

20FM016 INSTRUMENTATION AND RESEARCH TECHNIQUES

Hours Per Week :

L	T	P	C
3	-	-	3

Total Hours :

L	T	P	WA/RA	SSH/HSB	CS	SA	S	BS
45	-	-	-	-	-	-	-	-

Course Description & Objective:

To acquaint and equip with the concept of instrumentation used in farm power & machinery and measuring devices for force, torque and other parameters.

Course outcomes:

By the end of the module the student should be able to...

1. understand and respond to the need for rigorous and formal metrology concepts in designing and using measurement systems.
2. recognize the limits on data imposed by measurement and analyse uncertainty in an appropriate manner.
3. use basic statistical methods to aid data evaluation and decision making.
4. appreciate how to identify and specify sensors (or complete instruments) for controlling machines and processes.
5. understand the operating principles of a range of widely used instrumentation techniques and appreciate how to use them in the design of measurement systems

Skills:

Study of various sensors

Recording and analysis of vibration.

Knowledge of various mechanical gauges

UNIT I

Strain and stress, strain relationship, strain gauges. Mechanical, optical, electrical, acoustical and pneumatic etc. and their use. Various methods of determining strain/stresses experimentally.

UNIT II

Measuring devices for displacement (linear and rotational), velocity, force, torque and shaft power. Strain gauges: types and their application in two and three dimensional force measurement. Design and analysis of strain gauges.

UNIT III

Introduction to functional elements of instruments. Active and passive transducers, Analog and digital modes, Null and deflection methods. Performance characteristics of instruments including static and dynamic characteristics.

UNIT IV

Devices for measurement of temperature, relative humidity, pressure, sound, vibration, flow etc. Recording devices and their type. Measuring instruments for calorific value of solid, liquid, and gaseous fuels. Measurement of gas composition using GLC.

UNIT V

Basic signal conditioning devices - data acquisition system – microcomputers for measurement and data acquisition. Data storage and their application.

Text books:

1. Ambrosius EE. 1966. *Mechanical Measurement and Instruments*. The Ronald Press.
2. Beckwith TG. 1996. *Mechanical Measurements*. Addison-Wesley.

Reference books:

1. Doebelin EO. 1966. *Measurement System - Application and Design*. McGraw Hill.
2. Ernest O Doebelin. 1995. *Measurement Systems - Application and Design*. McGraw Hill.
3. Holman P 1996. *Experimental Methods for Engineers*. McGraw Hill.

o Vibration recording, analysis by using DEWESOFT and accelerometers at different locations in tractors

o Measurement of tractor engine speed using laser Tachometer