

UEI304: SENSORS AND SIGNAL CONDITIONING (WITH PROJECT)

L T P Cr
3 1 2 8

Course Objectives: To introduce the basics of measurements. To elucidate sensors and signal conditioning circuits. To introduce different error analysis methods. To familiarize with different sensors and transducers. To explain signal conditioning circuits.

Introduction: Definition, Application and types of measurements, Instrument classification, Functional elements of an instrument, Input-output configuration of measuring instruments, Methods of correction for interfering and modifying inputs, Standards, Calibration, Introduction to Static characteristics and Dynamic characteristics, Selection of instruments, Loading effects.

Error Analysis: Types of errors, Methods of error analysis, Uncertainty analysis, Statistical analysis, Gaussian error distribution, Chi-Square test, Correlation coefficient, Student's t-test, Method of least square, Curve fitting, Graphical analysis, General consideration in data analysis, Design of Experiment planning.

Sensors/Transducers: Definition, Types, Basic principle and applications of Resistive, Inductive, Capacitive, Piezoelectric and their Dynamic performance. Fiber optic sensors, Bio-chemical sensors, Hall-Effect, Photoemissive, Photo Diode/ Photo Transistor, Photovoltaic, LVDT, Strain Gauge Digital transducers: Principle, Construction, Encoders, Absolute and incremental encoders, Silicon micro transducers.

Signal Conditioning: Operational Amplifiers: application in instrumentation, Charge amplifier, Carrier amplifier, Introduction to active filters, Classification, Butterworth, Chebyshev, Couir filters, First order, Second order and higher order filters, Voltage to frequency and frequency to voltage converters.

Laboratory Work: Measurement of Linear Displacement, Angular displacement, Temperature, Light intensity, Capacitance, Resistance, Inductance.

Project: Projects based upon sensors and signal conditioning i.e. temperature measuring system, Pressure Measuring system, Level measuring system etc.

Course Learning Outcomes (CLO):

After the successful completion of the course the students will be able to:

1. Apply different methods for the measurement of length and angle
2. Elucidate the construction and working of various industrial parameters / devices used to measure pressure, sound and flow
3. Explicate the construction and working of various industrial parameters / devices used to measure temperature, level, vibration, viscosity and humidity
4. Ability to analyse, formulate and select suitable sensor for the given industrial applications
5. Describe signal conditioning circuits

Text Books:

1. *Doebelin, E.O. and Manic, D.N., Measurement Systems: Applications and Design, McGraw-Hill (2004).*
2. *Sawhney, A.K. and Sawhney, P., A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai (2008).*

Reference Books:

1. *Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India (2003).*
2. *Nakra, B.C. and Chaudhry, K.K., Instrumentation, Measurement and Analysis, Tata McGraw Hill (2003).*

Evaluation Scheme:

S.NO.	Evaluation Elements	Weightage
1	MST	20
2	EST	30
3	Sessional (May include Assignments//Quizzes/Lab Evaluations)	50