

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Course Code:13EC1120

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Course Educational Objectives:

- ❖ To learn about measurements and its relation with instrumentation system.
- ❖ To familiarize with the concepts of electronic measurements.

Course Outcomes:

At the end of the course the student will be able to

- ❖ Illustrate the concepts of indicating instruments for voltage and current measurements.
- ❖ Analyze various measuring techniques for both electrical and non-electrical quantities
- ❖ Compare different types of bridge circuits
- ❖ Use oscilloscope to determine frequency and phase of a sinusoidal signal.

UNIT-I

(14 Lectures)

MEASUREMENT SYSTEMS:

Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error, DC Voltmeters, Ammeters- Multi-range, Range extension, AC voltmeters-multi-range, range extension,-shunt. Thermocouple type RF ammeter, Ohm meters series type, shunt type, Voltage, Current, Resistance measurement using DMM, Auto zeroing, Auto ranging.

UNIT-II**(12 Lectures)****CATHODE RAY OSCILLOSCOPE:**

Oscilloscopes CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, Dual beam CRO. Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital readout oscilloscope, digital storage oscilloscope, Lissajous method of phase measurement, standard specifications of CRO, probes for CRO-Active & Passive, attenuator types.

UNIT-III**(12 Lectures)****TIME AND FREQUENCY MEASUREMENTS:**

Phase and Magnitude Measurement at high frequency using vector voltmeter, Frequency, Time and Period measurements.

ANALYZERS:

Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzer - FFT analyzer, Logic analyzer, Digital signal analyzer, Digital Fourier analyzer.

UNIT-IV**(10 Lectures)****BRIDGES:**

DC Bridges- Wheatstone bridge, Kelvin's bridge, AC Bridges Measurement of inductance- Maxwell's bridge, Anderson bridge, Measurement of capacitance -Schering Bridge, Wien Bridge, Errors and precautions in using bridges. LCR-Q meter - principle of digital LCR-Q meter, specifications & applications.

UNIT-V**(12 Lectures)****TRANSDUCERS:**

Transducers- active & passive transducers : Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezoelectric transducers, Acoustic Transducers, Resistance Thermometers, Thermocouples, Measurement of physical parameters: force, humidity, speed.

TEXT BOOKS:

1. H.S.Kalsi, "*Electronic instrumentation*", 3rd Edition - Tata McGraw Hill, 2010.

2. A.D. Helfrick and W.D. Cooper, “*Modern Electronic Instrumentation and Measurement Techniques*”, PHI, 5th Edition, 2002.

REFERENCES:

- 1 David A. Bell, “*Electronic Instrumentation & Measurements*” - PHI, 2nd Edition, 2003.
2. Robert A. Witte, “*Electronic Test Instruments, Analog and Digital Measurements*”, Pearson Education, 2nd Ed., 2004.
3. K. Lal Kishore, “*Electronic Measurements & Instrumentations*”, Pearson Education - 1st Edn, 2005.

