

**Objective(s)**

To make students aware of instrumentation used in agricultural sector and as per current trend of agricultural automation sector

**Unit I****Basic Controller Design:**

**Study of transducers:** Description of various types of transduction principles, classification, Guidelines for selection, Requirements, Types and Application of Transducers, Transducers based on variable resistance, variable inductance, variable capacitance and piezo-electric effects, Displacement transducers - wire wound potentiometers, strain gage designation system LVDT, RVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Photosensitive Device, Hall effect transducers.

**Unit II****Measurement of Electrical and Non Electrical Quantities:**

Classification, Selection Criteria, Characteristics, Sensors & Actuators Construction, Working Principles, Application of following Transducers- Potentiometers RTD, Thermocouples, Thermistors, LVDT, Strain Gauges, Capacitive and Inductive transducers Piezoelectric Transducers, Photoelectric Transducers.

Force and Torque Measurement: Drawbar dynamometers, octagonal ring transducers, torque transducers.

Flow Measurement: Pitot static tube, hot wire anemometer, orifice meter, rotameter, turbine flow meter.

Temperature Measurement: Bimetallic thermometers, pressure thermometers, thermocouples, thermopiles, resistance thermometers, thermistors, radiation thermometers. Liquid Level Measurement: Humidity Measurement; Concept of Biosensors.

**Unit III****Mechanical Sensors & Actuators:**

Stress and Strain, Hooke's Law. Stress and Strain of Beam Structures, Cantilever, Pressure sensors, Piezo-resistance Effect, Piezoelectricity, Piezo-resistive Sensor, capacitive sensors, Inductive sensors, MEMS inertial sensors, micro machined micro accelerometer for MEMS, Parallel-plate Actuator, piezo-actuators.

**Unit IV****Virtual Instrumentation:**

Introduction to Lab VIEW: Virtual Instruments, Parts of VI, Project explorer, Front panel and block diagram window, Creating simple VI

**Data Acquisition and Processing:**

Circuits for Noise Filtering and Signal Amplification, Sample and Hold Circuits, Analog to Digital and Digital to Analog Conversion, Data Transmission and telemetry, Introduction to Digital Signal Processing.

**Unit V****Advanced Technologies and Automation in Agriculture:**

Introduction, Examples of Advanced Precision Agriculture Components, Objectives, Mass Flow Sensor, Site specific spraying, Fertilizer spreader, Sensors and actuators, Controllers, Networks in Agriculture. Real time irrigation control system.

**Reference Book(s):**

1. Electronic Instrumentation & Measurement by William D Cooper & Albert C. Helfric, PHI Pub.
2. Electrical and Electronic Measurements and Instrumentation by A. K Sawhney.

3. Analysis and Design Principles of MEMS Devices by Minhang Bao, ELSEVIER.
4. M. J. Usher, "Sensors and Transducers", McMillian Hampshire.
5. N. P. Mahalik, "MEMS" Tata McGraw Hill
6. Analysis and Design Principles of MEMS Devices by Minhang Bao, ELSEVIER
7. M. J. Usher, "Sensors and Transducers", McMillian Hampshire.
8. N. P. Mahalik, "MEMS" Tata McGraq Hill

**Practical(s):**

1. Study of various transducers.
2. Young's Modulus by Bending.
3. Modulus of rigidity.
4. Study of piezoelectricity.
5. Hall Effect.
6. Diode Characteristics.
7. Thermocouple.
8. Study of various control system.

**SMNR 311 SEMINAR-II**

**1\*(0+1)**