

IE 4511/5511 Human Factors and Work Analysis

Fall 2016

Professor: Dr. Renaldo Blocker
Wednesday 6:10PM-9:30PM
3-210 Keller Hall
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Teaching Assistants:

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Catalog Description

Human factors engineering (ergonomics), methods engineering, and work measurement. Human-machine interface: displays, controls, instrument layout, and supervisory control. Anthropometry, work physiology and biomechanics. Work environmental factors: noise, illumination, toxicology. Methods engineering, including operations analysis, motion study, and time standards.

Course Prerequisite(s) Prereq-ISyE senior; ME 5211, IE 4511, IE 5511, HUMF 5211

Course objectives

- Student will understand how people fit into technological systems
- Student will recognize the limits of human perceptual-motor capabilities.
- Student will recognize the limits of human cognitive functioning and why people make errors.
- Student will be able to assess workstation and task design for ergonomic deficiencies.
- Student will be able to define safety hazards and general approaches for their control.
- Student will recognize the human indicators of fatigue and stress.
- Student will appreciate the importance of organization and job design factors for performance and satisfaction.
- Student will be able to define the ethical application of human factors in designing products and processes.
- Student will be able to write reports that describe human performance.

Textbook and Required Readings:

- Wickens, C. D., Lee, J. D., Liu, Y., & Becker, S. E. G. (2004). *An Introduction to Human Factors Engineering* (2nd ed.). Prentice Hall. Available at the University Bookstore.
- In addition, there will be a variety of required papers to read for the lab sections and for some of the lectures. These are listed here and in the lab syllabus. Readings not in the book will be posted to the web.

Course Notes and Website:

The course lectures may be posted on the website. Handouts and other readings will be posted there as well. The website allows you to provide emails to me, and I encourage you to provide me with feedback on any issues about the course during the semester.

Attendance at the Lectures:

Attendance will not be monitored, but if you miss class it will be difficult to do well on your exams. Lectures will cover material not in the book.

Expectations:

- Attend class.
- Conduct yourself according to the National Society of Professional Engineers Code of Ethics. For more information see the National Society of Professional Engineers: <http://www.nspe.org/resources/ethics/code-ethics> or the Institute of Industrial Engineers <http://www.iienet2.org/Details.aspx?ID=299> .
- Read all assigned readings.
- Be prepared to participate in class when given the chance.
- Be respectful of your classmates.
- Ask any question you have at any time.
- Late assignments are not accepted.
- Exams must be taken in class, on the scheduled exam dates.

Grading:

Midterm #1	20%
Midterm #2	20%
Midterm #3	20%
In-Class Labs	20%
Final Project	20%

Grading Scale:

Highest	Lowest	Letter
100.00 %	93.00 %	A
92.99 %	90.00 %	A-
89.99 %	87.00 %	B+
86.99 %	83.00 %	B
82.99 %	80.00 %	B-
79.99 %	77.00 %	C+
76.99 %	73.00 %	C
72.99 %	70.00 %	C-
69.99 %	67.00 %	D+
66.99 %	60.00 %	D
59.99 %	0.00 %	F

Three Exams: The three exams each cover one-third of the class material. Each exam is comprised of short discussion questions, problem solving and multiple choice questions; each only covers the material from the one-third of the course just completed. **EXAMS MUST BE TAKEN IN CLASS.**

Labs: Each lab, you will be graded on participation (50%) and performance on assignments (50%). The second half of each class meeting will be devoted to the Labs. Late assignments are not accepted.

Design Project:

Objective: The objective of the Design Project is to allow students to demonstrate application of the course HFE Design Philosophies. Instructions for the Design Project will be presented in the week #7 lab and posted online before the second exam.

HFE Design Philosophies:

- Systems (e.g. machines or hospitals) need to be designed for and to work with people
- Systems must be designed to accommodate the range of users
- How systems are designed will influence human behavior and therefore system performance
- Design needs to be evidence-based, not “common sense” or designer driven
- All design must take into account the system of use

Accommodations on the basis of disability:

Students who are requesting any accommodations on the basis of disability should schedule an office appointment with me as soon as possible/within the first three weeks of the semester. Please schedule this office appointment by (indicate your preferred method for communication: email, phone call, office secretary, etc.) To maintain the confidentiality of your request, please **do not** approach me before or after class to discuss your accommodation needs.

Academic Misconduct:

If you have not already done so, be sure to visit the Office for Student Conduct and Academic Integrity website listed below. If you are found to have committed academic misconduct, you risk expulsion from the University of Minnesota-Twin Cities.

The Office for Student Conduct and Academic Integrity (OSCAI): <http://www.oscai.umn.edu/>

Course Weekly Schedule (schedule is subject to change):

<u>Week</u>	<u>Date</u>	<u>Topic</u>	<u>Readings</u>
1	Sept 7	Introduction to and history of human factors and ergonomics	Chapter 1, 2 and 3
		Lab of the week: N/A	
2	Sept 14	Cognitive ergonomics: Human information processing and usability	Chapter 6
		Lab of the week: Introduction and Stroop Test	
3	Sept 21	Cognitive ergonomics: Vision and visual display design	Chapter 4
		Lab of the week: Signal detection/ Inattention blindness	
4	Sept 28	Cognitive ergonomics: Hearing, smelling and auditory and olfactory display design	Chapter 5
		Lab of the week: Usability Lab	
5	Oct 5	Guest Speaker	
		Lab of the week: N/A	
6	Oct 12	EXAM #1 [Exam will cover week #1-5]	Chapters 1-6
7	Oct 19	Macro and cognitive ergonomics: Touch and tactile displays and controls. Automation	Chapter 9, Chapter 16
		Lab of the week: Design Project and Review	

