DEPARTMENT: PSYCHOLOGY   PREPARED BY: PSYCHOLOGY DEPT.
DATE: FALL 2017

COURSE TITLE: Human Factors: Systems Analysis and Design

COURSE CODE: PSY 345

CREDITS: 4

CONTACT HOURS: 75

CATALOG DESCRIPTION:

This course will address the systems engineering approach to system design and the role of the human factors professional in that process. The human methods and techniques that are applied to the development of system requirements, allocation of functions to human and machine subsystems, the analysis of human task and work requirements, analysis of staffing requirements, the design control centers to support the human tasks, and methods of system evaluation, verification, and validation will be examined. This course will require students to apply the concepts and methods discussed to an actual design project as part of a design team. Prerequisite(s): PSY 101. Credits: 3 (3,0)

PREREQUISITES: PSY 101, PSY 130 or PSY 131, or permission of the Department Chairperson

REQUIRED FOR: Applied Psychology Program, Human Factors Concentration

ELECTIVE FOR: All curricula with upper level social science electives.

Human Factors: Systems Analysis and Design

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Behavioral Objectives

1. The student will acquire knowledge of the systems approach to design.
2. The student will understand the general characteristics of human-machine systems and the characteristics that can make those systems difficult to use and operate.
3. The student will understand the cognitive and behavioral contributors to system design and operation.
4. The student will be familiar with the methods and techniques that are used by human factors psychologists in the design of products and systems for human use.
5. The student will obtain a sufficient understanding of systems analysis and design to apply their knowledge to an actual design project.

COURSE OUTLINE

The following is an overview of the topics to be covered in this course. Each unit will include relevant theory, current research, and its application.

Unit 1: Introduction to Systems Theory

Applied systems theory provides an approach to the design of a broad range of systems from consumer products of complex transportation, medical, aviation and computer systems. Human machine systems are designed and developed using a top-down human factors engineering (HFE) approach. Top-down refers to a process that starts at the "top" with high-level system goals that are systematically broken down into the functions necessary to achieve the mission goals. Functions are allocated to human and system resources and are broken down into tasks for the purposes of specifying the information and controls that will be required to accomplish function assignments. Tasks are arranged into meaningful jobs and the displays and controls are designed to best support
job task performance. The detailed system design is the "bottom" of the top-down process. In this unit general concepts of systems theory will be presented.

Unit 2: Human Factors Program Planning
Design projects begin with the formulation of a detailed plan that describes the technical program activities that will help ensure that all aspects of the system are developed, designed, and evaluated on the basis of a structured top-down systems analysis using accepted HFE principles. The fundamentals of project planning and management will be discussed in this unit.

Unit 3: Systems Analyses
Many different types of analyses go into the design of a human-machine system. Among them are (1) operational experience analysis, (2) system requirements analysis and allocation, (3) task analysis, (4) staffing and personnel requirements analysis, and (5) risk analysis. Operating Experience Analysis is used to identify problems and issues related to the use and maintenance of similar systems so that they are improved in the development of the current system. Function analyses are performed to identify the functions that must be performed to meet the purposes and objectives of the system. Functions are allocated to personnel, system elements, and combinations of personnel and system elements using methodologies that take advantage of human strengths and avoid allocating functions that would be negatively affected by human limitations. Task analysis is the evaluation of the performance requirements for those functions that personnel are required to perform in order to define the information, controls and support aids. Staffing analysis addresses the requirements for the number and qualifications of personnel in a systematic manner. Finally, risk analysis is performed to minimize the likelihood of personnel error and to provide for error detection and recovery capability. This unit will present the purpose and methods that are used for each of these types of analyses and their role in overall system development.

Unit 4: Human-System Interface Design
The results of the system analyses are used to design the details of the human-system interface, i.e., the alarms, displays, control, procedures, and support systems that are needed to operate and maintain the system. The design process uses a structured methodology that guides designers and helps to ensure that interfaces are designed to best reflect both system requirements and human physiological and cognitive capabilities and characteristics. This unit will present the methods and techniques that are used for detailed design. The databases and evaluation tools and techniques will be discussed.

Unit 5: Training and System Support
Training of system personnel is an important consideration, especially in the safe, efficient, and reliable operation of complex systems. In this unit the methods used to determine the knowledge, skills, and abilities of personnel will be presented. The systems approach to the training, based on the analysis of job and task requirements, will be discussed.
Unit 6:  Systems Tests and Evaluations
Once a system is designed, a variety of techniques are used to test and evaluate whether the system meets its overall objectives and purposes. The type and extent of evaluations is related to the type of system. For more complex systems, verification and validation evaluations are used to systematically and comprehensively determine that the design conforms to HFE design principles and that it enables personnel to successfully perform their tasks to achieve safety and other operational goals. These evaluations may include verifications to ensure that interface components are provided to accomplish all personnel tasks and that the design reflects HFE principles, standards, and guidelines. Validation is a performance-based evaluation of the integrated design to ensure that the design supports safe operation of the system. These may involve tests using the actual system or a simulation of the actual system. In this unit, the range of approaches used to evaluate both simple and complex systems will be presented and the methodology, strengths, and weaknesses of each will be discussed.

Design Laboratory Project
Students will perform a laboratory exercise during this project which is designed to illustrate the topics discussed. Students will form design teams (of two) and will select a system to design. Over the course of the semester, the design team will perform the planning, analysis, design, and evaluation methods and techniques that are discussed. Documentation of each design activity will be performed and submitted at the end of each unit. The competed project will be submitted at the end of the semester.