

6. Ergonomics and Human Factors

Ergonomics and Human Factors as a field of research and practice is concerned with the design and analysis of equipment and devices that fit the human body and its cognitive abilities. The knowledge area includes contributions from anthropometry, statistics, psychology, physiology, biomechanics, industrial design, graphic design, operations research, and other disciplines.

It is the study of designing equipment and devices that fit the human body and its cognitive abilities. The areas of emphasis are: Physical Ergonomics, Cognitive Ergonomics, and Organizational Ergonomics.

6.1. Ergonomic Basics

- 6.1.1. Focuses of ergonomics
- 6.1.2. Ergonomics and its areas of application in a work system
- 6.1.3. Ergonomic interventions
- 6.1.4. Effectiveness and cost effectiveness of ergonomics

6.2. Organizational and Social Aspects of System Design

- 6.2.1. Systems design methods for ergonomics (see Systems Design and Engineering knowledge area)
- 6.2.2. Organizational aspects
- 6.2.3. Psychosocial factors
- 6.2.4. Litigation
- 6.2.5. Cross-cultural considerations

6.3. Anthropometric Principles in Workspace and Equipment Design

- 6.3.1. Basic body mechanics
- 6.3.2. Risk factors for musculoskeletal disorders
- 6.3.3. Designing for a population of users
- 6.3.4. Sources of human variability
- 6.3.5. Anthropometry and its uses in ergonomics
- 6.3.6. Principles of applied anthropometry in ergonomics
- 6.3.7. Application of anthropometry in design
- 6.3.8. Designing for everyone

6.4. Work Capacity and Fatigue

- 6.4.1. Muscles, structure, function, and capacity
- 6.4.2. Occupational biomechanics
- 6.4.3. Cardiovascular system
- 6.4.4. Respiratory system
- 6.4.5. Physical work capacity
- 6.4.6. Applied physiology in designing the workplace
- 6.4.7. Fitness for work

- 6.5. Design of the Thermal Environment**
 - 6.5.1. Fundamentals of human thermoregulation
 - 6.5.2. Thermoregulatory mechanisms
 - 6.5.3. Measuring the thermal environment
 - 6.5.4. Work in hot climates
 - 6.5.5. Work in cold climates

- 6.6. Design of Repetitive Tasks**
 - 6.6.1. Introduction to work-related musculoskeletal disorders
 - 6.6.2. Injuries to the upper body at work
 - 6.6.3. Tissue pathomechanics
 - 6.6.4. Carpal tunnel syndrome
 - 6.6.5. Lower and upper limbs

- 6.7. Design of Manual Handling Tasks**
 - 6.7.1. Anatomy and biomechanics of manual handling
 - 6.7.2. Prevention of manual handling injuries in the workplace
 - 6.7.3. Design of manual handling tasks
 - 6.7.4. Lifting, carrying, and pushing
 - 6.7.5. NIOSH lifting equation

- 6.8. Design for Standing and Sitting**
 - 6.8.1. Ergonomic approach to workstation design
 - 6.8.2. Design for standing workers
 - 6.8.3. Design for seated workers
 - 6.8.4. Work surface design
 - 6.8.5. Visual displays
 - 6.8.6. Guidelines for the design of static work
 - 6.8.7. Computer workstation design

- 6.9. Vision, Light, and Lighting**
 - 6.9.1. Vision and the eye
 - 6.9.2. Measurement of light
 - 6.9.3. Lighting design considerations
 - 6.9.4. Visual fatigue, eyestrain, and near work
 - 6.9.5. Psychological aspects of indoor lighting

- 6.10. Hearing, Sound, Noise, and Vibration**
 - 6.10.1. Sound and the ear
 - 6.10.2. Measurement of sound
 - 6.10.3. Hearing protection
 - 6.10.4. Design of the acoustic environment
 - 6.10.5. Noise control
 - 6.10.6. Effects of noise on task performance
 - 6.10.7. Non-auditory effects of noise on health
 - 6.10.8. Vibration

6.11. Human Information Processing, Skill, and Performance

6.11.1. Information processing models

6.11.2. Cognitive systems

6.11.3. Problem solving

6.12. Displays and Controls

6.12.1. Human-centered design processes for interactive systems

6.12.2. Principles for the design of visual displays

6.12.3. Auditory displays

6.12.4. Design of controls

6.12.5. Combining displays and controls

6.13. Human-machine interaction, human error, and safety

6.13.1. Human error and equipment design

6.13.2. Mental workload in human machine interaction

6.13.3. Psychological aspects of human error

6.13.4. Characterizing human-machine interaction

6.13.5. Prevention of error in human-machine interaction

6.13.6. Accidents and safety

REFERENCES:

Introduction to Human Factors and Ergonomics for Engineers. Lehto, Mark R. and Landry, Steven J. CRC Press, 2nd Edition. 2013.

Fundamentals of Industrial Ergonomics. Pulat, Babur M. Waveland Press. 2nd Edition. 1997.

Engineering Psychology and Human Performance. Wickens, Christopher D., Hollands, Justin G., Banbury, S. and Parasuraman, R. Routledge, 4th Edition. 2016.

Introduction to Ergonomics. Bridger, R. CRC Press, 3rd Edition. 2008.

Kodak's Ergonomic Design for People at Work. Eastman Kodak Company. Wiley, 2nd Edition. 2004.

Occupational Biomechanics. Chaffin, Don B., Andersson, Gunnar B.J. and Martin, Bernard J. Wiley, 4th Edition. 2006.

An Introduction to Human Factors Engineering. Wickens, Christopher D., Lee, J., Gordon-Becker, S. and Liu, Y. Pearson, 2nd Edition. 2014.