PSYCHOLOGY 2220
Human Factors in Design (4 credits)

General Information

Instructor: Michael J. Kalsher, Ph.D.
4203 Sage Bldg ~ (518) 276-8267 ~ kalshm@rpi.edu
Office hours: M/Th noon – 1:00 p.m and by appointment

Teaching Asst. Eric Walsh, Walshe3@rpi.edu
Office hours: TBA

Class Schedule: Monday, Thursday; 10:00 - 11:50 a.m. TBD

Classroom: SAGE 4101

Course Web Site: Kalsher.com: All lecture slides and any course updates posted here.

Course Description & Learning Goals

Human factors (also termed Ergonomics) is the scientific discipline concerned with the relationship between people's characteristics—their physical and cognitive strengths and limitations—and the design of equipment, consumer products, environments, and work.

This course focuses on a consideration of human factors principles/considerations in the chain spanning from product/equipment designers/manufacturers to end users, as well as well as the relative contribution of economic, environmental, cultural and societal influences. Topics covered include: research methods and statistics, design and evaluation methods, the human information-processing system and its underlying sensory/perceptual components (i.e., the human visual, auditory, vestibular/kinesthetic, and haptic systems, cognition and decision-making), displays and controls, human-computer interaction, anthropometry and biomechanics.

During the course we will read and discuss/debate case studies in which a technical solution pursued did not have the desired effect because the people involved focused too much on the technology without paying sufficient attention to human factors principles/considerations and non-technical issues (e.g., environmental, economic, socio-cultural, political) associated with the technology's ultimate usage. Students will work individually, or in small teams, to design a system, component, or process to meet desired needs within realistic constraints (e.g., economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability).

Student Learning Outcomes

- Students will demonstrate their knowledge of basic human factors concepts/principles.
- Students will demonstrate their knowledge of the consequences of engineering solutions in a global, economic, environmental, political and social-cultural context by reading/discussing/debating case examples in which proposed technical solutions did not have the desired effects because the people involved failed to adequately consider the aforementioned factors.
- Students will design and/or evaluate a system, component, or process intended to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- Students will prepare a technical report or conference/journal paper based on their research associated with this course and will have the opportunity to present the results of their design projects in class.

Grading

Exams: **240 points** (*4 in-class exams @ 60 pts each*).

Design Project: *(write-up)* **45 points**

Participation: **15 points** *(includes attendance and participation in in-class activities/discussions).*

Final Grade:

Grade	Range	Grade	Range
A	276 - 300	C	220 - 229
A-	269 - 275	C-	210 - 219
B+	260 - 268	D+	200 - 209
B	250 - 259	D	190 - 199
B-	240 - 249	D-	180 - 189
C+	230 - 239	F	Below 180

Course Policies

Attendance Policy.

There is no formal attendance requirement. However, students are responsible for all material covered in class. The topics covered each day will be clearly outlined in the course schedule so check the course schedule regularly to ensure that you are prepared for class on any given day. Note also that the course schedule may change, depending on how things are going, so be sure to check the course website at Kalsher.com for updates. At each exam, please be prepared to show your student ID.

Academic Integrity

Student-teacher relationships are built on mutual respect and trust. Students must be able to trust that their teachers have made responsible decisions about the structure and content of the course and that they are conscientiously making their best effort to help students learn. Teachers must be able to trust that students do their work conscientiously and honestly, making their best effort to learn. Acts that violate this mutual respect and trust undermine the educational process. The Rensselaer Handbook of Students Rights and Responsibilities defines various forms of Academic Dishonesty and you should make yourself familiar with these. In this class, all assignments that are turned in for a grade must represent the student's own work. The required design project write-up, if carried out by a group, should reflect an equivalent amount of effort by each group member.

Policy on Collaboration and Cheating/Plagiarism

A grade of zero will be given on the first assignment where cheating or plagiarism is detected and will be reported to the Dean of Students. If there is a subsequent infraction the student will receive a grade of F for the course. If a student has any question concerning this policy before submitting an assignment, please ask the course instructor for clarification.

Late Work

You should submit your design project write-up on time. Due dates will be posted at the course website (Kalsher.com/HF). Late work will be accepted only if you consult with me prior to the day/time the work is due, or present an official excuse from the Dean of Students Office. Late work, if unexcused, will incur a penalty of 5% reduction per day.

