S.No.	Topic	No of Practicals
5.	Lab Testing and evaluation of nozzles	1
6.	Field testing of rotavators	1
7.	Lab testing of rotavators for soil sample analysis	1
8.	Testing and evaluation of reapers	1
9.	Testing and evaluation of combine harvester and threshers	1
10.	Testing and evaluation of chaff cutters	1
11.	Testing and evaluation of laser land leveler	1
12.	Case study of test reports of different agricultural implements	3
	Total	**15**

X. Suggested Reading

- Barger E L, Liljedahl J B and McKibben E C. 1967. *Tractors and their Power Units*. Eastern Wiley 4th Edition.
- *Indian Standard Codes for Agricultural Implements*. Published by BIS, New Delhi.
- Inns F M. 1986. *Selection, Testing and Evaluation of Agricultural Machines and Equipment*. FAO Service Bull. No.115.
- Mehta M L, Verma S R, Rajan P and Singh S K 2019. *Testing and Evaluation of Agricultural Machinery*. Daya Publishing House, Delhi.
- *Nebraska Tractor Test Code for Testing Tractor*, Nebraska, USA.
- Smith D W, Sims B G and O'Neill D H 2001. *Testing and Evaluation of Agricultural Machinery and Equipment -Principle and Practice*. FAO Agricultural Services Bull. 110.

I. Course Title : Ergonomics and Safety in Farm Operations

II. Course Code : FMPE 503

III. Credit Hours : 2+1

IV. Aim of the course

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.

V. Theory

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.

VI. 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.

VII. Learning 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.

VIII. Lecture 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
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

S.No.	Topic	No. of Lectures
29.	Safety gadgets for tractors and trailers	1
30.	Standard/ codes for agricultural machinery safety	1
	Total	**32**

IX. List of Practicals

S.No.	Topic	No of Practicals
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
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**

X. Suggested Reading

- Bridger R S 2009. *Introduction to Ergonomics*. CRC Press, Boca Rotan, USA
- Sanders M S and McCormick E J 2000. *Human Factors in Engineering and Design*. McGraw Hill. 7th edition
- Astrand P, Rodahl K, Dahl H A and Stromme S B 2003. *Textbook of Work Physiology - Physiological Basis of Exercise*. McGraw Hill.
- Gite L P 2009. *Anthropometric and Strength Data of Indian Agricultural Workers for Farm Equipment Design*. Central Institute of Agricultural Engineering, Bhopal.
- 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.

I. Course Title : Design of Tractor Systems

II. Course Code : FMPE 504

III. Credit Hours : 2+1

IV. Aim of the course

To introduce the student to the principles that direct the design of a tractor and its subsystems and enable the student to apply the concept of machine design in designing the subsystems and critical components.

V. Theory

Unit I

Design and types, research, development, design procedure, technical specifications