

## INSTRUMENTATION AND SENSOR TECHNOLOGIES OF CIVIL ENGINEERING APPLICATIONS

<b>Course Code</b>	19EC2801B	<b>Year</b>	IV	<b>Semester</b>	II
<b>Course Category:</b>	Inter Disciplinary Elective	<b>Branch</b>	ME	<b>Course Type</b>	Theory
<b>Credits:</b>	3	<b>L – T – P</b>	3 – 0 – 0	<b>Prerequisites:</b>	Nil
<b>Continuous Evaluation:</b>	30	<b>Semester End Evaluation:</b>	70	<b>Total Marks:</b>	100

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)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	2	1	2	1										2
<b>CO2</b>	2	1	2	1										2
<b>CO3</b>	2	1	2	1										2
<b>CO4</b>	2	1	2	1										2
<b>1- Low</b>			<b>2-Medium</b>						<b>3-High</b>					

Course Content		
<b>UNIT-1</b>	<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
<b>UNIT-2</b>	<p><b>Resistive Transducers:</b> Potentiometers-Linear POT, Rotary POT, characteristics of POT. Thermistors- Construction and its Resistance- Temperature characteristics. 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
<b>UNIT-3</b>	<p><b>Capacitive Transducers:</b> Introduction-Variable area type-variable air gap type- differential arrangement in capacitive transducers, variation of dielectric constant</p>	CO-2,

	for measurement of liquid level, , variation of dielectric constant for measurement of displacement, advantages & disadvantages of Capacitive transducers . <b>Piezoelectric Transducers:</b> Measurement of Force, Modes of operation of Piezoelectric crystals, properties of Piezoelectric crystals, use of Piezoelectric Transducers.	CO-3
<b>UNIT-4</b>	<b>Hall effect Transducers:</b> Hall effect element, Measurement of displacement, current and power. <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.	CO-2, CO-3
<b>UNIT-5</b>	<b>Digital and Smart Sensors:</b> Introduction to digital encoding transducer- digital displacement transducers- shaft encoder-optical encoder, Introduction to Smart Sensors, Overview in Applications of sensors in Civil Engineering.	CO-4
<b>Learning Resources</b>		
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. A.K.Ghosh, "Introduction to Measurements &amp; Instrumentation", IIRded, PHI</li> <li>2. A.K.Sawhney&amp;PuneetSawhney, "A Course in MechanicalMeasuremnets&amp; Instrumentation",DhanapatRai&amp; Co.</li> <li>3. D.V.S.Murty, "Transducers &amp; Instrumentation", PHI.</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Raman Pallas-Arney&amp; John G.Webster, "Sensors &amp; Signal Conditioning",2012.</li> <li>2. D.Patranabis, "Sensors and Transducers" 2nd edition., PHI, 2013.</li> <li>3. BC Nakra, KK Chaudhry "Instrumentation, Measurement and Analysis", 2nd Edition,TMH</li> </ol>	