Human Factors in Systems Design

EIN 5249

Class Periods and Location: M,W,F | Period 7 (1:55-2:45pm), Online

Academic Term: Spring 2021

Last Updated: Jan 3, 2021

Instructor:
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Course Description

This course will provide an understanding of concepts and methods in human factors and applications to human-machine system design. We will consider the system design implications of human cognitive and physical capabilities and limitations in perception, memory, decision-making and motor-control.

Course Pre-Requisites / Co-Requisites

None

Course Objectives

- Develop knowledge of human factors and ergonomics (hf/e) terminology and issues in design;
- Learn models of human-machine interaction;
- Develop an understanding of basic human factors research methods;
- Learn human capacities in information processing;
- Develop an understanding of approaches to human-systems design and how the principles of human factors can be applied;
- Develop familiarity with a model of human information processing;
- Develop a familiarity with the human factors literature;
- Apply human factors design principles to real-world problems through exercises; and
- Learn outcomes that can be expected from human factors in systems design.

Required Textbooks and Software

- Lee, J.D., Wickens, C. D., Liu, Y. D. & Boyle, L.N. (2017). Designing for People: An Introduction to Human Factors Engineering (3rd Ed.) ISBN: 978-1539808008 (Required).
- Supplemental readings will be provided.

Course Schedule

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Week	Date	Lecture Number	Topic	Readings and Problem Sets
1	M 1/11	1	**Course Introduction**	Ch 1
	W 1/13	2	**Defining Human-Machine Systems and Cognitive Engineering** *(Introduction assignment assigned)*	Woods and Roth, 1988, Cognitive Engineering: Human Problem Solving with Tools
	F 1/15	3	**History of human factors**	Ch 1
2	M 1/18	4	No Class – MLK Day	
	W 1/20	5	**Research methods**: Introduction and methods.	Ch 2
	F 1/22	6	**Research methods:** Analytic methods *(Problem set 1 assigned.)*	Ch 2 **Introduction assignment due**
3	M 1/25	7	**Research methods**: Design methods.	Ch 2

	W 1/27	8	**Research methods**: Evaluative methods introduction.	Ch 3
	F 1/29	9	**Research methods**: Evaluative methods and experiment design.	Ch 3
4	M 2/1	10	**Research methods**: Experiment design.	Ch 3
	W 2/3	11	**Human sensory systems**: Vision.	Ch 4
	F 2/5	12	**Human sensory systems**: Vision. *(Problem set 2 assigned.)*	Ch 4 **Problem set 1 due**
5	M 2/8	13	**Human sensory systems:** Hearing.	Ch 5
	W 2/10	14	**Human sensory systems**: Hearing.	Ch 5
	F 2/12	15	**Human sensory systems:** Somatosensory system	Ch 5
6	M 2/15	16	Review and practice problems.	-
	W 2/17	17	**Midterm Exam 1**	-
	F 2/19	18	**Perception to detection**: Signal detection theory.	Ch 4, Ch 5
7	M 2/22	19	**Perception to detection**: Receiver operating characteristic curves (practice problems). **(Problem set 3 assigned.)**	McNicol, 1972
	W 2/24	20	**Perception to detection**: Receiver operating characteristic curves (practice problems).	McNicol, 1972
	F 2/26	21	**Cognition and Human information processing (HIP):** Memory *(Problem set 3 assigned.)*	Ch 6 **Problem set 2 due**
8	M 3/1	22	**Cognition and Human information processing (HIP):** Attention	Ch 6
	W 3/3	23	**Cognition and Human information processing (HIP):** Examples	Ch 6
	F 3/5	24	**Decision-making:** Frameworks for study, level of control *(Project assigned.)*	Ch 7, NDM: Klein et al. (2010)
9	M 3/8	25	**Physical Ergonomics and Systems Design:** Guest Lecture	**Problem set 3 due**
	W 3/10	26	**Decision-making:** Biases and heuristics	Ch 7
	F 3/12	27	**Decision-making:** Situational awareness, problem solving and diagnostics, scheduling and planning, metacognition	Ch 7
10	M 3/15	28	**Displays**: Principles of display design, displays, maps, visual scanning, visualizations	Ch 8
	W 3/17	29	**Displays:** Displays classification, types of displays	Ch 8
	F 3/19	30	Review and practice problems.	**-**
11	M 3/22	31	**Midterm Exam 2**	**-**
	W 3/24	-	Recharge Day – Class Cancelled	
	F 3/26	32	**Information Theory:** Applications to Display and Control design	Ch 9 **Project Part 1 due**
12	M 3/29	33	**Controls**: Principles of control design, Proximity compatibility principle, Hick-Hyman law,	Chp 9, Fitts 1992 (1954 reprint); MacKenzie (2018)
	W 3/31	34	**Controls**: Stability, Open and closed loop systems, Fitts's Law Revisited, Activity	Fitts 1992 (1954 reprint); MacKenzie (2018)
	F 4/2	35	**Safety and accident prevention:** Safety culture, error classification	Ch 16.1, 16.3, 16.5, 16.6
13	M 4/5	36	**Safety and accident prevention:** Applications and examples	Ch 16.1, 16.3, 16.5, 16.6
	W 4/7	37	**Teamwork and organization factors:** Social factors, and work organizations	Ch 18.1, 18.2

