

## Session 8 - ERGONOMICS

**ERGON --> WORK**

**NOMOS --> LAW**

**The Laws to be Observed at Work**

### Human Factor Engineering

Human Factors

Physical and mental work capacity  
 Fatigue  
 Body forces, strength and posture  
 Body sizes  
 Thermal comfort/ heat stress/cold stress  
 Vision  
 Hearing  
 Perception  
 Information processing  
 Decision making  
 Performance and efficiency  
 Adaptation and rehabilitation

Engineering

Industrial design  
 Work place design  
 Product design  
 Furniture design  
 Machine design  
 Ventilation  
 Lighting  
 Acoustics  
 Engineering control  
 (Chemical & Physical)  
 Building orientation  
 Maintenance

### Ergonomics

- Ergonomics means literally the study or measurement of Work
- In addition to work as labour for monetary gain, work also includes
  - é Sports
  - é Leisure activities
  - é Domestic work
  - é Education and training
  - é Health and social services

### **Ergonomics considers human operators variability**

- An automobile design has to consider
  - Range of physical size and strengths of users
  - Seats are comfortable
  - Controls readily identifiable and within easy reach
  - Clear visibility front and rear
  - Easily read internal instruments
  - Ease of entry and egress

### **AIMS OF ERGONOMICS**

- Ensures that human needs for safe and efficient working are met in the design of work system
- To design
  - Appliances
  - Technical Systems
  - Tasks
  - In such a way to improve
    - Human Safety
    - Health
    - Comfort and
    - Performance

### **Basic aims of ergonomics**

- Efficiency in purposeful activity
- To achieve desired result without
  - ä Waste
  - ä Error
  - ä Damage to persons
- Working situation in harmony with the activities of the worker

### **Difficulties in achieving the aims of ergonomics**

- è Human operator is flexible and adaptable
- è Large individual differences
  - è Obvious differences: --> Physical size, strength
  - è Not obvious differences --> Culture, style, level of skill

Thus a systematic approach and theory are necessary. There should be measurable objectives to be checked and remedial action taken. A detailed study of the science of ergonomics provides these approaches and theories

### **DEFINITIONS OF ERGONOMICS**

- ä Ergonomics is a means of improving working conditions and reducing illness at work
- ä Ergonomics attempts to 'Fit the Job to the Man' rather than 'Fit the Man to the Job'
- ä Ergonomics is concerned with the design of systems in which people carry out work
- ä Ergonomics optimizes Efficiency, Health, Safety and Comfort of people through better designs of products and work places

### **Who is a human operator?**

- è Skilled professional using a complex machine in an artificial environment
- è Customer who has purchased a new equipment
- è Child sitting in a classroom
- è Disabled person in a wheel chair

## WHAT IS ERGONOMICS?

Ergonomics is:

- 1 “Higher productivity and a better place to work”
- 1 “The science that saves both lives and dollars”
- 1 “Human engineering where the goal is to optimize worker well being and productivity”
- 1 “A way of thinking about and planning work so that it suits the capabilities and needs of the people”

Ergonomics is a solution finding method for questions like these:

- \_ How can human body dimensions be applied to car seat design?
- \_ What is the proper height for kitchen counters?
- \_ How can traffic lights be programmed for optimal urban traffic flow throughout the day?
- \_ How can stereo receiver displays and controls be coded to effectively define their respective functions?
- \_ How can the material and design of swim suits for competition be improved for minimal water resistance?
- \_ How should computer software and screens work and look best to fit human cognitive capabilities?

### Ergonomic needs in a workplace

- Physical work environment
  - Thermal comfort
  - Noise and vibration control
  - Adequate and proper lighting
- Chemical environment
  - Control of pollution
  - General and exhaust ventilation
- Work physiology
  - Control excessive physical load
  - Avoid physical and muscular fatigue
  - Adequate rest pauses
  - Arrangement of static and dynamic work
- Anthropometry (Body sizes)
  - Designs to fit body sizes of users
  - Appropriate working levels
  - Adequate work space
  - Avoid overcrowding of machines and workers
- Occupational Biomechanics
  - Appropriate work postures (sitting, standing)
  - Safe load lifting and carrying techniques
  - Adopt proper techniques in manual materials handling
- Psychological aspects

- Avoid perceptual and mental loads and fatigue
- Appropriate design of displays and control
- Appropriate conditions for Vigilance tasks
- Avoid human error and stress
- Job motivation and satisfaction
- Social psychology
  - Practice good relationship among employees and between employer and employee
- Macro ergonomics
  - Suitable working hours , intervals, holidays, leave
  - Appropriate shift schedules
  - Welfare facilities
  - Job rotation and incentives schemes
  - Fair salary structure, Good administrative structure
  - Good work organization schemes
  - Fringe benefits (housing, transport, sports)
  - Labour union facilities
  - Training and education
  - Promotional prospects
- Safety and Ergonomics
  - Good housekeeping
  - Performance feedback
- Systems ergonomics
  - Systems groups in problem solving and development work
  - Participative ergonomics
  - User centered designs

### **Benefits of ergonomics**

- Productivity
- Product quality
- Safety
- Health
- Reliability
- Job satisfaction
- Personal development

### **Ergonomic contributions to development in industrially developing countries**

- Research on basic data needs
- Promote special abilities
- Refine simple methods
- More appropriate “experts”
- Action learning (Learning by doing, not imitating)
- Better supported education and research
- Re-conceptualize standard setting