

Devi Ahilya University, Indore, India Institute of Engineering & Technology			II Year B.E. (Electronics and Instrumentation Engg.)				
Subject Code & Name	Instructions Hours per Week			Credits			
4EIRC2 SENSOR AND TRANSDUCERS	L	T	P	L	T	P	Total
	3	1	2	3	1	1	5
Duration of Theory Paper: 3 Hours							

Learning Objectives:

- To develop good understanding on the principle of operation and the important characteristics of Sensor & Transducers commonly used in industry.
- Knowledge of recent developments in the field of Sensor & Transducers.
- Criterion for selection, installation of suitable sensing elements and to design the appropriate signal conditioning circuit for their specific measurement applications.

COURSE OF CONTENTS

UNIT I : BASIC CONCEPT OF MEASUREMENTS AND INSTRUMENTS

Measurement Methods, Generalized measurement System, Classification of Instruments, Static & Dynamic Characteristics, Errors & Uncertainty measurement of system, Accuracy, Precision, Fidelity, speed of response, Linearization of techniques. Errors in measurement: Classifications of errors, Statistical Analysis, Linear & Non-linear Systems.

UNIT II: TRANSDUCER FUNDAMENTALS AND DISPLACEMENT MEASUREMENT

Basic concept of Sensors and transducer, their comparisons, Classification of Transducer, working of transducers used for measurement of Displacement- resistive, inductive and capacitive method, Linear and Angular Velocity moving coil and moving magnet method, various tachometers and stroboscope, Acceleration- seismic and piezo electric accelerometer, Working principle of Capacitive Transducer, Piezo-Electric Transducer, and LVDT.

UNIT III: TEMPERATURE AND HUMIDITY MEASUREMENT

Transducers for Temperature Measurement- non- electrical and electrical method, Bimetallic Thermometer, Resistance Thermometer like RTD, Thermistor and Thermocouple, Radiation and Optical Pyrometer,

Measurement of Humidity and Moisture - basic definitions, psychometric method

UNIT IV: STRAIN AND PRESSURE MEASUREMENT

Strain Gauges- strain measurement technique, resistance strain gauge and its types, Signal conditioning of strain gauges,

Transducers for Measurement of Pressure: - Manometers types (like Single column, inclined, U-tube), Mechanical Types (Bourdon, bellows and diaphragm), Elastic Types transducers, Low Pressure measurement gauges (Ionization, McLeod etc.),

UNIT V: FLOW AND LEVEL MEASUREMENT

Transducers for Measurement of Flow: - Types of flow meters, Theory of variable head constant area meter, theory of constant head variable area meter and its types, theory of variable head variable area meter and its types, Special flow meters- Electromagnetic, Hot wire Anemometer, Turbine meter and Ultrasonic flowmeter.

Transducer for Level Measurement: - direct and indirect method, resistive method, Ultrasonic, Capacitive level Gauges

Learning Outcomes: After successful completion of this course, students can

1. Understand the fundamental principles of various types of sensors including thermal, mechanical, electrical, electromechanical and optical sensors.
2. Understand their general characteristics, terminologies, sensing and transduction principles;
3. Be familiar with criteria for sensors and transducers selection and choose appropriate measurement methods for engineering tasks and scientific researches.

BOOKS RECOMMENDED:

- [1] A.K. Sawhney & Puneet Sawhney, "A Course in Electrical and Electronic measurements and Instrumentation", 7/e, Dhanpat Rai & Co.(P) Ltd., 2005
- [2] Albert D. Helfrick & William D. Cooper, "Modern Electronic Instrumentation and measurement Technique", Low Price Edition, Pearson Education, 2005
- [3] Ernest O. Doebelin, "Measurement Systems Application and Design", 5/e, Tata McGraw –Hill Publishing Company Ltd., 2004
- [4] DVS Murthy, "Transducers and Instrumentation", PHI 2nd Edition 2013
- [5] Patranabis D, "Sensors & Transducers", Wheeler, 1996.
- [6] Dr.D.S.Kumar, Mechanical Measurements and Control, 3/e, Reprint-2004,
- [7] Metropolitan Book Co. Private Ltd., 2004
- [8] Liptak, B.G., "Instrumentation Engineers Handbook (Measurement)", CRC Press, 2005.