2EL13: SENSORS AND TRANSDUCERS
CREDITS - 3 (LTP:3,0,0)

Course Objective:

1. Introduce students to the principle of various Transducers, their construction, applications and principles of operation, standards and units of measurements.
2. Provide students with opportunities to develop basic skills in the design of electronic equipment.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory		Practical		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Electronics Measurement and Instrumentation:** Transducers and sensors- Accuracy and precisions, types of errors, statistical analysis, probability of errors, limiting errors, sensitivity, linearity, hysteresis, resolution, reproducibility, transfer function.	5
2	**Analog Signal Conditioning:** Signal conditioning, Loading effects, Bridges for measurement techniques, Wheatstone, Wein, Kelvin's, Maxwell bridge and Hey bridge, Attenuators and Amplifiers, Passive filters, Op-amp based signal conditioning circuits, Inverting and Non-Inverting Amplifiers, Linearization, Differential amplifiers and Instrumentation amplifiers.	8
3	**Digital Signal Conditioning:** Digital measuring techniques, Sample and Hold Circuits, Comparator, Buffers, D/A Conversion and A/D Conversion, Weighted Resistor DAC, R-2R ladder DAC, Dual Slope, Parallel-comparator Successive Approximation ADC techniques, Single channel and multi-channel Data Acquisition System (DAS).	8
4	**Temperature Sensors:** Resistance Vs Temperature characteristics for different materials, Thermistors, Thermocouples - thermoelectric effects for thermocouples, thermocouple tables, RTD, Other Thermal Sensors.	8
5	**Pressure, force, displacement and weight measurement:** Capacitive and inductive transducers, Displacement Sensor (LVDT), Strain Sensors – strain gauges, its principle, applications, types of strain gauges, Load cells, Piezo-electric sensors, Motion sensors.	8
6	**Flow measurement:**	8

Unit No.	Topics	Teaching Hours
	Basic principle of flow meter, Differential pressure flow meters, Variable area flow meter, Volumetric flow meter, Hotwire anemometer, Magnetic and ultrasonic flow meter, Rota meter, Hall effect transducer working and measurement techniques.	
	Total	**45**

List of References:

1. Curtis D. Johnson, *"Process Control Instrumentation Technology"*, Prentice Hall India.
2. D.V.S. Murty, "*Transducers and Instrumentation"*, Prentice Hall India.
3. Helfrick Albert D. and Cooper W. D., "*Modern Electronic Instrumentation and Measurement Techniques"*, Prentice Hall India.
4. Kalsi H. S. *"Electronic Instrumentation",* Tata McGraw-Hill Education.
5. Shawhney A. K. "*A Course In Electrical and Electronics Measurements and Instrumentation",* DhanpatRai& Sons, 11th Ed., 1999.
6. Bell David A. "*Electronic Instrumentation and Measurements",* PHI / Pearson Education.

Course Outcomes (COs):

At the end of this course students will be able to:

1. Understand the terminology of Instrumentation and analyze various sensors.
2. Able to apply signal conditioning for measurements.
3. Explain various measurements techniques for industrial applications based on transducers.