Week	Date	Topic
1	*Mon. 01/16*	MLK Day; no classes
	Thurs. 01/19	Introduction to HF
2	*Mon. 01/23*	Research Methods and Statistics
	Thurs. 01/26	RMS cont.
3	*Mon. 01/30*	Writing Technical Reports and Articles
	Thurs. 02/02	Summary and Review
4	*Mon. 02/06*	EXAM 1
	Thurs. 02/09	Design of Every Day Things: 1 and 2
5	*Mon. 02/13*	Design of Every Day Things: 3
	Thurs. 02/16	Design of Every Day Things: 4
6	*Tues. 02/21*	Design of Every Day Things: 5
	Thurs. 02/23	Summary and Review
7	*Mon. 02/27*	EXAM 2
	Thurs. 03/02	Human Visual System 1
8	*Mon. 03/06*	Human Visual System 2
	Thurs. 03/09	Auditory, Tactile, Vestibular Systems
9	*Mon. 03/13*	Spring Break
	Thurs. 03/16	Spring Break
10	*Mon. 03/20*	Cognition
	Thurs. 03/23	Decision Making
11	*Mon. 03/27*	Summary and Review
	Thurs. 03/30	EXAM 3
12	*Mon. 04/03*	Displays
	Thurs. 04/06	Controls
13	*Mon. 04/10*	Anthropometry
	Thurs. 04/13	Biomechanics
14	*Mon. 04/17*	Cont.
	Thurs. 04/20	Ethics and Product Liability Issues
15	*Mon. 04/24*	Hazards and Failure Analysis
	Thurs. 04/27	Summary and Review
	Mon. 05/01	EXAM 4

Course Reference Materials

(all book descriptions below are from Amazon.com)

Highly Recommended:

Norman, D. (2013). The design of everyday things. New York, NY: Basic Books.

Even the smartest among us can feel inept as we fail to figure out which light switch or oven burner to turn on, or whether to push, pull, or slide a door. The fault, argues this book, lies not in ourselves, but in product design that ignores the needs of users and the principles of cognitive psychology. The problems range from ambiguous and hidden controls to arbitrary relationships between controls and functions, coupled with a lack of feedback or other assistance and unreasonable demands on memorization. *G*ood, usable design is possible. The rules are simple: make things visible, exploit natural relationships that couple function and control, and make intelligent use of constraints. The goal: guide the user effortlessly to the right action on the right control at the right time. ISBN: 978-0465050654

Wickens, C.D., Gordon-Becker, S.E., Liu, Y., & Lee, J.D. (2004). An introduction to human factors engineering (2nd Edition). Pearson.

This book describes the physical and cognitive capabilities and limitations of the human operator and how these should be used to guide the design of systems with which people interact. General principles of human-system interaction and design are presented, and included are specific examples of successful and unsuccessful interactions. It links theories of human performance that underlie the principles with real-world experience, without a heavy engineering-oriented perspective. Topics include design and evaluation methods; different systems such as visual, auditory, tactile, vestibular, automated, and transportation; cognition, decision-making, and aesthetics; physiology; and stress, safety, accidents, and human error. An excellent reference for personnel and managers in the workplace. ISBN: 978-0131837362

Recommended:

Voland, J. (2003). Engineering by design (2nd Edition). Prentice Hall.

This book introduces students to a broad range of design topics. The engineering design process provides the skeletal structure for the text, around which is wrapped numerous cases that illustrate both successes and failures in engineering design. The text provides a balance of qualitative presentation of engineering practices that can be understood by students with little technical knowledge and a more quantitative approach in which substantive analytical techniques are used to develop and evaluate proposed engineering solutions. ISBN: 978-0131409194

Optional Reading:

Casey, S.M. (1998). Set phasers on stun: And other true tales of design, technology, and human error. Aegean.

Technological disasters are frequently caused by incompatibilities between the way things are designed and the way people actually perceive, think, and act. Structurally sound aircraft plummet to the earth, supertankers run aground in calm weather, and the machines of medical science maim unsuspecting patients - - all because designers sometimes fail to reflect the characteristics of the user in their designs. Designers and the public alike are realizing that many human' errors are more aptly named designed-induced' errors. Most consumers experience the frustration of using many new products, but the problems consumers experience with modern everyday things are shared by the users of large-scale technologies where the consequences of design can go well beyond simple matters of inconvenience or amusement.

Petroski, H. (1996). Invention by design: How engineers get from thought to thing. Cambridge, MA: Harvard University Press.

Petroski delves deeper into the mystery of invention, to explore what everyday artifacts and sophisticated networks can reveal about the way engineers solve problems.