8	Oct 26	Macroergonomics: Job stress and Shiftwork and Teams	Chapter 13, Chapter 18 and 19
		Lab of the week: Heuristic Evaluation	
9	Nov 2	Macroergonomics: Training, Accidents, human error and safety	Chapter 14, 18,19
		Lab of the week: Occupational Stress	
10	Nov 9	EXAM #2 [Exam will cover week #6-9]	Chapters 9,13,14,16,18,19
11	Nov 16	Physical ergonomics: Physiological workload, fatigue and temperature stress	Chapter 12 and 13
		Lab of the week: NIOSH Lifting Equation	
12	Nov 23	Design Projects: Work on Project/No Class	
		Lab of the week: No Lab	
13	Nov 30	Physical ergonomics: Anthropometry and design Physical ergonomics: Posture, vibration, computer workstations, manual materials handling, hand tools and links to musculoskeletal disorders	Chapters 10-12
		Lab of the week: Fitts Law & Anthropometry	
14	Dec 7	Domain Focus: Healthcare, Manufacturing, Aviation, Surface Transportation and Cost-benefit analysis of HFE and Engineering Ethics	Chapter 14, Chapter 3 and Code of Ethics NPSE and IIE
		>>>>>>DESIGN PROJECTS ARE DUE<<<<<<<<	
		Lab of the week: Safety and Designing for Disabilities	
15	Dec 14*	EXAM #3 [Exam will cover week 10-14]	

Below are suggested readings. Readings with * are ones I highly recommend.

Additional texts on fundamentals of human factors engineering

- *Eastman Kodak Company (2004). *Ergonomic Design for People at Work*. John Wiley and Sons.
- Grandjean, Kroemer, & Kroemer (1997). *Fitting the Task to the Human*. Taylor and Francis.
- *Karwowski (2005). *Handbook of Standards and Guidelines in Ergonomics and Human Factors*. Lawrence Erlbaum Associates
- *Karwowski and Marras (2006). *Occupational Ergonomics*. CRC Press
- Kroemer, Kroemer & Kroemer (2001). *Ergonomics: How to Design for Ease and Efficiency*. Prentice Hall
- Salvendy (Ed.), (2006) *Handbook of Human Factors and Ergonomics* (3rd ed). John Wiley and Sons.
- Sanders, M. S., & McCormick, E. J. (1993). *Human Factors in Engineering and Design* (7th ed). McGraw-Hill, Inc.
- Stanton, Hedge, Brookhuis and Salas (2004). *Handbook of Human Factors and Ergonomic Methods*. CRC Press.
- Stanton, Salmon and Baber (2005). *Human Factors Methods: A Practical Guide for Engineering and Design*. Ashgate Publishing
- Wilson and Corlett (2005). *Evaluation of Human Work*. Taylor and Francis
- *Woods and Hollnagel (2006). *Joint Cognitive Systems*. CRC Press.

Books focused on usability

- Nielsen J, Mack RL. *Usability inspection methods*. New York, NY: John Wiley & Sons, 1994.
- *Nielsen, J. *Usability Engineering*. New York: AP Professional, 1993.
- Preece, J., Rogers, Y., Sharp, H. *Interaction Design*. Wiley. 2002
- Rubin JR. *Handbook of usability testing*. New York, NY: John Wiley & Sons, 1994.
- Schneiderman, B. *Designing the User Interface: Strategies for Effective Human-Computer Interaction*. Reading, MA: Addison Wesley Longman, Inc. 1998.
- Wiklund ME. *Medical device and equipment design: Usability engineering and ergonomics*. Buffalo Grove, IL: Interpharm Press, 1995.

Additional Links on Human Factors Engineering

- *<http://www.hf.faa.gov> Awesome website with descriptions of over 300 human factors tools, web tutorials.
- *www.useit.com **Extremely practical** set of HFE links, articles, tools, and tidbits – especially as applied to computer systems. Operated by leader in the field, Jakob Nielsen, with several commentaries and lay press reports.
- * <http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HumanFactors/default.htm> **Fantastic web site** about applying practical human factors tools and principles to device and software design. “Do it By Design” is especially good primer on HFE process (free download); here is the link: <http://www.fda.gov/medicaldevices/deviceregulationandguidance/guidancedocuments/ucm094957.htm>
- * <http://www.hf.faa.gov/training.aspx> Nice **web-based HFE training**. Designed by FAA human factors professionals for all the people in the FAA that build or buy devices and software (e.g., air-traffic control software).
- <https://www.usability.gov/what-and-why/index.html>
- <http://www.stcsig.org/usability/resources/toolkit/toolkit.html>
- Human Factors and Ergonomics Society. www.hfes.org
- International Ergonomic Association. www.iea.cc
- ACM/Special interest group on computer human interaction (SIGCHI) sigchi.org
- Usability Professionals Association www.upassoc.org
- Information Architecture Institute/ newsletter iainstitute.org
- HCI Bibliography < <http://www.hcibib.org/>>
- (Jesse James Garrett’s) Information architecture resources jgg.net/ia/
- Information Design resources/newsletter www.boxesandarrows.com
- Usability First www.usabilityfirst.com