

# Oregon State University

## Graduate-Level Courses Related to Human-Centered Design

20 November 2018

The courses listed below are related to our understanding of human interaction with the built environment and the design of systems, devices, and environments so as to enhance human performance, safety, comfort, and pleasure. This listing is subject to change, so check the OSU Course Catalog (<https://classes.oregonstate.edu/>) and with the units offering the courses for the latest information. Note: Many of these courses are offered as specific sections of \_\_ 599, Special Topics, so be sure to look for the right section(s) when consulting the course catalog or when registering.

The information contained herein was believed to be correct at the time of writing, but the academic schedule is fluid, so some changes may have come about in the interim.

### Course Offerings (subject to change)

Fall Term	Winter Term	Spring Term
BIOE 599. Physiology for Engineers (4).	CE 552 Isolated Traffic Signals (3)*.	CS567: Lab Studies in SE and HCI (4)*
CCE 526. Design for Safety (3).	CE 554. DRIVING SIMULATION (3)*.	IE 507. SEM/HUMAN-CENTERED DESIGN (1),
CS 519. RESEARCH METHODS IN HCI.	CS 569. EMPIRICAL LAB STUDIES (4)*.	H 590. ADVANCED ERGONOMICS (3)*.
IE 545. HUMAN FACTORS ENGINEERING (4).	H 594. APPLIED ERGONOMICS (3).	IE 599. DESIGN OF HUMAN FACTORS/ERGONOMICS EXPERIMENTS (4).
IE 599: HUMAN ANALYTICS AND BEHAVIORAL OPERATIONS (3).	IE 599. HUMAN FACTORS ENGINEERING II (4).	KIN 575. RESEARCH IN HUMAN MOVEMENT (3)
PSY 594. ENGINEERING PSYCHOLOGY (4).	KIN 523. BIOMECHANICS OF MOTOR ACTIVITIES (3)*.	ROB 567: HUMAN-ROBOT INTERACTION (4)*.
ROB 599. SOCIAL ROBOTICS (4).	KIN 525. BIOMECHANICS OF MUSCULOSKELETAL INJURY (3)*.	PSY 599 VISUAL PERCEPTION (4).
	ME 599. DIGITAL HUMAN MODELING FOR DESIGN (4)*	PSY 699: ST/ENGINEERING PSYCHOLOGY (4)
	PSY 514. RESEARCH METHODS I (4).	
	PSY 542. PERCEPTION (4)*.	
	PSY 643. APPLIED COGNITION (4).	

\* Not offered every year.

## Course Descriptions

### **BIOE 599. PHYSIOLOGY FOR ENGINEERS (4).**

Integration of engineering principles and human physiology in the following areas: bioelectricity in the nervous system; mechanics of the musculoskeletal system; transport phenomena in the pulmonary, cardiovascular, renal and gastrointestinal systems.

PREREQS:

OFFERINGS: F every year

NOTES: To be offered in future years under a permanent number TBD, .Modeling of Physiological Systems.

### **CCE 526. Design for Safety (3).**

Theoretical concepts and industry practices used to model, evaluate, and improve construction worker safety through the design of the project features, construction operations, and site safety program elements. Causes of construction site accidents, hazard recognition and comprehension, safety risk valuation and mitigation, and the true costs of injuries and fatalities.

PREREQS: Graduate standing or consent of instructor.

OFFERINGS: F every year

### **CE 552 Isolated Traffic Signals (3).**

Relationships between traffic signal display, user response, vehicle detection, and signal timing parameters are examined in detail. Traffic simulation is introduced to visualize and design the various elements of isolated signalized intersections.

REREQS: None.

OFFERINGS: usually every other winter

### **CE 554. DRIVING SIMULATION (3).**

Relationships between the functional elements of driving simulation (simulation computer processing, sensory feedback generation, sensory display devices, & the human operator) are examined in detail. The role of driving simulation in transportation engineering research and practice is also considered in depth. Students will design experiments, analyze and interpret data, and extrapolate simulator results to real world scenarios.

PREREQS: None

OFFERINGS: usually every other winter

NOTES: Previously known as CE 590 Driving Simulation

### **CS 519. RESEARCH METHODS IN HCI.**

HCI is often the subject of these special topics courses. Consult the OSU catalog for upcoming offerings.

PREREQS: vary with topic

OFFERINGS: F every year

### **CS 567. LABORATORY STUDIES IN SE AND HCI (4).**

This course is about empirical methods in understanding humans' use of languages, environments, etc., in software development. There are many possibilities about empirical methods, and we can't cover them all. Thus, this course will focus on a method that is very useful for certain kinds of questions about the HCI (human aspects) of software development, but is not well understood in computer science: how to scientifically conduct and analyze (statistically oriented) laboratory studies with human participants. This course will cover how you go about designing, preparing for, running, analyzing, and writing-for-publication quantitative (statistical) lab experiments of programming situations involving human participants. This is an end-to-end coverage of the entire process, and will put you in a position to conduct lab studies of your own with human participants.

