**PMOSH Course 6**

**Special Topics: BCP 8853/6600: Applied Ergonomics**

**Instructors:** Young Mi Choi, Paul Schlumper

**Course Description:**

# In this course, the participant will learn how to apply ergonomic principles for the reduction of stress and strain on a person’s body as well as the control of workplace musculoskeletal and nerve disorders. Concepts such as job hazard analysis and effective control strategies will be covered. Participants will learn how to identify workplace characteristics that may contribute to workplace musculoskeletal and nerve disorders, and develop methods to improve jobs, workstations, and equipment/tooling. Additionally, analysis of manual lifting tasks and estimation of reasonable lifting limits and design of lifting tasks will be covered.

# Prerequisites: BCP 8843/6500

# Textbooks: An Introduction to Human Factors Engineering by Christopher Wickens, John Lee, Yili Liu and Sallie Gordon-Becker (2003) Pearson

# Course Objectives:

Students will become familiar with the physical and sensory factors important in the workplace for the design of workstations and physical tasks. Methods for evaluating existing and designing new workstations and tasks with respect to worker safety and health will be covered.

# Learning Outcomes:

By the end of this course, a student will:

1. Describe the physical and sensory factors that are important for good workspace and task design
2. Design ergonomically appropriate workspaces and tasks
3. Describe how to utilize different methods to objectively evaluate the ergonomics of workspaces and tasks
4. Describe the effects of workspace and task design on worker safety and health

**Grading:**

Assignments: 40 %

Midterm Exam: 30 %

Final Exam: 30 %

# Learning Accommodations:

# If needed, we will make classroom accommodations for students with documented disabilities. These accommodations must be arranged in advance and in accordance with the ADAPTS office (http://www.adapts.gatech.edu).

# Academic Integrity:

Students are encouraged to study together and collaborate on case studies, but each student must submit their own work unless the assignment is specifically structured as a group assignment/project. Any reference sources (including online sources) used to prepare written assignments must be paraphrased in your own words and cited. Students are to neither receive nor provide help to others during exams. Any student suspected of behavior in violation of the Georgia Tech Honor Code will be referred to the Office of Student Integrity. The Georgia Tech Honor Code is available on the Office of Student Integrity website ([http://www.osi.gatech.edu](http://www.osi.gatech.edu/))

**Schedule:**

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| **Week** | **Topic** | **Assessments** |
| 1 | Human Factors of the Physical Senses  Topics covered: Impact of human Vision, Auditory, Tactile and Vestibular Systems on work environment and tasks.  Reading 1 | Students will review case studies and required to identify issues/problems related to physical senses. They will apply information from the week's lectures and readings to recommend improvements to the work environment. |
| 2 | Cognition and Decision Making  Topics covered: Top Down/Bottom Up processing, Memory, Task Design Guidelines for Memory and Perception, Decision Making Models, Information Processing, Heuristics and Bias  Reading 2 | Students will review case studies and required to identify issues/problems related to tasks performed by human operators. They will apply information from the week's lectures and readings to identify improvements to the design of the tasks. |
| 3 | Design Evaluation Methods and Research  Topics covered: Function and Task Analysis, Workload Analysis, Heuristic Evaluation | Students will utilize function/task analysis to evaluate a product to identify design issues and to recommend specific feature and product improvements to mitigate/eliminate ergonomic issues. |
| 4 | Human Computer Interaction and Automation  Topics covered: Guidelines for Interfaces, Automation Design and Function Allocation, Calibration and Trust in Automation  Reading 4 | Mid Term Exam |
| 5 | Design of Workstations, Displays and Control Systems  Topics covered: Design and Selection of Control Devices, Display Design Principles, Control Dynamics and Characteristics, Fitt's Law  Reading 5 | Students will review case studies and required to identify and correct issues/problems related to the design of controls, displays and automation. They will apply information from the week's lectures/readings to recommend corrections for identified issues. |
| 6 | Biomechanics, Stress and Workload Evaluation  Topics covered: Body Segment Inertial Parameters, Application of NIOSH Lifting Equation, Seated Workspaces, Hand Tool Design, Musculoskeletal Injury Factors, Cumulative Trauma, Workload Evaluation, Environmental Stress  Reading 6 | Students will review case studies and required to identify and correct issues/problems related to performance of physical tasks. They will apply information from the week's lectures/readings, including application of models such as the NIOSH lifting equation and others to analyze lifting, pushing, pulling and carrying tasks. |
| 7 | Workplace Safety and Health  Topics covered: Safety and Accident Prevention, Taxonomy of Human Error, Hazard and Failure Analysis, Fault Trees  Reading 7 | Students will review case studies to learn to identify potential safety problems in tasks, products and environments. They will apply strategies from the week's lectures and readings to suggest corrections to identified issues. |
| 8 | Evaluation and Testing of Workplace Ergonomics  Topics covered: | Final Exam |

**Reading List:**

**Reading 1**

Psychology as a Biological Science.

Section 3: Vision

Section 3: Hearing

Section 3: Touch and Pain

Section 3: The Vestibular System

Salvendy, G. (2012). Handbook of Human Factors and Ergonomics. John Wiley & Sons Inc.

Ch 24: Illumination

**Reading 2**

Psychology as a Biological Science.

Section 5: Judgment and Decision Making

**Reading 3**

Meister, D. (2001) Human Factors in System Design, Development and Testing. CRC Press.

Ch 3: Design Methods

**Reading 4**

Sears, A, Jacko, J. eds (2012). The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications. CRC Press.

Ch 5: Cognitive Architecture

Ch 17: Visual Design Principles for Usable Interfaces

Salvendy, G. (2012). Handbook of Human Factors and Ergonomics. John Wiley & Sons Inc.

Ch 59: Automation

**Reading 5**

Bridger, R.S. (2008). Introduction to Ergonomics. CRC Press. Boca Raton.

Ch 13: Displays, controls and virtual environments

Dix, A., Finlay, J., Abowd, G., Beale, R. (2004). Human-Computer Interaction. Pearson Education Ltd.

Ch 7: Design Rules

**Reading 6**

MacLeod, Dan (2013). The Rules of Work: A Practical Engineering Guide to Ergonomics. CRC Press. Boca Raton.

Part I: The Rules

Review the principles in sections 1-10

Part II: Measurements and Guidelines

14. Anthropometry

15. Exertion and Biomechanics

16. Posture

17. Motions

18. Miscellaneous

19. NIOSH Lifting Guide

19. Pushing, Pulling and Carrying Guides

**Reading 7**

Salvendy, G. (2012). Handbook of Human Factors and Ergonomics. John Wiley & Sons Inc.

Ch 25: Occupational Health and Safety Management

Ch 38: Accident and Incident Investigation

Wickens, C. Hollands, J. Banbury, S., Parasuraman, R. (2015). Engineering Psychology and Human Performance. Psychology Press.

Ch 11 (last half): Attention, Time-Sharing and Workload

Ch 12: Stress and Human Error