	F 4/9	38	**Selection and Training:** personnel selection and training	Ch 17
14	M 4/12	39	**Human-Action Cycle**	Ch. 10.1, 10.3
	W 4/14	40	**Human Automation Interaction**	Ch. 11.1-11.4; Lee & See (2004)
	F 4/16	41	**Project presentations**	-
15	M 4/19	42	**Project presentations**	-
	W 4/21	43	**Project presentations**	**Project Part 2 due**
	F 4/23	-	No Class – Reading Day	-

Final	TBD		Final Exam	-

Evaluation of Grades

Assignments	**Points**
Problem sets and assignments (4)	15%
Project	40%
Post-class diary	5%
Midterm exam 1	10%
Midterm exam 2	10%
Final exam	20%

Grading Policy

Percent	**Grade**	**Grade Points**
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
UF Graduate Catalog
Grades and Grading Policies

Problem sets

Problem sets cover material discussed during lectures and from the readings. They will consist of short-answer and calculation questions. Problem sets must be completed individually. Please submit your completed problem sets online through Canvas.

Projects

The course projects will consist of design and analysis of real-world tasks and accidents that will require that you synthesize and apply your knowledge of the course material to solve and mitigate challenges human factors challenges in systems design. The projects are done in teams and all members of the team are expected to

contribute equally to the success of the project. The projects will have multiple deliverables including a final presentation at the end of the course and written reports.

Post-class diary

At the end of each week, you will be asked to complete a "diary" about what you learned in the course during that week. The diary entry for the week is due at midnight on Saturday. It is useful for you to complete these entries as early as possible so that I can incorporate your feedback into our next class and because the material is fresh on your mind. You must complete a diary entry for at least 75% of the lectures to receive full marks.

This is not meant to be a long essay, and point-form is okay. The goal is for you to organize your thoughts about you have learned and provide feedback for me about your understanding.

- **reflect** on what new concepts that you have learned, and how they apply to your own research interests
- include any **outstanding questions** you may have about the class material from that week
- for online EDGE and asynchronous students, the diary is also a chance for you to provide any of your thoughts about the discussions and activities that are being done in class; I will provide you with feedback on these comments

Exams

Midterm exams are held during class hours. The final exam will occur during the exam period.

Attendance Policy and Class Expectations

It is important to complete the required readings before your class in order to fully benefit from the class activities. Teaching and learning is a shared responsibility, influenced by individual knowledge and experience, and achieved through expanding our awareness of the different issues and approaches involved in human factors and ergonomics. Commitment, preparation, and active participation are important ingredients to realize this goal. Your preparation and participation is important to your learning and the learning of your colleagues. As such, you should attend and participate in every class.

Make-Up and Regrade Policy

In the case of a series illness or emergency that will result in you missing an exam, please contact the instructor by e-mail as soon as possible. Please provide a written explanation for the missed exam accompanied by a doctor's note, an accident report, or any other relevant documentation. If there is a legitimate emergency or illness then you will either be given a make-up exam within one week of the original exam date, or the final exam score will be substituted for the missing exam score. The choice is left to the instructor.

Please submit all requests for regrading in writing to the instructor within one week of receiving the grade. Late requests will not be accepted. Be as specific as possible about the issue that needs to be addressed in your request; generic requests for regrading the entire assignment or exam will not be accepted. Please be aware that regrades may result in both increases and decreases in your grade as we will regrade the entire component in question.

Assignment Policy

Please make every effort to meet the assignment and problem set deadlines. If you absolutely require an extension, please send the instructor a request with the following information: (i) reason for extension, (ii) current status of the assignment, and (iii) due date requested. If an extension is granted, you must include correspondence regarding the request and the reply with your assignment. In the absence of an extension, late assignments will be accepted for 24 hours after the due date with a 25% deduction.

Communication Policy

Please do not email course content questions directly to the instructor. If you have a question, there is a good chance other people in the course have the same question or, at least, will benefit from the answer. Please post all questions related to course content on E-Learning using the questions discussion board so that everyone in the course can

benefit from your questions and the replies. Alternatively, you may include the questions in your lecture learning diary. Questions posted to question discussion board will be answered within two (2) business days.

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Click here for guidance on how to give feedback in a professional and respectful manner. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students here.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see the Notification to Students of FERPA Rights.

Campus Resources:

Health and Wellness

U Matter, We Care:
If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or police.ufl.edu.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling.

Library Support, Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.

Student Complaints Campus

On-Line Students Complaints