

**INSTRUMENTATION AND SENSOR TECHNOLOGIES OF CIVIL  
ENGINEERING APPLICATIONS**

<b>Course Code</b>	19EC2801A	<b>Year</b>	IV	<b>Semester</b>	II
<b>Course Category</b>	Inter Disciplinary Elective III	<b>Branch</b>	Common to all	<b>Course Type</b>	Theory
<b>Credits</b>	3	<b>L-T-P</b>	3-0-0	<b>Prerequisites</b>	--
<b>Continuous Internal Evaluation:</b>	30	<b>Semester End Evaluation:</b>	70	<b>Total Marks:</b>	100

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**Course Outcomes**

Upon successful completion of the course, the student will be able to

<b>CO1</b>	Summarize various performance characteristics of instruments and the quality of measurement (L2)
<b>CO2</b>	Interpret the type of transducer based on the transduction principles(L2)
<b>CO3</b>	Identify the relevant transducer for measurement of physical quantities (L3)
<b>CO4</b>	Discover the additional attributes in advanced sensors and their role in Civil Engineering(L4)

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**Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)**

Note: 1- Weak correlation    2-Medium correlation    3-Strong correlation

\* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1										2
CO2	2	1	2	1										2
CO3	2	1	2	1										2
CO4	2	1	2	1										2
<b>Average* (Rounded to nearest integer)</b>	2	1	2	1										2

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**Syllabus**

<b>Unit No.</b>	<b>Contents</b>	<b>Mapped CO</b>
I	<p><b>Introduction:</b> Definition of sensor/transducer-Block Diagram-elements of measurement system-classification of sensors/transducers-static characteristics-accuracy, precision, resolution, linearity, sensitivity, range, loading effect, threshold, dead time, dead zone, span.</p> <p><b>Errors in measurement:</b> True value, static error, static correction, scale range and scale span, error calibration curve, readability, repeatability &amp; reproducibility, drift and noise</p>	CO-1

II	<p><b>Resistive Transducers:</b> Potentiometers-Linear POT, Rotary POT, characteristics of POT. Thermistors- Construction and its Resistance- Temperature characteristics.</p> <p>Thermocouples- Construction and its Resistance-emf characteristics</p> <p><b>Inductive Transducers:</b> Principle of change of self inductance, Principle of change of mutual inductance, Linear variable differential transformer (LVDT), Rotary variable differential transformer (RVDT).</p>	CO-2, CO-3
III	<p><b>Capacitive Transducers:</b> Introduction-Variable area type-variable air gap type- differential arrangement in capacitive transducers, variation of dielectric constant for measurement of liquid level, , variation of dielectric constant for measurement of displacement, advantages &amp; disadvantages of Capacitive transducers .</p> <p><b>Piezoelectric Transducers:</b> Measurement of Force, Modes of operation of Piezoelectric crystals, properties of Piezoelectric crystals, use of Piezoelectric Transducers.</p>	CO-2, CO-3
IV	<p><b>Hall effect Transducers:</b> Hall effect element, Measurement of displacement, current and power.</p> <p><b>Optical Transducers:</b> Vacuum photo emissive cell and its characteristics, semi conductor photo electric transducer- Photo conductive cell and its characteristics, photo diode and its characteristics, photo voltaic cell and its characteristics.</p>	CO-2, CO-3
V	<p><b>Digital and Smart Sensors:</b></p> <p>Introduction to digital encoding transducer- digital displacement transducers- shaft encoder-optical encoder, Introduction to Smart Sensors, Overview in Applications of sensors in Civil Engineering.</p>	CO-4

### Learning Resources

#### Text Books

1. A.K.Ghosh, "Introduction to Measurements & Instrumentation", IIIrd ed, PHI
2. A.K.Sawhney & Puneet Sawhney, "A Course in Mechanical Measurements & Instrumentation", Dhanapat Rai & Co.
3. D.V.S.Murty, "Transducers & Instrumentation", PHI.

#### Reference Books

1. Raman Pallas-Arney & John G.Webster, "Sensors & Signal Conditioning", 2012.
2. D.Patranabis, "Sensors and Transducers" 2<sup>nd</sup> edition, PHI, 2013.
3. BC Nakra, KK Chaudhry "Instrumentation, Measurement and Analysis", 2<sup>nd</sup> Edition, TMH

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