PREREQS: Recommended background in one of: usability/hci, software engineering

OFFERINGS: Spring every other year

#### **CS 569. EMPIRICAL LAB STUDIES (4).**

This is a four-credit course graduate course. This course will cover how you go about designing, preparing for, running, analyzing, and writing-for-publication lab experiments of programming situations involving human subjects. This is an end-to-end coverage of the entire process, and will put you in a position to conduct lab studies of your own with human subjects and guidelines in how to analyze the study results.

PREREQS: Graduate standing and interest in the course

OFFERINGS: usually every other winter

#### **H 590. ADVANCED ERGONOMICS (3).**

This course will examine the advanced theories, applications, and contemporary topics of occupational ergonomics and biomechanics. Topics include muscle physiology, work-related musculoskeletal disorders, assessing biomechanical exposure in the workplace, various material handling assessment tools, 3-Dimensional Static Strength Prediction Program, human vibrations, and implementing ergonomic interventions.

PREREQS: None

OFFERINGS: S every other year

NOTES: A new course being offered at OSU. It will cover objective assessment tools including electromyography, electro-goniometers, force transducers, vibration measurement, signal processing, etc.

#### **H 594. APPLIED ERGONOMICS (3).**

This course covers principles of occupational ergonomics for managing optimal worker performance and well-being, including common work-related musculoskeletal disorders and high risk industries; work task, individual, and organizational risk factors which contribute to musculoskeletal disorders; specific workplace ergonomics regulations and guidelines; various assessment tools for evaluation of upper extremity, lifting and manual handling hazards in the workplace; solutions for identified workplace hazards, accounting for impact, implementation, and cost in different work environments; the significance, strategy, and structure of an occupational ergonomics program for preventing musculoskeletal disorders; and current literature on research findings in occupational ergonomics.

PREREQS: None

OFFERINGS: W every other year (last offered W 2015)

NOTES: A slash course so very basic. Could be in transition with Dr. Kim developing an Advanced Ergonomic Course so that we can make the course complementary.

#### **IE 507. SEM/HUMAN-CENTERED DESIGN (1).**

The purpose of this seminar is to bring together graduate students and faculty from around the University whose research focuses on understanding human interaction with the built environment and designing systems, devices, and environments to enhance human performance, safety, comfort, and pleasure. The format of the Seminar will be flexible to accommodate formal presentations, poster sessions, and informal discussions of a variety of topics in human-centered design.

PREREQS: Graduate standing.

OFFERINGS: winter every year

#### **IE 545. HUMAN FACTORS ENGINEERING (4).**

Analysis and design of work systems considering human characteristics, capabilities and limitations. Analysis and design of displays, controls, tools, and workstations. Human performance analysis. Human factors research methods.

PREREQS: Graduate standing.

OFFERINGS: F every year

#### **IE 599. ST/HUMAN FACTORS ENGINEERING II (4).**

Advanced topics in human factors engineering, including: advanced human-machine systems engineering; human cognition and its impacts on the operation of complex, high-risk systems; cognitive task analysis; mental models; human factors requirements, specifications, and standards; human error and human error frameworks; human factors in important human-machine system domains, such as health care, transportation, and manufacturing; human factors of automation; recent developments in human factors research and engineering.

PREREQS: IE 545

OFFERINGS: usually W every year

**IE 599. ST/DESIGN OF HUMAN FACTORS/ERGONOMICS EXPERIMENTS (4).**

This course is designed to provide graduate students with introductions to a broad range of methods appropriate for studying humans, tasks, environments and their interaction along with various topics in the area of Human Factors/Ergonomics. This course will have a reading/discussion format.

At the end of this course, students are expected to be able to:

- Learn knowledge of human factors/Ergonomics terminology, equipment, models and various research areas related to human factors.
- Become proficient in reviewing published research papers in the human factors area.
- Gain familiarity with the content and characteristics of different types of human factors journals.
- Design human factors/ergonomics experiments to solve research questions using proper methodologies.
- Select proper statistical methods to analyze data.
- Formulate research proposals in an appropriate format

PREREQS: IE 545

OFFERINGS: S 2017

NOTES: Course schedule is TBD

**IE 599: HUMAN ANALYTICS AND BEHAVIORAL OPERATIONS (3).**

This course bridges human factors engineering and production planning. The objective of the course is to introduce IE graduate students to several quantitative applications related to determining workforce size, skill-sets, and multi-functionality in service and manufacturing systems based on measurable quality and productivity performance. Students will acquire the skill to model and solve several of these problems in the context trading off the speed and accuracy of known techniques. Topics for future research will also be discussed throughout the course. The course complements other graduate industrial engineering courses including to varying extents the human factors courses, operations research courses, and services courses. As a human factors related course, a number of human behavioral characteristics are discussed and modeled, including learning, forgetting, teamwork, and individual differences.

PREREQS: none

OFFERINGS: F 2017

NOTES: Course schedule is TBD

**KIN 523. BIOMECHANICS OF MOTOR ACTIVITIES (3).**

Kinematic and kinetic analysis of volitional human movement with emphasis on analytical techniques and quantitative problem solving.

