



- I. Course Title : Ergonomics in Working Environment**
II. Course Code : FMPE 614
III. Credit Hours : 2+1

IV. Aim of the course

To enable the student to understand the concept of designing the working environment and designing farm machinery and equipment to ensure operators comfort and safety.

V. Theory

Unit I

Musculoskeletal problems in sitting and standing postures-behavioral aspects of posture, body mechanics. Workspace design for standing and seated workers. Display units, controls and human-machine interaction, design of static work.

Unit II

Noise and noise control. Measurement of noise and safe limits. Protection from noise. Vibration and health. Vibrations generated by agricultural machines. Types of vibrations: Whole body vibrations and hand transmitted vibrations. Methods of measurements of vibrations, hazards of vibrations. Vibration White Fingers (VWF). Vibration reductions in agricultural machines.

Unit III

Working environment-heat and cold stress conditions. Thermal balance of human body. Measurement of thermal environment. Heat and cold stress condition. Thermoregulatory system of human body. Heat and cold acclimatization. Effect of climate on human performance. Environmental dust and its measurement: Organic and inorganic dust. Types of dust and their hazards: Respirable, thoracic and inhalable dust. Personal protection from dust.

Unit IV

Time motion study and its purpose. Application of Time motion study in agricultural and processing operations. Recent research works related to ergonomics in agriculture.

VI. Practical

Design of workspace for static work in standing and sitting positions. Study of body mechanics and postures in design of agricultural machinery. Human energy expenditure, calibration of subjects, Human work load and its assessment. Study of work and rest schedule. Measurement of visibility of tractors. Measurement and control of noise in tractors and self-propelled machines. Measurement of human vibrations in farm tractors and agricultural machines. Study of dust generated in agricultural operations.

VII. Learning outcome

Ability to design working environment of different agricultural machinery for efficient and safe operations.

**VIII. Lecture Schedule**

S.No.	Topic	No. of Lectures
1.	Basics of body mechanics, stability and support	1
2.	Control of muscle function, fatigue and discomfort	1
3.	Musculoskeletal problems in sitting and standing posture	2
4.	Behavioural aspects of posture, risk factors for musculoskeletal disorders	1
5.	Importance of ergonomics in workspace design	1
6.	Workspace design for standing workers	1
7.	Workspace design for seated workers	1
8.	First hourly examination	1
9.	Visual display units, controls and human- machine interaction	1
10.	Design of static work	1
11.	Importance of noise control and safe limits for human	1
12.	Measurement of noise, reduction and protection	1
13.	Machine vibrations, human vibrations and health hazards	1
14.	Whole body vibrations and hand transmitted vibrations	1
15.	Methods of measurements of vibrations and health hazards	1
16.	Vibration reduction techniques for agricultural machines	1
17.	Mid-semester examination	1
18.	Working environment- heat and cold stress conditions, thermal balance of human body	1
19.	Measurement of thermal environment	1
20.	Thermo-regulatory system of human body, heat and cold acclimatization, effect of climate on human performance	2
21.	Environmental dust and its measurement, type of dust - organic and inorganic dust, dust health hazard	1
22.	Respirable, thoracic and inhalable dust, protection from dust	1
23.	Time motion study and its purpose	1
24.	Application of time motion study in agricultural and processing operations	1
25.	Recent research work related to physiological parameters of ergonomics in agriculture	1
26.	Recent research work related to tractor space layout and design of controls	1
27.	Recent research work related to noise studies on farm machines	1
28.	Recent research work related to vibrations studies on farm machines	1
29.	Recent research work related to accidents and safety studies on farm machines	1
30.	Revision and discussion	1
	Total	32

IX. List of Practicals

S.No.	Topic	No. of Practicals
1.	Design of workspace for static work in standing or sitting posture	1
2.	Study of body mechanics and posture in design of agricultural machinery	2
3.	Study of displays and controls in tractors	1
4.	Calibration of subjects on ergometer and treadmill	2
5.	Human workload and its assessment	1



S.No.	Topic	No of Practicals
6.	Study of work and rest schedule	1
7.	Measurement of visibility to tractor operators	1
8.	Measurement of noise in tractors and self-propelled machines	1
9.	Measurement of machine component vibration	1
10.	Measurement of hand arm vibrations	1
11.	Measurement of whole body vibrations	1
12.	Study of dust generated in agricultural operations	1
13.	Case study of design improvement in agricultural machine/ tool through ergonomic concept	1
14.	Practical examination	1
	Total	16

X. Suggested Reading

- Astrand PO, Rodahl K, Dahl HA and Stromme SB. 2003. *Textbook of Work Physiology: Physiological Bases of Exercise*. Champaign IL: Human Kinetics.
- Bridger RS. 2009. *Introduction to Ergonomics*. 3rd edition CRC Press, Boca Raton, USA.
- Gite LP, Majmudar J, Mehta CR and Khadatkhar A. 2009. *Anthropometric and Strength Data of Indian Agricultural Workers for Farm Equipment Design*. Central Institute of Agricultural Engineering, Bhopal, India.
- Gite LP, Agrawal KN, Mehta CR, Potdar RR and Narwariya BS. 2019. *Handbook of Ergonomical Design of Agricultural Tools, Equipment and work Places*. Jain Brothers, New Delhi.
- Kroemer KHE and Grandjean E. 1997. *Fitting the Task to the Human: A Textbook of Occupational Ergonomics*. Taylor & Francis, Philadelphia, USA.
- Pearsons K. 2003, *Human Thermal environments: The Effects of Hot, Moderate and Cold Environment on Human Health, Comfort and Performance*. Taylor and Francis, New York, USA.
- Sanders MS and McCormick EJ. 1993. *Human Factors in Engineering and Design*. McGraw Hill, New York, USA.

