Devi Ahilya University, Indore, India Institute of Engineering & Technology				II Year B.E. (Electronics and Telecommunication Engg.)			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
4ETRC1 MEASUREMENT SYSTEM AND SENSORS	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
	3	**1**	**0**	**3**	**1**	**0**	**4**
Duration of Theory Paper: 3 Hours							

Learning Objectives:

- To enable students to monitor, analyze and control a physical system.
- To make understand students how sensors work, their construction and applications.
- To introduce students a knowledge to design and develop electronic projects
- To provide knowledge to students to design and create novel products and solutions to resolve real life problems.

Prerequisites:

Basic Electronic fundamentals, Operational amplifier and Signal Conditioning circuits

COURSE CONTENTS

UNIT-I
Basic concept of Measurements and Instruments
Measurement Methods, Generalized measurement System, Classification of Instruments, Static & Dynamic Characteristics, Accuracy, Precision, Fidelity, speed of response, Linear & Non-linear Systems, Errors & Uncertainty in measurement, Classifications of errors, Statistical Analysis

Sensors - Classification of sensors as Active-Passive, Analog-Digital, Contact-Non contact type etc, introduction to Intelligent Sensors: General Structure of smart sensors & its components, Characteristic of smart sensors as Self-calibration, Self-testing & self-communicating

UNIT-II
Temperature, Force/ Pressure Sensors and measurement
Temperature Sensors- RTD, Thermistor, Thermocouple, Infrared, Pyrometer, IC based type
Pressure Sensors - Traditional methods as Bourdon tube, Diaphragm, Piston, Bellows type
Piezoelectric, strain gauge, Smart sensors and application

UNIT-III
Distance, Motion and Position Sensors and measurement
Traditional sensors as LVDT, Proximity/ Motion detector sensors - Inductive, Capacitive, Photoelectric, Ultrasonic type, Accelerometer- Hall effect, capacitive and piezoelectric type, Gyro meter- Rotary, Vibrating, Optical, MEMS type, Smart sensors and applications

UNIT-IV
Flow, Level, Humidity Sensors and measurement
Traditional methods as variable head constant area, constant head variable area meter as Rotameter, Venturi, Orifice, Turbine meter etc, Ultrasonic, Electromagnetic type flowmeter, Level Sensors - Capacitive, Ultrasonic, Infrared type, Smart sensors and applications

UNIT-V
Miscellaneous Sensors and Measurement -
Gas sensor - CO2, Oxygen, Methane, Smoke sensors - Photoelectric, Ionization types
Image sensors - CCD, CMOS
Display panels - LCD, TFT, LED, OLED, AMOLED, And Super AMOLED and applications

Learning Outcomes:

Upon completing the course, students will be able to:

- To use the techniques and skills for sensing and measuring various parameters to develop electronic projects.
- Designing systems using sensors to solve different problems in real time.

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] Wilson J, *"Sensor Technology Handbook& Transducers"*, ELSEVIER, 2005.
[6] Internet resources and websites
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