

EC 256: Transducers and Measurement Techniques

CREDITS =6 (L=4,T=0,P=2)

- 1 **Sensor, transducers and measurement:** Basic concept of measurement and system of units, characteristics of measurement devices. Classification of transducers, characteristics of a transducers, accuracy, precision, error, linearity repeatability, sensitivity and resolution. 4
2. **Temperature Transducers:** Resistance Temperature Detectors and Thermistors, linearization, Effect of self heating, Thermoelectric effects, Thermocouples, Change of table reference, Noise effects, Integrated circuit based temperature sensors and transducers 8
- 3 **Displacement Transducers:** Physical interpretation, Potentiometers – single turn and multiturn, Linear Variable Differential Transformer, Synchros, Strain Gauges-metal and semiconductor. 8
- 4 **Optical Transducers:** Nature of EM radiation, Characteristics of Light, Photo conductive detectors, Photo voltaic detectors, Photo diode, Photo Transistor and Photo emissive detectors 4
- 5 **Digital Transducers:** Linear encoders, Rotary encoders – incremental and absolute, proximity detectors. 4
- 6 **Signal Condition Circuits:** Difference amplifier, Instrumentation amplifiers, Integrating amplifiers and differentiating amplifiers, voltage to frequency and frequency to voltage converter circuits.
- 7 **D/A and A/D Converters:** Basic terminology, R-2R Techniques, Binary weighted resistor network, Accuracy of conversion, sampling, quantization and encoding, flash A/D, Integrating type A/D, Counter type A/D, Successive approximation A/D, Delta –Sigma converters. 8

REFERENCE BOOKS

Title: Measurement Systems : Application and Design

Author: Ernest O.Dobelin and D.N. Manik

Publisher: Tata McGraw- Hill Company

Title: Process Control Instrumentation Technology

Author: C.D. Johnson

Publisher: Prentice Hall of India

Title: Instrumentation: Devices and System

Author: C.S. Rangan, G.R. Sharma and V.S.V. Mani

Publisher: Tata McGraw-Hill Company

LIST OF PRACTICALS

- 1 **Introduction to Digital MultiMeters (DMM) for measurement**
 - Measurement of voltage, resistance and current using DMM.
 - Compare performance of various DMM like repeatability, linearity, accuracy
 - Testing various electronic component using DMM

- 2 **Introduction to Cathode Ray Oscilloscope (CRO) for measurement**
 - Study of Front panel control of CRO
 - Study of Internal circuit of CRO
 - Measurement of Frequency, Phase Difference and Voltage using CRO

Note: This experiment may be completed in more than one session.

- 3 **Obtaining RTD Characteristics**
 - Study of data of an RTD
 - Obtain temperature v/s resistance graph
 - Convert resistance change in equivalent voltage

Observe the effect of self heating.

- 4 **Obtaining Characteristics of Thermistor**
 - Study of data of a Thermistor
 - Obtain temperature v/s resistance graph
 - Convert resistance change in equivalent voltage

Observe the effect of self heating.

- 5 **Obtain Characteristics of a Thermocouple**
 - Study the data of a thermocouple and its table
 - Obtain temperature v/s voltage characteristics

- 6 **Obtain Characteristics of Integrated circuit based Temperature Sensor**
 - Study data sheet of the ICs
 - Obtain temperature v/s voltage characteristics

- 7 **Obtain Characteristics of Potentiometers**
 - Study specification of potentiometer
 - Obtain displacement v/s voltage characteristics of potentiometer

- 8 **Obtain Characteristics of Synchros**
 - Study specification of Synchros
 - Obtain displacement v/s voltage characteristics of Synchros

- 9 **Obtain Characteristics of an LVDT**
 - Study specification of an LVDT
 - Obtain displacement v/s voltage characteristics of LVDT

- 10 **Obtain Characteristics of Strain Gauge**
 - Study specification of strain gauge
 - Obtain displacement v/s voltage characteristics of strain gauge

- 11 **Obtain Characteristics and study application of optical Transducers**
 - Study of LDR as an optical transducer
 - Study of Photo diode and Photo Transistor as optical transducer

- 12 **Study performance of digital transducers**
 - Study the specifications of encoders
 - Study incremental encoders and its output signal pattern and obtain position
 - Study absolute encoder and its output signal pattern and obtain position

- 13 **Performing experiment for signal amplification and conversion**
 - Integrating amplifier
 - Differentiating amplifier
 - Instrumentation amplifier

- 14 **Performing an experiments to convert digital signal in to analog signal**
- R-2R Ladder Network
 - Binary Weighted Resistor Network
- 15 **Performing an experiments to convert analog signal into digital signal**
- Simultaneous ADC
 - Counter Type ADC
 - Integrating Type ADC