20VL017 - SENSORS AND SENSOR CIRCUIT DESIGN

Objectives:

- Introduce the sensor used in the industries and their characteristics, properties, interfaces connection
- Students learn how to analyze, design, build and troubleshoot a variety of sensor circuit

Course Outcomes:

Upon successful completion of this course student should be able to:

CO1: Understand the basic concepts of op-amp and filters for sensor circuits.
CO2:Analysing various sensor circuit performances along with application.
CO3: Integrated the various circuits for sensors for analysing the performance.
CO4: Understand the basic concepts of signal conditioning circuits.
CO5: Understand the performance of various types of sensors.
CO6: Integrated the sensors with corresponding circuits.

UNIT-1

Review of Measurements and instrumentation: Review of Static characteristics of Instrument systems, dynamic characteristics of Instrument systems, Review of Op-Amp Circuit, passive-, and active-filters

UNIT-2

Analog Signal Conditioning: Principles of analog signal conditioning, Signal-Level and Bias Changes, Linearization, Conversions, Filtering and Impedance Matching, Concept of Loading, PASSIVE CIRCUITS: Voltage Divider, Bridge Circuits, Bridge Resolution , Bridge Applications

UNIT-3

Digital Signal Conditioning: Review of Digital Electronics: Digital Information, Fractional Binary Numbers, Boolean Algebra, Digital Electronics Circuits: comparator, converter, Digital-to-Analog Converters (DACs), Analog-to-Digital Converters (ADCs) : Flash-, SAR, Dual Slope

UNIT-4

Digital Signal Conditioning: Sensor-to-Frequency Conversion, Data-Acquisition Systems: Hardware and Software of Data Aquisition System (DAS) , Characteristics of digital data: Digitized Value, Sampled Data Systems, Linearization,

UNIT-5

Thermal Sensors: Definition of Temperature: Thermal Energy, absolute and relative Temperature, Metal resistance versus temperature devices: Resistance versus Temperature Approximations, Resistance-Temperature Detectors (RTD), Other thermal sensor: Bimetal Strips, Gas Thermometers, Vapor-Pressure Thermometers, Liquid-Expansion Thermometers, Solid-State Temperature Sensors, Design considerations

Text Book and Reference:

1.“Process Control Instrumentation Technology, 6th Edition”, Author: Curtis D. Johnson, Publisher: Prentice Hall International Edition.

2. “Measurement, Instrumentation, and Sensors Handbook”, Author/Chief Editor: John G. Webster., Publisher: CRC – Press – Taylor and Francis Group.

3. “Introduction to Instrumentation and Measurement, 3rd Edition”, Authors: Robert B. Northrop, Publisher: CRC – Press – Taylor and Francis Group.