ME 5130/6130 – DESIGN IMPLICATIONS FOR HUMAN-MACHINE SYSTEMS

University of Utah
Department of Mechanical Engineering

TH / 12:25PM-01:45PM
WEB L114

COURSE DIRECTOR:
>   Mark Fehlberg, PhD
>   Email: m.fehlberg@utah.edu
>   Office: 1569 MEK

OFFICE HOURS:
- ~10-15 min before and after class in classroom
- Recurring: 2:00-3:00pm Mon/Fri
- Walk-ins when my door is open and I'm not with someone already
- Having trouble finding me? Email for an appointment

TEACHING ASSISTANT:
>   Sabin Nepal
>   Email: sabin.nepal@utah.edu
>   Office: 3857 SMBB

TA OFFICE HOURS: 1:45-2:45pm Tues/Thurs

REQUIRED TEXTS:
>   Human Factors in Engineering and Design (7th Edition), Sanders and McCormick. ISBN 978-0070549012
>   The Design of Everyday Things (Revised and Expanded Edition), Norman. ISBN 978-0465050659

OPTIONAL TEXTS:
>   Fitting the Human: Introduction to Ergonomics / Human Factors Engineering (7th Edition), Kroemer. ISBN 978-1498746892

SUGGESTED REFERENCE MATERIAL
>   Biomechanics in Ergonomics (2nd Edition), Kumar. ISBN 978-0849379086
>   Occupational Biomechanics (3rd Edition), Chaffin, Anderson, and Martin. ISBN 978-0471246978

COURSE DESCRIPTION: A human-machine system integrates the functions of a human operator and a machine as a single entity. This course focuses on design aspects and their implications for simple (e.g., use of hand tools) to complex (e.g., piloting an aircraft) human-machine system performance. This course will also address information processing and the cognitive aspects of ergonomic design. Students will gain insight into web-site and electronic application design. Physical ergonomics (musculoskeletal

disorders and biomechanics) and the effects of various environments (hot, cold, noise, information overload, etc.) on humans and human performance will be addressed briefly. Physical ergonomics topics are covered in more depth in MEEN 5100/6100 Ergonomics and MEEN 7100 Advanced Ergonomics-Occupational Biomechanics.

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

1. Have an understanding of basic human capabilities and limitations with respect to system performance.
2. Gain an understanding of how humans receive and process information and how this can sometimes result in system errors.
3. Understand basic control/display relationships, population stereotypes, and compatibility between control operation and desired system output.
4. Understand the implications of human factors engineering for website and electronic application design.
5. Be able to apply human factors engineering concepts in the evaluation of existing systems and in the design of new systems.

EVALUATION OF STUDENT PERFORMANCE:

Evaluation:	
HOMEWORK	15%
QUIZES	15%
PROJECTS	40%
MIDTERM	10%
FINAL EXAM	20%
TOTAL	100%

Dr. Fehlberg will provide more information on the homework and project reports as the semester progresses.

EXAMS: Exams will cover text/handout material and material/information discussed in class.

PROJECTS: There will be two class projects. The second project will be more heavily weighted than the first. Project reports and presentations will entail a Human-Machine System analysis/evaluation. Project 1 will focus on one aspect of human input or output, replicating a Human Factors study, preferably from Sanders and McCormick. Project 2 will build on all course content focusing on a particular HMS device design. For example, Project 2 topics might include usability analysis of commercial websites, evaluation/beta testing of a consumer product, or interface evaluation of a mechanical device or electronic system.

LECTURES: The lecture schedule shows the text material to be covered each class period. These lectures will also be made available through canvas and can be reviewed at any time during the course. It is recommended that students read the material before the class lecture. Due dates, holidays, and exam dates have been outlined and are available in Canvas. The schedule will be adhered to as closely as possible; however, some changes will undoubtedly be required (particularly to schedule any guest lecturers). Changes to the schedule (due dates, additional information provided, etc.) will be announced during the lecture period. You are responsible for noting these changes.

