



- I. Course Title : Applied Instrumentation in Farm Machinery**
II. Course Code : FMPE 513
III. Credit Hours : 2+1

IV. Aim of the course

To understand the operation of instruments that is used in design and evaluation of farm machinery and their application.

V. Theory

Unit I

Strain gauges, types and applications in two and three dimensional force measurement in farm machinery. Various methods of determining strain/stresses experimentally. Design, selection and analysis of strain gauges.

Unit II

Introduction to transducers (sensors). Active and passive transducers, analog and digital modes, null and deflection methods. Performance characteristics of instruments including static and dynamic characteristics.

Unit III

Load cells, torque meters, flow meters types and principles of working. Devices for measurement of temperature, relative humidity, pressure, sound, vibration, displacement (LVDT) etc. Recording devices and their types. Measuring instruments for calorific value of solid, liquid, and gaseous fuels.

Unit IV

Basic signal conditioning devices, data acquisition system. Micro computers for measurement and data acquisition. Data storage and their application including wireless communication. Application of sensors in farm machinery and power: Tractor and selected farm machinery.

VI. Practical

Calibration of load cells, torque meters, flow meters etc. Experiment on LVDT, strain gauge transducer, speed measurement using optical devices, vibration measurement, making of thermocouples etc, application of sensors in farm machinery like wheel hand hoe, etc.

VII. Learning outcome

The student will be able to select and implement suitable systems for measurement of different parameters like force, torque, speed and pressure etc, that are used in design and evaluation of Farm machinery.

VIII. Lecture schedule

S.No.	Lecture	No. of Lectures
Unit I		
1.	Strain gauges and its types; working principle, wheatstone bridge measurement, commercial available strain gauges	2
2.	Applications of strain gauges in two and three dimensional force measurement in farm machinery	2
3.	Various methods of determining strain/stresses experimentally.	2
4.	Design, selection and analysis of strain gauges.	2



S.No.	Topic	No of Lectures
Unit II		
5.	Introduction to transducers (sensors).	1
6.	Active and passive transducers, analog and digital modes, null and deflection methods.	2
7.	Performance characteristics of instruments including static and dynamic characteristics.	2
Unit III		
8.	Load cells, torque meters, flow meters types and principles of working	3
9.	Devices for measurement of temperature and relative humidity	2
10.	Devices for measurement of pressure and sound	2
11.	Devices for measurement of vibration and displacement (LVDT)	2
12.	Recording devices and their types	1
13.	Measuring instruments for calorific value of solid, liquid, and gaseous fuels	2
Unit IV		
14.	Basic signal conditioning devices and data acquisition system	1
15.	Micro computers for measurement and data acquisition; general purpose microcontrollers and microprocessors	2
16.	Data storage and their application including wireless communication	2
17.	Application of sensors in farm machinery and power: Tractor and selected farm machinery	2
Total		32

IX. List of Practicals

S.No.	Topic	No of Practicals
1.	Calibration of Load Cells	2
2.	Calibration of Torque Meters	1
3.	Calibration of Flow Meters	1
4.	Experiment on LVDT.	2
5.	Experiment on Strain Gauge	1
6.	Speed measurement using optical devices	2
7.	Vibration Measurement	2
8.	Making of Thermocouples	2
9.	Application of Sensors in Farm Machinery like wheel hand hoe etc.	3
Total		16

X. Suggested Reading

- Ambrosius EE. 1966. *Mechanical Measurement and Instruments*. The Ronald Press Company.
- Doebelin EO. 2004. *Measurement System- Application and Design*. Tata McGrawHill
- Nakra BC and Choudhary KK. 1985. *Instrumentation, Measurement and Analysis*. 2nd Edition Tata McGraw Hill.
- Nachtigal CL (Editor). 1990. *Instrumentation and Control. Fundamentals and Application*. Wiley Series in Mechanical Engineering.
- Oliver FJ. 1971. *Practical Instrumentation Transducers*. Hayden book company Inc.