

GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. SEMESTER: V
INSTRUMENTATION AND CONTROL ENGINEERING

Subject Name: **Sensors and Signal Conditioning**
Subject Code: **151702**

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Practical (I)
3	0	2	5	70	30	50

Part A

Sr. No.	Course content
1.	<p>Measurement, Instrumentation and Calibration:</p> <p>Measurement system components; instrumentation introduction; transducer classification; performance characteristics of instruments – static and dynamic; Dynamic performance of system (zero order, first order, second order, and higher order); errors in measurement; calibration and standards</p>
2.	<p>Signals and Their Representation:</p> <p>Classification of signals; Role of Laplace and Fourier Transform in signal representation and analysis; standard test signals; Periodic signals and Aperiodic signals; Bandwidth; Modulated signals; Sampled data; pulse modulation; pulse code modulation;</p>
3.	<p>Electrical Measuring Systems:</p> <p>Measurement of current; measurement of voltage; Measurement of resistance; Measurement of impedance; Basics of Electronic amplifiers (difference, electrometer, feedback, operational, instrumentation, isolation, charge, power); Measurement of phase angle; Frequency measurement; Time interval measurement;</p>
4.	<p>Passive Electrical Transducers:</p> <p>Resistive Transducer: Resistive Thermometer; Hot – wire resistance transducers; resistive displacement transducers; resistive strain transducers; resistive pressure transducers; resistive moisture transducers; resistive magnetic flux transducers; resistive optical transducers</p> <p>Inductive Transducers: Inductive thickness transducers; Inductive displacement transducers; Movable core type inductive transducers; eddy current type inductive transducers;</p>

	<p>Capacitive Transducers: Capacitive thickness transducers; Capacitive displacement transducers; capacitive moisture transducers</p>
5.	<p>Active Electrical Transducers:</p> <p>Piezoelectric Transducers: Piezoelectric phenomenon; piezoelectric materials; piezoelectric force transducers; piezoelectric strain transducers; piezoelectric torque transducers; piezoelectric pressure transducers; piezoelectric acceleration transducers</p> <p>Magnstrictive Transducers: Magnetostrictive phenomenon; magnetostrictive force transducers; magnetostrictive acceleration transducers; magnetostrictive torsion transducers</p> <p>Hall effect Transducer: Hall effect phenomenon; application of hall effect in transducers</p> <p>Electromechanical Transducers: Tachometer; Variable – Reluctance tachometers; Electro-dynamic vibration transducers;</p> <p>Photoelectric Transducers: Photoelectric phenomenon; Photoconductive transducers; Photovoltaic transducers; Photo-emissive transducers</p> <p>Ionization Transducers: Ionization displacement transducers; nuclear radiation transducers; radioactive thickness gauge;</p> <p>Digital Transducers: Digital displacement transducers; digital tachometer; transducer oscillators</p> <p>Electrochemical Transducers: Basics of electrode potentials; reference electrode; indicator electrode; measurement of pH; measurement of bioelectric signals</p>

Part B

Sr. No.	Course content
1.	<p>Signal Processing Circuits:</p> <p>DC Power supplies: Voltage power supply system components; three terminal voltage regulator; variable three terminal voltage regulators; Constant current sources;</p> <p>Oscillators and Signal Generators: Wien – Bridge Oscillator; Crystal Oscillator; LC – tuned circuit oscillator; square wave generator; pulse generator; function generator</p> <p>High frequency amplifier: tuned RF amplifier; wideband amplifier; high frequency op-amps</p> <p>Comparators: Window comparator; Schmitt trigger</p> <p>Active Filters: First order active filters; second order active filters; higher order active filters</p>

	<p>Analog Modulators and demodulators (basic): amplitude modulators and demodulators; frequency modulators and demodulators;</p> <p>Sampling circuit: sampling system components; sampling circuit; sampling circuit performance parameters</p> <p>Voltage to frequency converter: Basic concept; Circuit diagram with op-amp</p> <p>Analog Multiplexer and De-multiplexer: basic concept;</p>
2.	<p>Data Display and Recording Systems:</p> <p>Data loggers; Analog indicators; Digital readout systems – alphanumeric devices and CRT readout; Analog recorders; Magnetic tape recorders; Digital input – output devices</p>

Reference Books:

1. Transducers and Instrumentation by D. V. S. Murthy; Prentice Hall India
2. Electrical and Electronics Measurement and Instrumentation by A. K. Sawhney; Dhanpat Rai Pub.
3. Opamps and Linear Integrated Circuits by Ramakant Gaykwad; Pearson Education