Course Name Sensors & Transducers

Course Code EI(EE)802A

Course Credit 3

Contact Hour 3L

Prerequisite Engineering Physics, Electrical & Electronics Measurement

Course Objective

The objectives of this course are

1. To provide knowledge to students of about the measuring instruments and the methods of measurement and the use of different transducers.
2. To give the idea of measurements and the errors associated with measurement.
3. To differentiate between the types of transducers available.
4. To improve and brush-up students knowledge about the function of various measuring instruments and using them.

Course Outcome

On completion of the course students will be able to

1. Define units and standards, elements of measurement system and error analysis
2. Understand the static and dynamic characteristics of transducers.
3. Describe resistive transducers which are used for measuring various parameters like displacement, temperature, humidity etc.
4. Describe the principle of operation, construction and characteristics of inductance and capacitance & other transducers.
5. Identify the various transducers used for various applications.
6. Formulate the different types of Transducers equations.

CO Mapping with departmental POs

H: High, M: Medium, L: Low

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	H											
CO 2	H	H			L							
CO 3	H	H										
CO 4	H	H										
CO 5	H	M	L									
CO 6			M									

Course Content

Module 1: Mechanical and Electromechanical sensor **12L**

Definition, principle of sensing & transduction, classification.

Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity.

Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesive, rosettes.

Inductive sensor: common types- Reluctance change type, Mutual inductance change type, transformer action type, Magnetostrictive type, brief discussion with respect to material, construction and input output variable, Ferromagnetic plunger type, short analysis.

LVDT: Construction, material, output input relationship, I/O curve, discussion.

Proximity sensor

Module 2: Capacitive sensors **8L**

Variable distance-parallel plate type, variable area- parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type, calculation of sensitivity.

Stretched diaphragm type: microphone, response characteristics.

Piezoelectric element: piezoelectric effect, charge and voltage co-efficient,

Crystal model, materials, natural & synthetic type, their comparison, force & stress sensing, ultrasonic sensors.

Module 3: Thermal sensors **11L**

Material expansion type: solid, liquid, gas & vapor

Resistance change type: RTD materials, tip sensitive & stem sensitive type, Thermister material, shape, ranges and accuracy specification.

Thermo emf sensor: types, thermoelectric power, general consideration,

Junction semiconductor type IC and PTAT type.

Radiation sensors: types, characteristics and comparison.

Pyroelectric type.

Module 4: Magnetic sensors **9L**

Sensor based on Villari effect for assessment of force, torque, proximity,

Wiedemann effect for yoke coil sensors, Thomson effect, Hall Effect, and Hall drive,performance characteristics.

Radiation sensors: LDR, Photovoltaic cells, photodiodes, photo emissive cell types,materials, construction, response.

Geiger counters, Scintillation detectors, Introduction to smart sensors.

Text Books:

1. Sensor & transducers, D. Patranabis, 2nd edition, PHI
2. Instrument transducers, H.K.P. Neubert, Oxford University press.
3. Measurement systems: application & design, E.A.Doebelin, Mc Graw Hill.