Course Code	18ECO133T	Course Name	SENSORS AND TRANSDUCERS	Course Category	O	Open Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		Electronics and Instrumentation Engineering	Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR): The purpose of learning this course is to:

- **CLR-1 :** Gain knowledge on classification, and characteristics of transducers
- **CLR-2 :** Acquire the knowledge of different types of inductive and capacitive sensors
- **CLR-3 :** Acquire the knowledge of different types of thermal and radiation sensors
- **CLR-4 :** Acquire the knowledge of different types of magnetic sensors
- **CLR-5 :** Acquire the knowledge of different types of sensors measuring non-Electrical quantity
- **CLR-6 :** Locate the Applications of sensors in industries and home appliances

Course Learning Outcomes (CLO): At the end of this course, learners will be able to:

CLO	Description	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1 Engineering Knowledge	2 Problem Analysis	3 Design & Development	4 Analysis, Design, Research	5 Modern Tool Usage	6 Society & Culture	7 Environment & Sustainability	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	13 PSO-1: Automatic control for continuous& discrete	14 PSO-2: Utilize PLC & DCS for control of	15 PSO-3: Effective management skills
CLO-1 :	To demonstrate the various types of basic sensors.	2,3	80	80	H	-	H	-	-	H	H	H	-	-	-	H	H	-	-
CLO-2 :	Understand the inductive and capacitive sensors which are used for measuring various parameters.	1,2	80	80	H	-	-	H	-	H	-	-	-	-	-	H	-	H	-
CLO-3 :	Understand the thermal and radiation sensors	1	80	80	-	-	-	-	-	H	-	-	H	H	-	-	H	-	-
CLO-4 :	Have an adequate knowledge on the various magnetic sensors	3	80	80	-	H	H	-	-	-	-	-	-	-	-	-	-	H	-
CLO-5 :	To demonstrate the various types of basic sensors measuring non electrical quantity	3	80	80	-	-	H	-	H	-	-	-	-	-	-	H	-	-	H
CLO-6 :	Select the right transducer for the given application	3	80	80	H	-	H	-	-	H	H	H	-	-	-	H	H	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to sensors/ transducers, Principles	Introduction to Inductive sensor	Thermal sensors: Introduction	Magnetic sensors: Introduction	Measurement of Non-Electrical quantity: Introduction
	SLO-2	Classification based on different criteria	Sensitivity and linearity of the sensor	Thermal Expansion type.	Villari effect	Flow Measurement – Introduction.
S-2	SLO-1	Characteristics of measurement systems	Transformer type transducer	Acoustics temperature sensors.	Wiedmann effect	Ultrasonic Flow Meters.
	SLO-2	Static characteristics Accuracy, Precision, Resolution, Sensitivity	Electromagnetic transducer	Thermo-emf sensor.	Hall effect	Hot Wire Anemometers.
S-3	SLO-1	Dynamic characteristics.	Magnetosrtictive transducer	Materials for thermos-emf sensors.	Construction,	Electromagnetic Flow meters.
	SLO-2	Environmental Parameters	Materials used in inductive sensor	Thermocouple construction	performance characteristics,	Principle and types.
S-4	SLO-1	Characterization and its type	Mutual Inductance change type	Types.	and its Application	Measurement of Displacement.
	SLO-2	Electrical characterization.	LVDT: Construction.	Thermo-sensors using semiconductor device	Introduction to smart sensors	Introduction and types.
S-5	SLO-1	Mechanical Characterization.	Material, input output relationship,	Pyroelectric thermal sensors	Film sensors: Introduction	Measurement of Velocity/ Speed.
	SLO-2	Thermal Characterization	Synchros-Construction	Introduction	Thick film sensors	Introduction and types.

S-6	**SLO-1**	Optical Characterization.	Capacitive sensor: Introduction	characteristics	Microelectromechanical systems	Measurement of Liquid Level.
	SLO-2	Errors and its classification.	Parallel plate capacitive sensor	Application	Micromachining.	Introduction and types.
S-7	**SLO-1**	Selection of transducers.	Variable thickness dielectric capacitive sensor	Radiation sensors.	Nano sensors	Measurement of Pressure.
	SLO-2	Introduction to mechanical sensors	Electrostatic transducer	Introduction	Applications: Industrial weighing systems: Link–lever mechanism.	Introduction and types.
S-8	**SLO-1**	Resistive potentiometer and types	Piezoelectric elements	Characteristics	Load cells – pneumatic, elastic and their mounting.	Measurement of Vibration.
	SLO-2	Strain gauge: Theory, type, design consideration, sensitivity.	Ultrasonic Sensors	Geiger counters	different designs of weighing systems.	Introduction and types.
S-9	**SLO-1**	Resistive transducer: RTD, materials used in RTD	Calculation of sensitivity.	Scintillation detectors	conveyors type.	Application of sensors in industries
	SLO-2	Thermistor: thermistor material, shape	Capacitor microphone, response characteristics	Application on radiation sensors	weighfeeder type.	Application of sensors in home appliances

Learning Resources	1. Patranabis, D., "Sensors and Transducers", 2nd Edition, Prentice Hall India Pvt. Ltd, 2010. 2. Doeblin, E.O., "Measurement Systems: Applications and Design", 6thEdition, Tata McGraw-Hill Book Co., 2011. 3. Bentley, J. P., "Principles of Measurement Systems", 4th Edition, Addison Wesley Longman Ltd., UK, 2004.	4. Murthy, D.V.S., "Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd., New Delhi, 2010. 5. Neubert H.K.P., "Instrument Transducers – An Introduction to their performance and Design", Oxford University Press, Cambridge, 2003.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
Level 2	Apply Analyze	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
Level 3	Evaluate Create	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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