Devi Ahilya University, Indore, India Institute of Engineering & Technology				**II Year B.E. (Electronics and Instrumentation Engg.) (Full Time)**			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
EIR4C4	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
SENSOR AND TRANSDUCERS	**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 1: Transducer Fundamentals

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 Velocitymoving coil and moving magnet method, various tachometers and stroboscope, Acceleration- seismic and peizo electric accelerometer, Working principle of Capacitive Transducer, Piezo-Electric Transducer, and LVDT.

Unit 2: Strain and Temperature Measurement

Strain Gauges- strain measurement technique, resistance strain gauge and its types, Signal conditioning of strain gauges, Transducers for Temperature Measurement- non- electrical and electrical method, Bimetallic Thermometer, Resistance Thermometer like RTD, Thermistor and Thermocouple, Radiation and Optical Pyrometer.

Unit 3: Pressure Measurement

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 4: Flow Measurement

Transducers for Measurement of Flow: - Types of flow meters, Theory of variable

head constant area meter and its types, 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 flow meter.

Unit 5: Miscellaneous Measurement and Smart Sensor

Transducer for Level Measurement:- direct and indirect method, resistive method, Ultrasonic, Capacitive and Gamma Ray level Gauges. Measurement of Humidity and Moisture- basic definitions, psychometric method,
Smart sensors - Fibre optic sensors, MEMS – Nano sensors, proximity sensor.

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

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 Mechanical Measurements and Instrumentation, 12/e, , Dhanpat Rai &
Co. (P) Ltd.,2004
[2].B.C.Nakra & K.K.Chaudhary,Instrumentation Measurement And Analysis, Tata McGraw-Hill Publishing Company
Ltd, New Delhi.,1996
[3].D.Patranabis, Principles of Industrial Instrumentation, 2/e, Tata McGraw-Hill Publishing Company Ltd, New
Delhi.,1998
[4].James W. Dally, William F. Riley & Kenneth G.McConnell, Instrumentation for Engineering Measurements,2/e,Wiley
Student Edition, John Wiley & Sons,INC,2003.
[5].John P.Bentley, Principles of Measurement Systems, Low Price Edition, Pearson Education Asia,2000
[6].Dr.D.S.Kumar, Mechanical Measurements and Control, 3/e, Reprint-2004, Metropolitan Book Co. Private Ltd.,2004
[7]. Liptak, B.G., “Instrumentation Engineers Handbook (Measurement)”, CRC Press, 2005.

List of Practical's:

1. Measurement of Temperature using Thermocouple.
2. Measurement of Temperature using Thermistor.
3. Measurement of Temperature using RTD.
4. To measure linear displacement using LVDT.
5. To study the principle and functioning of Load Cell (Cantilever type).
6. To study the principle and functioning of Load Cell (Strain gauge type).
7. To measure angular displacement using Capacitive Gauge.
8. To study the functioning of capacitive based digital water level indicator.
9. To study the conductivity meter
10. To measure pressure using Manometer.