

# 16EC403 ELECTRONIC INSTRUMENTATION



Hours Per Week :

L	T	P	C
3	-	2	4

## Course Description and Objectives:

This course deals with topics such as principles of measurements, errors, accuracy, units of measurements and standards, Q- meters, watt-meters, semiconductor device testers, counters, digital voltmeters, X-Y recorders, temperature controllers, transducers, introduction to the design of electronic equipments for temperature measurement, resistance, liquid level, speed etc. The objective of the course is to offer knowledge about the measurement systems, measuring instruments, errors, sensors and transducers for various electronic and industrial automation applications.

## Course Outcomes:

Upon successful completion of this course, students should be able to:

- CO1: Understand the fundamentals of static, dynamic characteristics and different errors used in the context of measuring instruments.
- CO2: Classify various electro mechanical instruments.
- CO3: Measure unknown impedance using AC and DC bridges.
- CO4: Understand and analyze various signal generators and Spectrum analyzer.
- CO5: Understand the working principles of Various Display Devices and signal conditioning circuits.
- CO6: Demonstrate the characteristics of various sensors.

## SKILLS:

- ✓ *Maintain electronic test and measuring instruments.*
- ✓ *Select the instruments for measuring electrical parameters.*
- ✓ *Use AC and DC bridges for relevant parameter measurement.*
- ✓ *Select appropriate passive or active transducers for measurement of a physical phenomenon.*
- ✓ *Use signal generator, frequency counter, CRO and digital IC tester for appropriate measurements.*
- ✓ *Test and troubleshoot electronic circuits using various measuring instruments.*

**UNIT - 1****L-10**

**ELECTRO MECHANICAL INSTRUMENTS AND THEIR CHARACTERISTICS:** Static characteristics, Dynamic characteristics, Errors - Gross error, systematic error, Random error, limiting error, Probable error; Electro mechanical instruments - Suspension galvanometer, PMMC mechanism, DC Ammeters, DC Volt meters, Ohmmeter, Multi range ohmmeter, Calibration of DC instruments; AC meters - Electro dynamometer, Rectifier meter, Thermo instruments, Watt hour meter, Power measurement using dynamometers, Power factor measurements, Instrument transformers.

**UNIT - 2****L-9**

**AC,DC BRIDGES AND ELECTRONIC INSTRUMENTS:** DC bridges - Wheat stone bridge, Kelvin's double bridge; AC Bridges - Measurement of inductance, Maxwell's bridge, Anderson bridge; Measurement of capacitance - Schering bridge, Hays bridge; Measurement of frequency - Wien's bridge, Errors and precautions in using bridges; Electronic instruments - Amplified DC meter, True RMS responding voltmeter, Electronic multi-meter, Digital voltmeter, Q-meter.

**UNIT - 3****L-9**

**SIGNAL GENERATORS, SIGNAL ANALYSIS AND FREQUENCY COUNTER:** Signal generator, Sine wave generator, Sweep generator, Pulse and square wave generator, Frequency synthesized generator, Function generator, Wave analyzers - Harmonic distortion analyzer, FT spectrum analyzer, Applications; Frequency counter and time interval measurement - Simple frequency counter, Time period measurement, Precision computing counter using dual counters.

**UNIT - 4****L-9**

**DISPLAY DEVICES ,RECORDERS AND SIGNAL CONDITIONING DEVICES:** Display devices - CRO principles, CRO operation and its applications, Dual beam, Dual trace oscilloscope, LCD, LED, Plasma displays; Recorders - Types of recorders, Strip chart recorders, XY recorders, Magnetic tape recorders; Signal conditioning devices - Signal conditioning, Op-Amp, Protection, Filtering.

**UNIT - 5****L-8**

**SENSORS AND TRANSDUCERS:** Classification of transducers, Strain gauges, Photoelectric transducers, Capacitive, Inductive transducers, LVDT Thermoelectric transducers, Load cell, Light and proximity sensors, Data acquisition systems.

**ACTIVITIES:**

- *Measure electrical and electronic parameters using various instruments.*
- *Design of data acquisition systems using different sensors and transducers.*
- *Acquire and analyze physical, optical and electrical signals.*
- *Design of electronic equipments, using various instruments and transducers.*

**LABORATORY EXPERIMENTS****LIST OF EXPERIMENTS**

Total hours-30

Measurement of

1. displacement using LVDT.
2. distance using LDR.
3. temperature using R.T.D.
4. temperature using thermocouple.
5. pressure using strain gauge.
6. pressure using piezo-electric pick up.
7. distance using capacitive pick up.
8. distance using inductive pick up.
9. speed of DC motor using magnetic pick up.
10. speed of DC motor using photo electric pick up.

**TEXT BOOKS:**

1. A.D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", 5<sup>th</sup> edition, PHI, 2002.
2. A.K. Sawhany, "Electrical and Electronics Measurements and Instrumentation", 2<sup>nd</sup> edition, PHI, 2003.

**REFERENCE BOOKS:**

1. David A. Bell, "Electronic Instrumentation and Measurements", 2<sup>nd</sup> edition, PHI, 2003.
2. R.K. Rajput, "Electronic Measurements and Instrumentation", 2<sup>nd</sup> edition, S. Chand, 2009.