PREREQS: KIN 321 or PH 201

OFFERINGS: W of every other year (alternates with KIN 525)

**KIN 525. BIOMECHANICS OF MUSCULOSKELETAL INJURY (3).**

Mechanical causes and effects of forces applied to the musculoskeletal system, material properties of human tissues, pathomechanics of injury, and degenerative changes across the lifespan.

PREREQS:

OFFERINGS: W of every other year (alternates with KIN 523)

**KIN 575. RESEARCH IN HUMAN MOVEMENT (3).**

Investigation and evaluation of research methods applicable to human movement study and professional physical education.

PREREQS: ST 511 or equivalent

OFFERINGS: S of each year

NOTES: As part of the course, students apply the material taught to develop a research proposal.

#### **ME 599. DIGITAL HUMAN MODELING FOR DESIGN (4)**

With the recent introduction of advanced manufacturing technologies (e.g., additive manufacturing) and hyper-convergence (e.g., internet of things), as well as advancements in materials and medical sciences, human aspects of design will be more prominent than ever. Through the foundations in human factors engineering and ergonomics, this course will equip students at the increasingly important intersection of human factors, engineering design and systems engineering. In this course, we will focus on human visualization techniques that influence management's willingness to implement, as well as mathematical models that give credibility to assessments about the human aspects of product and process design.

PREREQS:

OFFERINGS: W every other year

NOTES:

#### **PSY 514 RESEARCH METHODS I (4).**

An introduction to the tools and methods that psychologists use to examine the processes that underlie human behavior. Emphasis is on the skills necessary for completing a research study: hypothesis formulation, design criteria, data collection, analysis, interpretation, write-up, and presentation of results. Utilizes a combination of readings, discussions, and class exercises. Course culminates in an independent research project proposal.

PREREQS: Graduate standing

OFFERINGS: W every year

NOTES: Was PSY 599 BEHAVIORAL RESEARCH METHODS.

#### **PSY 542. PERCEPTION (4).**

Fundamental concepts of animal and human sensation and perception, with emphasis on audition and vision. Applications of psychophysical methods to research in all sensory modalities. Includes review workshops on basic mathematical, physical and physiological concepts necessary to interpret research in this field.

PREREQS: PSY 301 and (PSY 330 or PSY 340) but overrides possible

OFFERINGS: S every year

#### **PSY 594. ENGINEERING PSYCHOLOGY (4).**

Survey human capabilities and limitations in human-machine interaction, including vision, memory, attention, motor control, and human error. Emphasis on theory and implications for system designs.

PREREQS: (PSY 301 and PSY 340)

OFFERINGS: W

NOTES:

#### **PSY 599 VISUAL PERCEPTION (4).**

Fundamental concepts of human visual perception illustrated through a variety of demonstrations, lectures, and class discussions, with emphasis on the underlying psychological and biological processes that allow us to see and occasionally result in visual illusions. Includes research in neuroscience, neuropsychology, and psychophysics.

PREREQS: PSY 340, PSY 301 but overrides possible

OFFERINGS: W or S

#### **PSY 643 APPLIED COGNITION (4).**

Topics including skill acquisition, sport psychology, spatial navigation, and virtual reality with a focus on the strengths and limitations of human performance, and an emphasis on real-world behavior. Cognitive, perceptual, and motor processes in the context of everyday actions. Issues related to human-computer interaction, such as usability, interface design, and automation.

PREREQS: PSY 340, PSY 301 but overrides possible

OFFERINGS: usually W every other year

OTHER PSY NOTES: We plan to add PSY 541. COGNITION (4) in the PhD program.

**PSY 699 ST/ENGINEERING PSYCHOLOGY (4).**

Advanced survey of human information processing and performance in human-technology systems, with attention to theory, methodology, and implications for system analysis and design.

PREREQS: Graduate standing

**ROB 567 HUMAN-ROBOT INTERACTION (4)**

This course focuses on the emerging field of human-robot interaction (HRI), bringing together research and application of methodology from robotics, human factors, human-computer interaction, interaction design, cognitive psychology, education and other fields to enable robots to have more natural and more rewarding interactions with humans throughout their spheres of functioning. Each lecture session will consist of presentation of state-of-art readings followed by focused team exercises applying those readings to small-scale problems. Students will be expected to analyze the readings, contribute to discussions, and formulate solutions to small-scale HRI problems.

Students will also work together as a team on a larger project which addresses a more complex HRI scenario.

PREREQS: Recommended background in one of: human factors, usability/hci, programming experience, design

OFFERINGS: Spring every other year

**ROB 599 SOCIAL ROBOTICS (4)**

In-depth exploration of the leading research, design principles, and challenges in Human-Robot Interaction (HRI), with an emphasis on socially interactive robots. Topics include social embodiment, multi-modal communication, human-robot teamwork, social learning, aspects of social psychology and cognition, as well as applications and evaluation with human subjects. Requires participation, lightning talks, student-led lectures, written critiques of class readings, and a group project involving a hypothetical social robotics project.

PREREQS: None.

OFFERINGS: Fall of every year.

NOTES: Currently a special topics course.