

**Course Description & Objective:**

*To acquaint and equip with the ergonomic aspects in the design of farm machinery for safety of human beings*

**Course outcomes:**

1. *demonstrate an awareness of the unique attributes involved with farm work and planning for safety on a farm*
2. *understand the impact of near misses, injuries and fatalities on the farm, including the daily workings, business finances, the wide range of people affected, etc.*
3. *understand what hazards are, how they manifest, and how they impact business efficiency*
4. *understand the elements involved in creating a farm safe plan*
5. *understand how developing a farm safe plan can be valuable tool for business management, risk management, and human resources management*
6. *understand basic occupational health and safety principles (including terminology)*
7. *demonstrate an awareness of the legal responsibilities in farm safety planning*
8. *demonstrate an awareness of available resources and supports in the area of farm safety*
9. *conduct an inspection of their own operations to identify areas for improvement*
10. *create standard work procedures (swp) and general safety guidelines as they relate to farming practices*
11. *understand the difference between swp and general safety guidelines and when to use each understand how attitudes on a farm emerge and how farm climate can be altered regarding the importance of safety*

**UNIT I**

Importance of ergonomics and its application in agriculture , Anthropometry and Biomechanics: Anthropometric data and measurement techniques, analysis and application of anthropometric data, joint movement and method of measurement, , measurement of physical and mental capacities. Man-machine system concept. Human factors in adjustment of man and his work

**UNIT II**

liberation and transfer of energy in human body, concept of indirect calorimeter, work physiology in various agricultural tasks. Physiological stress indices and their methods of measurement: Mechanical efficiency of work, fatigue and shift work.

**UNIT III**

Vibration and noise: Theory, Classification of vibrations, Governing equations, Energy methods. Sensors: Types, Theory and concept, Applications. use of isolators, application in tractor seat design. Biomedical aspects of tractor operation; Visual perception in tractor control panel design..

**UNIT IV**

Noise and vibration and their physiological effects, thermal environment; heat stress, thermal comfort, effect on performance and behavior, field of vision, color discrimination, Principle and design of ROPS, International standards and testing of ROPS. Simulation of tractor cabin enclosure in view of ergonomics

## UNIT V

General guidelines for designing visual display, Design aspects of foot and hand controls on tractors and farm equipment, safety standards at workplace during various farm operations and natural hazards on the farm. Farm safety legislation. Design of operator's seat for agricultural equipment.

### Practical:

1. Study of anthropometric data of agricultural workers
2. Identification of anatomical reference planes and directional terms of human body
3. Identification of anthropometric dimensions for agricultural machinery design.
4. Measurement of identified anthropometric dimensions of sample objects.
5. Measurement of identified anthropometric dimensions of sample objects.
6. Computation of mean, SD 5<sup>th</sup>, 95<sup>th</sup> percentiles of anthropometric data.
7. Measurement of heart rate of farming operations using polar heart rate monitor.
8. Grading of energy cost of work.
9. Measurement of force required for manually operated implements using load cell.
10. Measurement of noise level of agricultural machinery and safe exposure level.
11. Design dimensions of wheel hoe based on anthropometric considerations.
12. Design dimensions of tractor operator seat based on anthropometric considerations.

### Suggested Readings

1. Bridger RS. 1995. *Introduction to Ergonomics*. McGraw Hill.
2. Charles D Reese. 2001. *Accident / Incident Prevention Techniques*. Taylor & Francis.
3. Gavriel Salvendy. 1997. *Hand Book of Human Factors and Ergonomics*. John Wiley & Sons.
4. Kromer KHE. 2001. *Ergonomics*. Prentice Hall.
5. Mathews J & Knight AA. 1971. *Ergonomics in Agricultural Design*. National Institute of Agric. Engineering, Wrest Park Silsoe, Bedford.
6. Mathews J Sanders, CormicksMS & MCEj. 1976. *Human Factors in Engineering and Design*. 4th Ed. McGraw Hill.
7. William D McArdle. 1991. *Exercise Physiology*. 1991. Lea & Febiger.
8. Zander J. 1972. *Principles of Ergonomics*. Elsevier.
9. Zander J. 1972. *Ergonomics in Machine Design*. Elsevier