HOMEWORK: Homework assignments and reports must be typed and presented in a professional manner. Unless otherwise stated, homework assignments are to be completed on an individual basis. Several homework assignments may require presentation to the class. Semester project reports require a written report and a final presentation to the class. Late work will receive a penalty of up to 10% per day. Homework assignments and lecture notes will be posted on Canvas.

ACADEMIC HONESTY: From the University of Utah's Code of Student Rights and Responsibilities https://regulations.utah.edu/academics/6-400.php:

"Academic misconduct" includes, but is not limited to, cheating, misrepresenting one's work, inappropriately collaborating, plagiarism, and fabrication or falsification of information. It also includes facilitating academic misconduct by intentionally helping or attempting to help another to commit an act of academic misconduct."

Violations include, but are not limited to:
- **Cheating.** Cheating on an examination, such as copying from another's paper, using unauthorized notes, calculators, etc., or giving or receiving unauthorized aid, such as trading examinations, whispering answers, passing notes, or using electronic devices to transmit or receive information.

- **Plagiarism.** This is using someone else's work without giving credit. It is, for example, using ideas, phrases, papers, laboratory reports, computer programs, data - copied directly or paraphrased - that you did not arrive at on your own. Sources include published works such as book, movies, Websites, and unpublished works such as other students' papers or material from a research service. In brief, representing someone else's work as your own is academically dishonest. *The risk of plagiarism can be avoided in written work by clearly indicating, either in footnotes or in the paper itself, the source of any major or unique idea or wording that you did not arrive at on your own. Sources must be given regardless of whether the material is quoted directly or paraphrased.*

- **Unauthorized collaboration**. This is working with or receiving help from others on graded assignments without the specific approval of the instructor. *If in doubt, seek permission from the instructor before working with others.* Students are encouraged to learn from one another: Form study groups, discuss assignments, BUT each assignment must be individual work unless specifically stated and turned in as a group assignment.

- **Copying.** Copying another student's assignment and putting your name on it is plagiarism. You are encouraged to talk to one another about your assignments; however, all assignments must be done by the student whose name is on it!

- **Multiple submissions**. This means using the same work to fulfill the academic requirements in more than one course. *Prior permission of the instructors is essential.*

Additional departmental policies can be found here: https://mech.utah.edu/files/2018/08/ME-Academic-Misconduct-Policy2.pdf.

COURSE SCHEDULE
ME EN 5130/6130

Week	Date	Sanders & McCormick Chapters	Norman Chapters	Key Topic(s)
1	24-Aug	1		Intro to Design Implications for Human-Machine Systems
	26-Aug	2		Reliability and Research Methodologies
2	31-Aug			Basic Statistics
	2- Sep			Statistical Analysis
3	7-Sep	3	1	Information Theory and Displays
	9-Sep			*(HW 1 – Presentations)*
4	14-Sep	3	2	Information Coding and Processing
	16-Sep	4		Process of Seeing
5	21-Sep	4	3	Vision, Text and Graphics
	23-Sep	4		Symbols and Codes (DOET Ch 1-3)
6	28-Sep	5		Dynamic Visual Displays
	30-Sep	6		Auditory Displays
7	5-Oct	6		Tactual and Olfactory Displays
	7-Oct			Haptics
8	12-Oct			*No Class - Fall Break*
	14-Oct			
9	19-Oct	7		Speech Displays
	21-Oct			**Midterm Exam**
10	26-Oct	8	4	Human Output/Control: Physical Work/Manual Material Handling
	28-Oct	8		Material Handling and Fatigue
11	2-Nov	9	5	Motor Skills: Fitts Law, Response Time
	4-Nov	9		Motor Control Theory
12	9-Nov	10	6	Human Control of Systems
	11-Nov	11		Controls and Data Entry Devices
13	16-Nov	12	7	Hand Tools and Devices
	18-Nov			Modern Control Inputs
14	23-Nov			Modern Data Entry Devices
	25-Nov			*No class - Thanksgiving Break*
15	30-Nov			Effective Website Design
	2-Dec			Effective Website Design
16	7-Dec			**Project 2 Presentations**
	9-Dec			Review for Final (**Project 2 Reports Due**)
Finals Week	13-Dec			**Final Exam** Monday, December 13, 2021 10:30 am – 12:30 pm