

FMPE 503 : Ergonomics and Safety in Farm Operations 2+1**Objectives:**

To understand the principles of the science of Ergonomics and its application to farm machinery in order to reduce drudgery in the use of tools and equipment and also make them safe and comfortable to operate.

Unit-I

Description of human-machine systems. Ergonomics and its areas of application in the work system. History of ergonomics. Modern ergonomics.

Unit-II

Anthropometry: Its role in daily life, principles in workspace and equipment design, design of manual handling tasks and application in equipment design. Human postures: Postural stress and its role in design of farm machinery.

Unit-III

Human factors in tractor seat design: Entry system, controls, shape, colour coding, dial and indicators. Modern technology for comfort in driving places.

Unit-IV

Physiological parameters: Psychological and mental stresses and their measurement techniques. Human energy expenditure: Calibration of subjects, human workload and its assessment.

Unit-V

Safety considerations and operators protective gadgets in farm operations. Standards/codes for tractors and agricultural machinery safety.

Practical:

Identifying role of ergonomics in our daily life. Measurement of anthropometric dimensions of agricultural workers and establishing relationship between them. Determination of human requirements for field operation with manually operated equipment. Assessment of psychological/general load for specific agricultural operations. Calibration of human subject on bicycle ergometer and/ or treadmill for its energy output and physiological parameters like heart rate, oxygen consumption rate under laboratory conditions. Case studies of agricultural accidents and safety measure.

Course Outcome:

The student will be able to apply the concepts of ergonomics in the design of agricultural tools and equipment and also evaluate the ergonomic suitability of such equipment.

Teaching Schedule

| S. No | Topic | No. of lectures |
|--------------|--|------------------------|
| 1 | Introduction to ergonomics, definition of ergonomics | 1 |
| 2 | Operator- machine-environment system approach | 1 |
| 3 | Relative advantages of man and machine, ergonomics in daily life | 1 |
| 4 | Importance of ergonomics in agriculture and farm machinery | 1 |
| 5 | History of ergonomics, modern ergonomics | 1 |

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| 6 | Man machine environment components, broad objectives of ergonomics | 1 |
| 7 | Basic issues and processes under ergonomics for design and development of machine | 1 |
| 8 | Anthropometry and its uses in daily life | 1 |
| 9 | First hourly examination | 1 |
| 10 | Principles of applied anthropometry in ergonomics | 1 |
| 11 | Availability of anthropometric database for Indian agricultural workers | 1 |
| 12 | Definitions and possible applications of anthropometric dimensions | 2 |
| 13 | Workspace and equipment design | 1 |
| 14 | Different modes of force application | 1 |
| 15 | Design of manual handling tasks | 1 |
| 16 | Biomechanics aspects in machine design | 1 |
| 17 | Mid-semester examination | 1 |
| 18 | Human posture, posture stresses and its role in design of agricultural machinery | 1 |
| 19 | Work place design for standing and seated workers | 2 |
| 20 | Human factors in tractor seat design | 1 |
| 21 | Entry system, controls, shape, colour coding, dial and indicators | 1 |
| 22 | Modern technology for safety and comfort in driving place | 1 |
| 23 | Physiological and psychological parameters for ergonomic evaluation | 1 |
| 24 | Physiological and psychological stresses and measurements techniques | 1 |
| 25 | Human work load assessment, human energy expenditure | 1 |
| 26 | Calibration of subjects – concept, importance and techniques | 1 |
| 27 | Accidents and safety in agriculture operations, general safety guidelines | 1 |
| 28 | Safety feeding systems for threshers and chaff cutters | 1 |
| 29 | Safety gadgets for tractors and trailers | 1 |
| 30 | Standard/ codes for agricultural machinery safety | 1 |
| | Total | 32 |

List of Practicals

| Sr. No | Topic | No. of lectures |
|--------|--|-----------------|
| 1 | Identify role of ergonomics in our daily life | 1 |
| 2 | Measurement of anthropometric dimensions of agriculture workers and establishing relation between them | 2 |
| 3 | Measurement of strength parameters | 1 |
| 4 | Determination of human requirements of field operation with manual operated equipment | 2 |
| 5 | Assessment of psychological/ general load for agricultural operations | 1 |

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| 6 | Assessment of stress on eyes by specific agricultural operation | 1 |
| 7 | Noise measurement in tractors | 1 |
| 8 | Calibration of human subject on bicycle ergometer | 1 |
| 9 | Calibration of human subject on treadmill | 1 |
| 10 | Measurement of physiological parameter viz. heart/ pulse rate | 1 |
| 11 | Measurement of oxygen consumption under laboratory conditions | 1 |
| 12 | Case study of accidents and safety on tractors and trailers | 1 |
| 13 | Case study of accidents and safety on chaff cutters and threshers | 1 |
| 14 | Practical examination | 1 |
| | Total | 16 |

Suggested Reading :

1. Bridger R S 2009. Introduction to Ergonomics. CRC Press, Boca Rotan, USA Sanders
2. M S and McCormick E J 2000. Human Factors in Engineering and Design. McGraw Hill. 7th edition
3. Astrand P, Rodahl K, Dahl H A and Stromme S B 2003. Textbook of Work Physiology - physiological Basis of Exercise. McGraw Hill.
4. Gite L P 2009. Anthropometric and Strength Data of Indian Agricultural Workers for Farm Equipment Design. Central Institute of Agricultural Engineering, Bhopal.
5. Gite L P, Agrawal K N, Mehta C R, Potdar R R and Narwariya B S. 2019. Handbook of Ergonomical Design of Agricultural Tools, Equipment and work Places. Jain Brothers, New Delhi.
6. Ernest J. McCromick 1976 Human Factors in Engineering and Design. McGraw hill. 4th Edition.
7. Grandiean E. 1980. Fitting the Task to the Man. Taylor and Francis Ltd, London.
8. Kroemer K H E 2008. Fitting the human: Introduction to Ergonomics. Taylor and Francis, London, 6th edition.
9. Murrel K. F. H. 1965. Ergonomics: man in his Working environment. Chapman and Hall, London.