BREAK**	
9	14-Oct	Mon		Kinematics and Biomechanics of Ergonomics	
		Wed	7, 8	Manual Material Handling	Lab 2
10	21-Oct	Mon	9	NIOSH Revised Lifting Equation	
		Wed	9	NIOSH Revised Lifting Equation (cont.)	HW 3
11	28-Oct	Mon		Lab 3 - Manual Materials Handling	
		Wed		Lab 3 - Manual Materials Handling	
12	4-Nov	Mon	8	Manual Material Handling (cont.), Energy and Fatigue	
		Wed	13, 14	Job Demands, ADA, Disabled and Rehabilitated Population	
13	11-Nov	Mon	11	Noise & Vibration - Exam 2 Review	HW 4
		Wed		**Exam 2 (Modules 7-10, 13-14, handouts, guest lectures)**	
14	18-Nov	Mon	12	Developing an Ergonomics Program, Cases and Legal Issues	Lab 3
		Wed	15	OSHA Compliance and Corporate Ergonomics	
15	25-Nov	Mon		Accident Investigation and Safety Management	
		Wed		Worker's Comp and Ergonomics	
16	2-Dec	Mon		System Stability and Sustainability - Exam 3 Review	HW 5
		Wed		**Exam 3 (Modules 11-15, handouts, guest lectures,)**	
17	10-Dec	Thurs		(Projects Due)	
NOTE: Lectures and guest presentations may be changed to accommodate guest lecturers' schedules.					